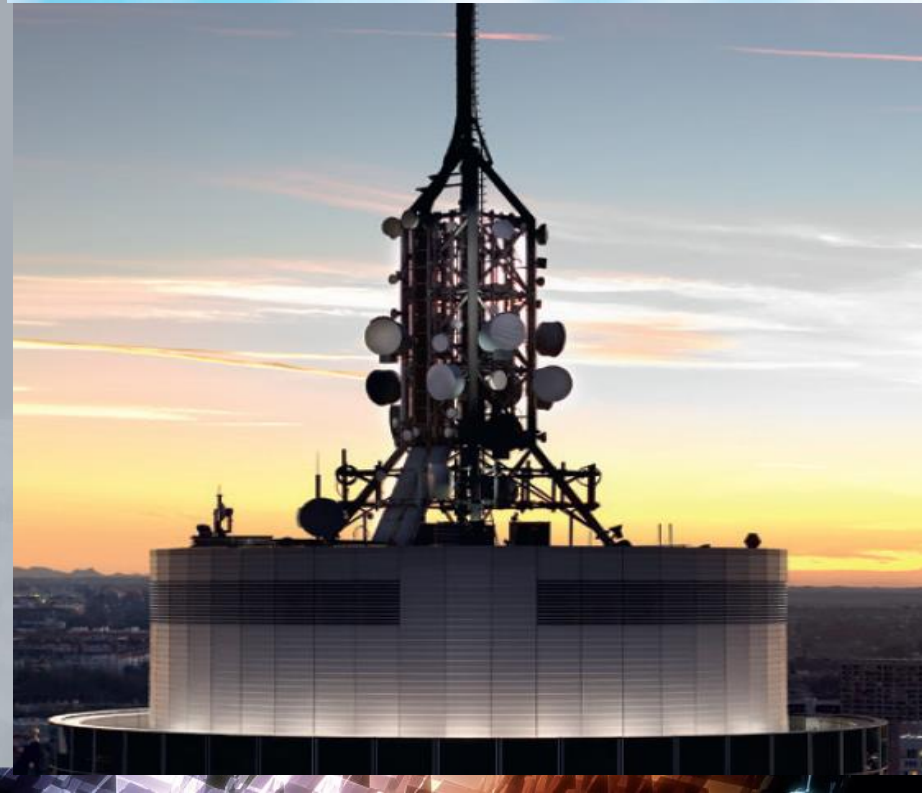


Examples for Network troubleshooting on the Radio Channel by use of unique network scanner functionalities

Christian Müller
Senior Director
Market Segment Development



Telecom Infra Event 2016



The company group at a glance

■ History

Established 1933 in Munich, Germany

■ Type of enterprise

Independent family-owned company

■ Global presence

In over 70 countries, approx. 60 subsidiaries

■ Net revenue

Approx. EUR 1.75 billion (FY 13/14, July through June)

■ Export share

More than 90 percent

■ Employees

9800 worldwide, with approx. 5900 in Germany

■ Success

A leading international supplier in all of its fields of business



Customers and markets



Manufacturers of mobile radio and other wireless equipment



Operators wireless and broadcast networks



Electronics manufacturers



Electronics service providers



Aerospace and defense



Studios and broadcasters



Government authorities and other public sector customers

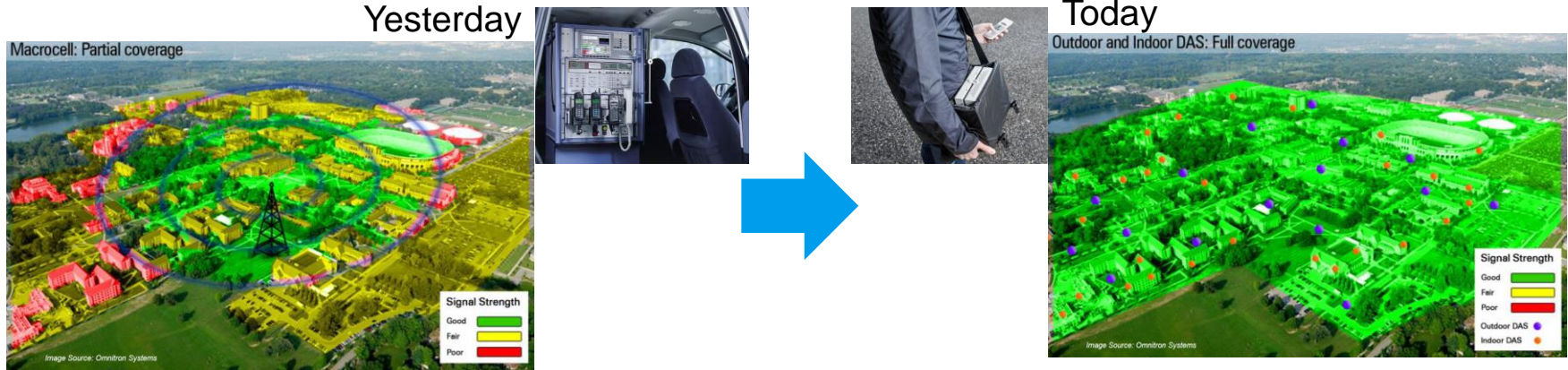


Companies of all types and sizes



Over-The-Air (OTA) Measurements for Outdoor & Indoor

- Channels in use?
- RF-Channel quality? → internal / external Interferences?



→ **Mobile Network Testing:**
Applications to Test Mobile Networks,
Rohde & Schwarz offers a defined and aligned Product Portfolio
from Installation, Fieldservice, Optimisation to Benchmarking



Tool requirements for Network Engineering and Optimistaion

multiband multi-
technology
networks

Why poor QoS?
→ RF channel
analysis

Networkscanner
performance
→ Faster
→ Non-intrusive
→ Higher
sensitivity
compared to UE

Usable for
Out- and Indoor



Better network insight by performant Network Scanners

- Non-intrusive → no subscription
- One instrument for all networks, technologies and bands
- BCH / SIB demodulation capabilities on all networks
- DL-/ UL- Spectrum Monitor
- Faster compared to Mobiles (approx. 50 times faster)
- Higher Accuracy and sensitivity compared to testmobiles



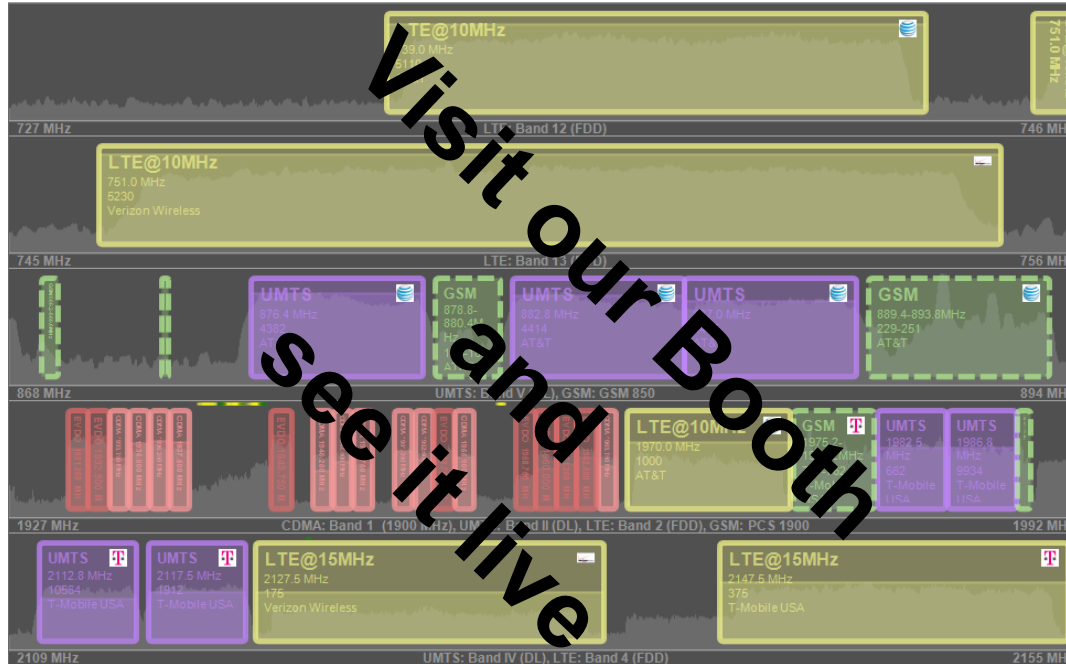
Automatic Channel Detection



Multi-band
Multi technology
networks

Quick overview

Non-intrusive



GSM, UMTS, LTE, CDMA/EV-DO, TETRA, Wimax



Some real questions about network performance e.g. LTE

- Why is my UE throughput so low?
- How loaded is this cell?
- How many users are in this cell?
- What about the RF channel quality?
- Are the resources of this cell efficiently used?
- What is the capacity of my competitor's network?



take a non-intrusive look at the load in any LTE cell

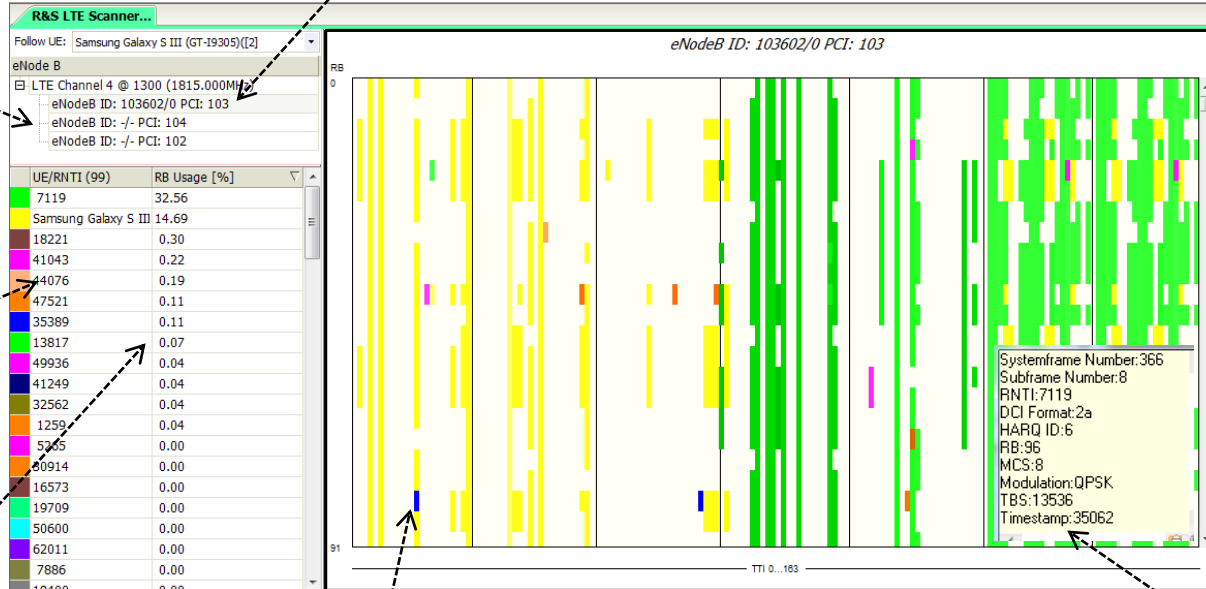


Downlink Allocation Analyzer View

Allocations are shown for the selected PCI, or for the PCI to which the test UE is connected

List of eNodeBs

List of RNTIs
Connected test UE is highlighted



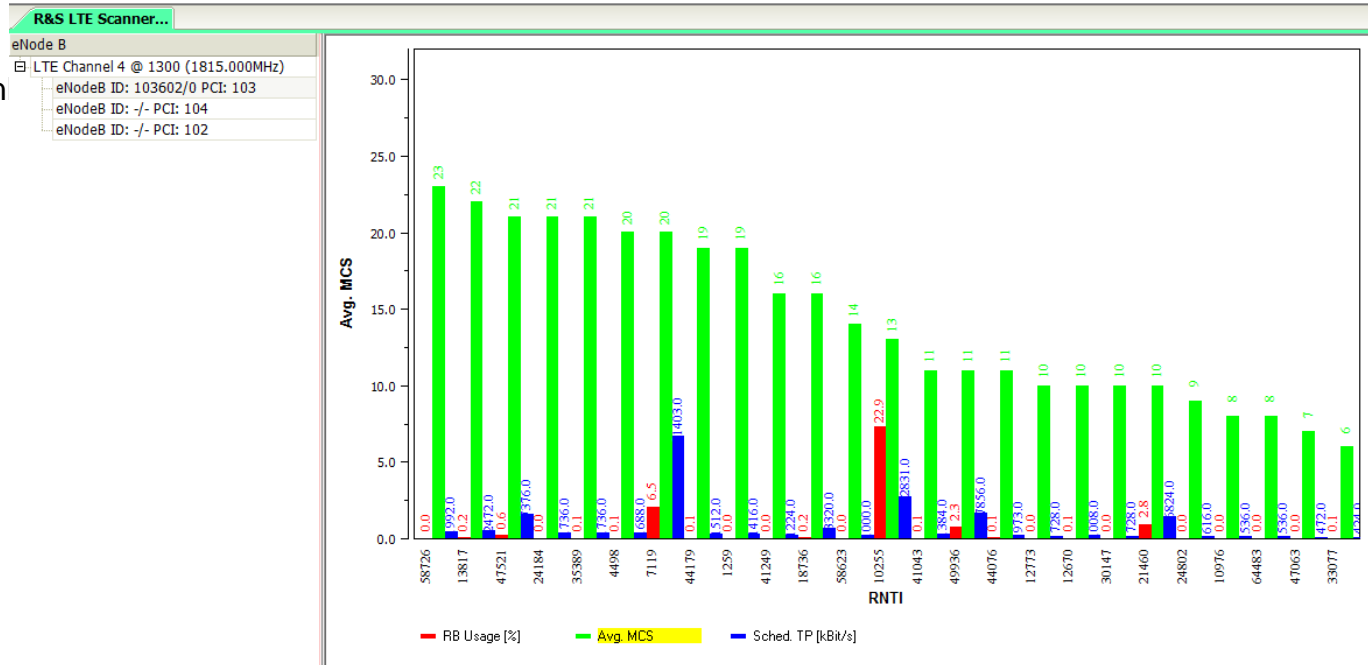
Percentage of the cell capacity in RB, that is used by an RNTI

Color: Allocation per RNTI
White: no allocation

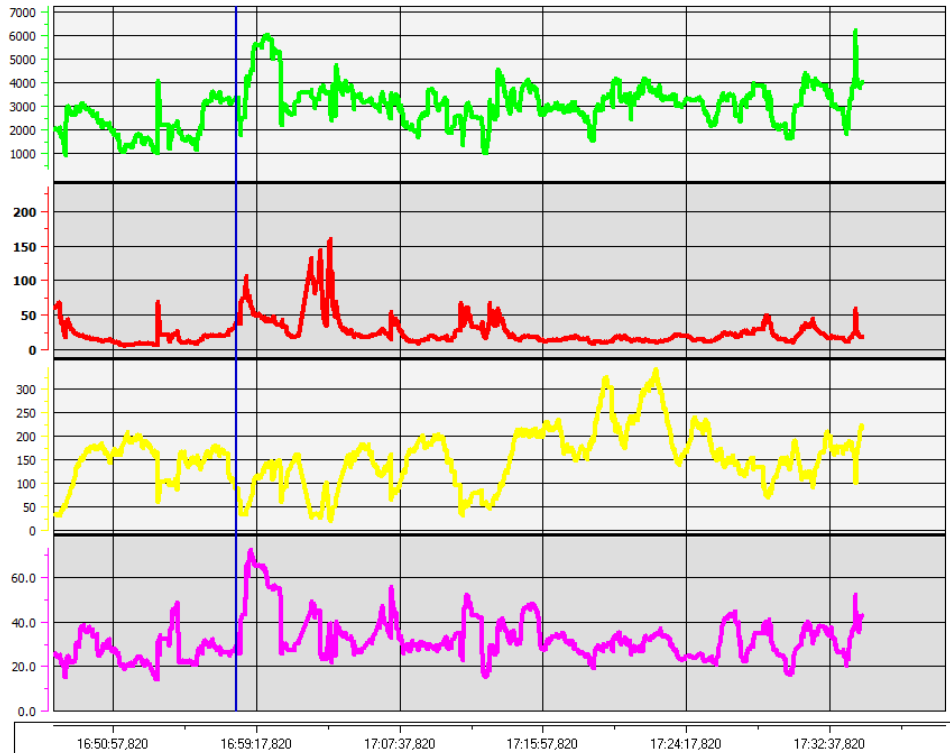
Doubleclick on TTI/RB opens details

RF-Channel quality

On



Over the Air all-over performance measurements



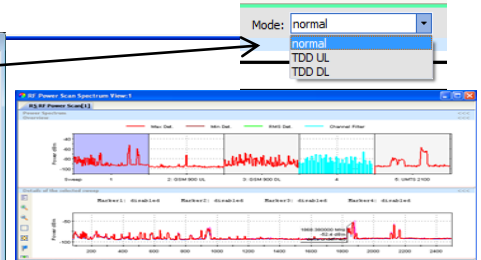
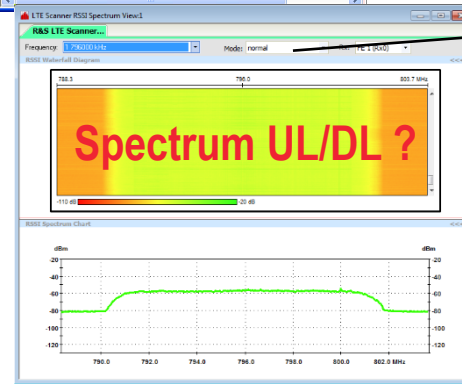
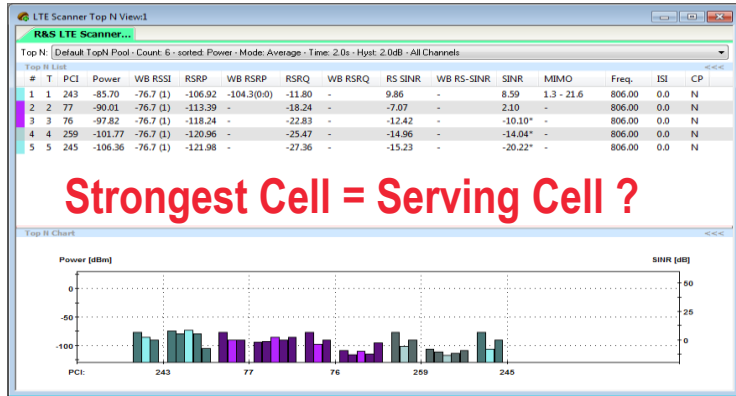
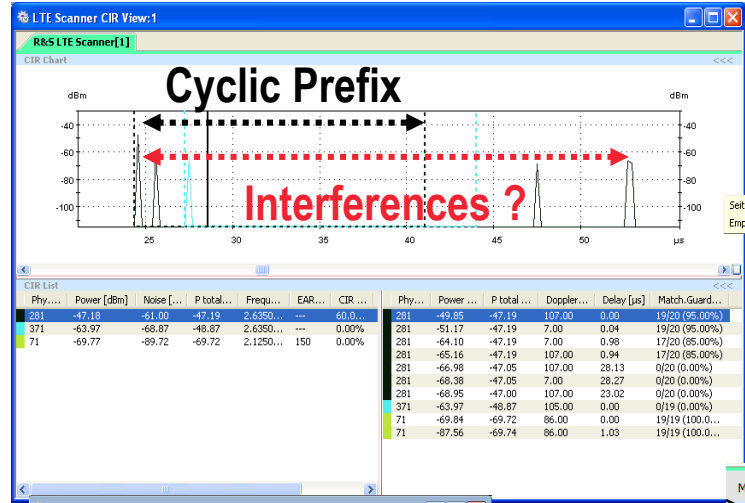
Average cell throughput per observation interval (5s, 60s, 300s or 600s)

Average RNTI throughput per observation interval (5s, 60s, 300s or 600s)

Number of RNTIs per observation interval (5s, 60s, 300s or 600s)

Average RB Usage in % per observation interval (5s, 60s, 300s or 600s)

Network Interference evaluations

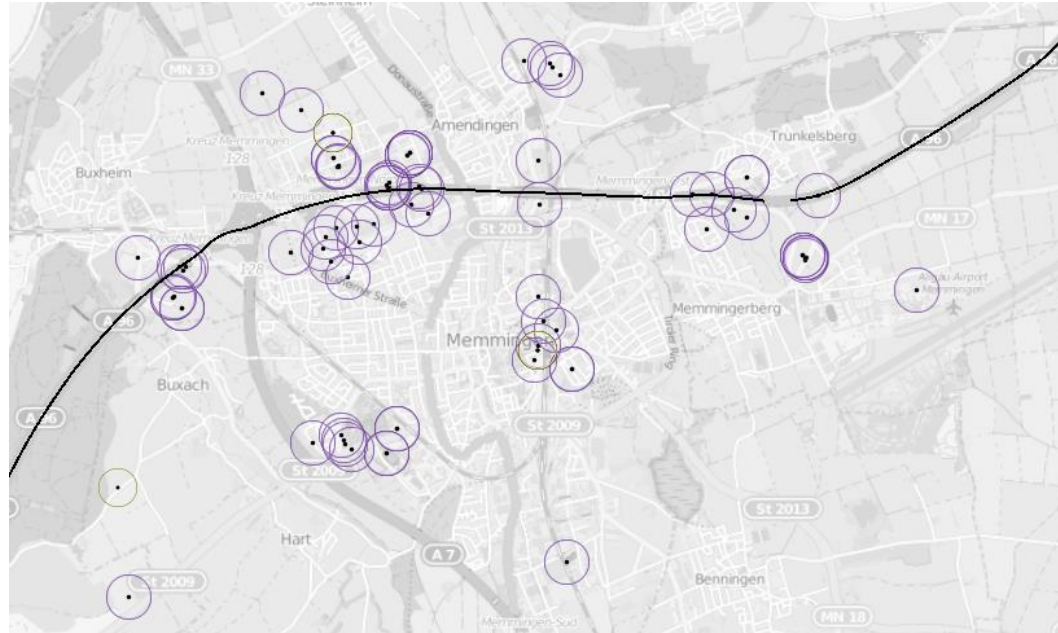


BTS Position Estimation

Source of
interference
across country
borders

Competitor
network density

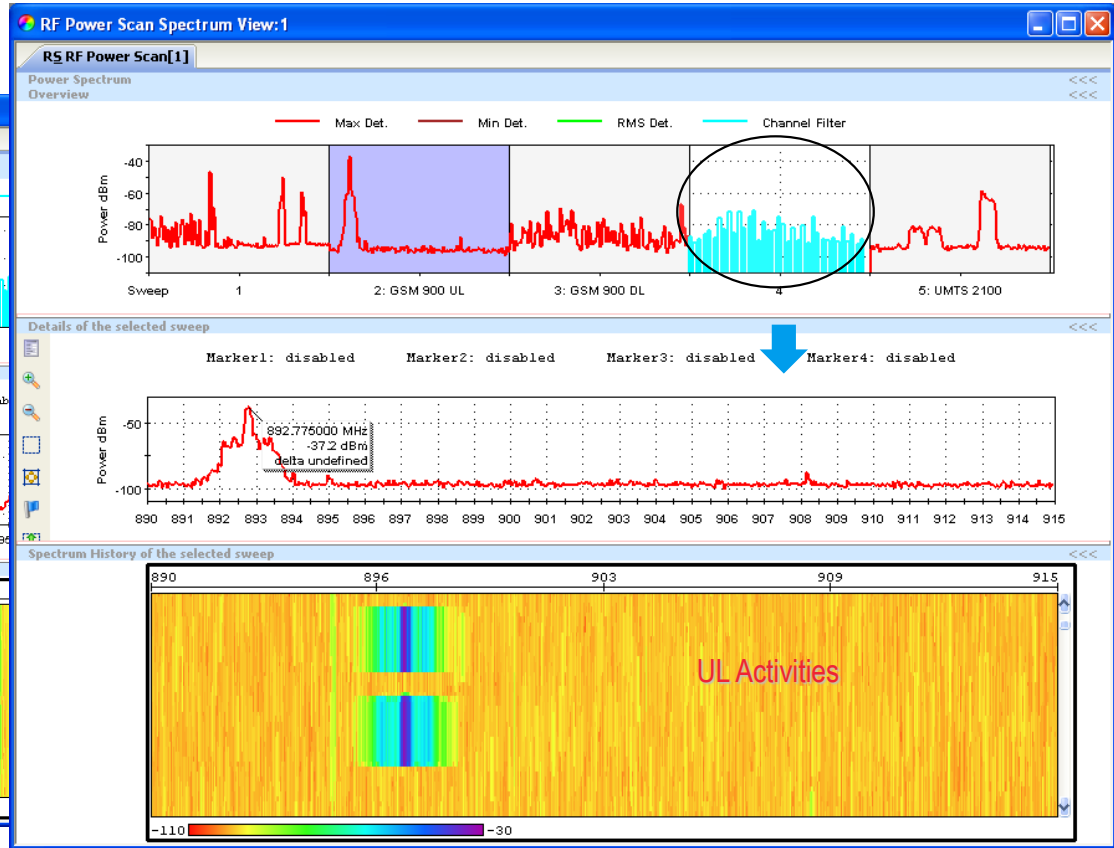
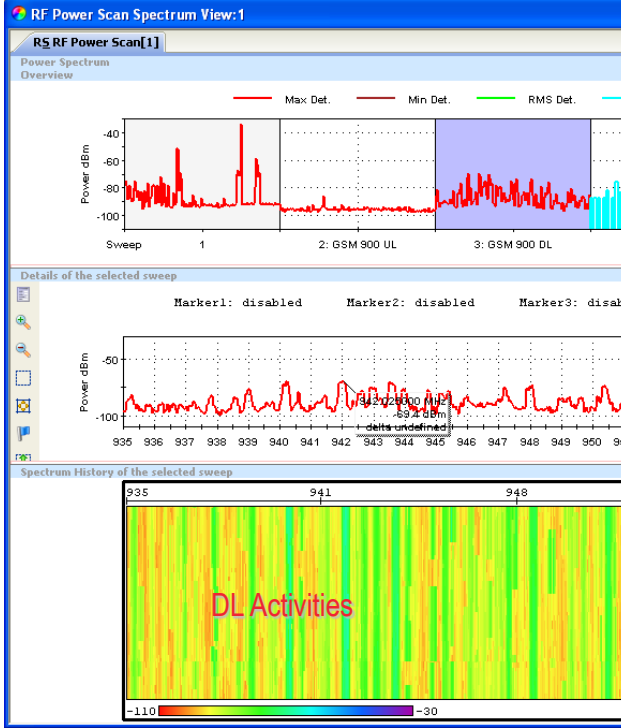
Site sharing



Estimate the positions of mobile radio cells of all operators for
GSM, WCDMA, LTE, CDMA2000/EVDO



RF Spectrum Scan



What to consider for indoor measurements?

Support of features for quick and easy



Portability

Autonomous multi-technology / band scanner control via tablet or smartphone possible.

BTS simulation

Multi technology Reference Signal simulation important in Single-Frequency Network environment



Indoor maps


Support of indoor maps for referencing walk tests in any location.

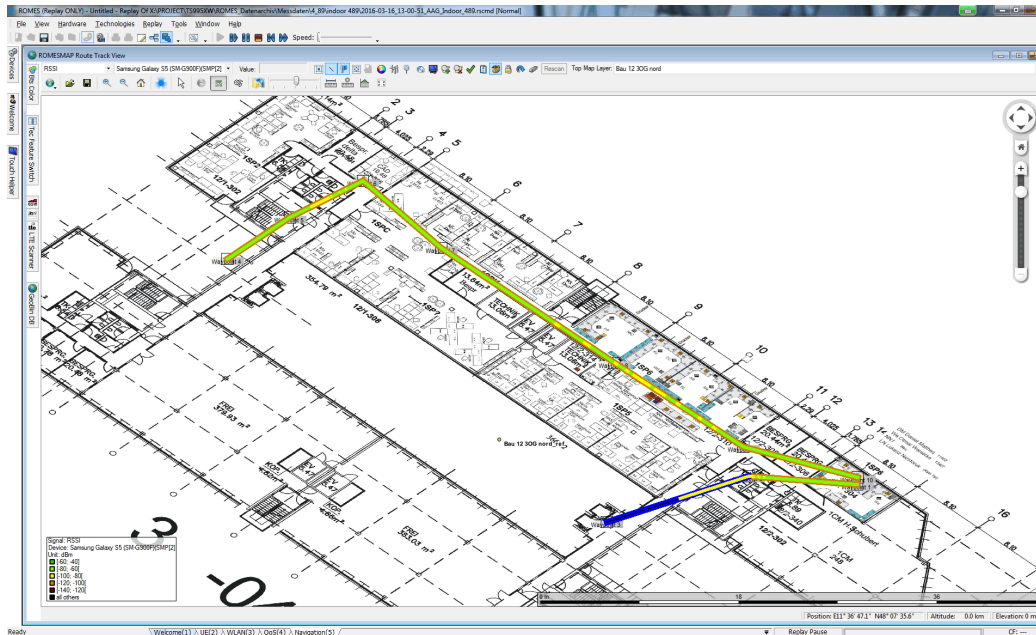
Waypoints

Set waypoints on the fly or pre-configure route where no GPS signal is available.



Pre-condition: Support of indoor maps with manual positioning

- Maps can be georeferenced as well as non-georeferenced
- Support of maps of **multiple formats**, including .png, .jpg, .tif, .bmp, .tab,  and .dxf



Waypoints / Route can easily be set in the map by **just clicking** in the map to set a waypoint or Continuous mode

Indoor scenario planing & verification

Signal source
CW or modulated

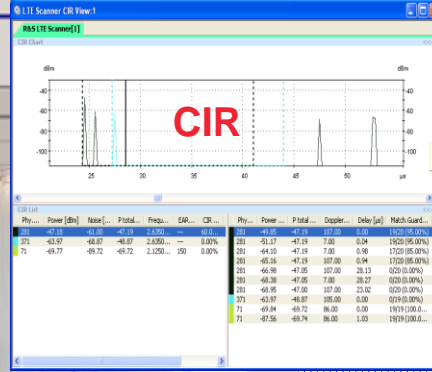


Number of Licenses/Waveforms

Select Waveform

Waveform

- 3GPP_DL_TM1_64Ch_1Fr_Scr.wv
- DigitalStandards_LevelUnchanged_ClockHighest.wv

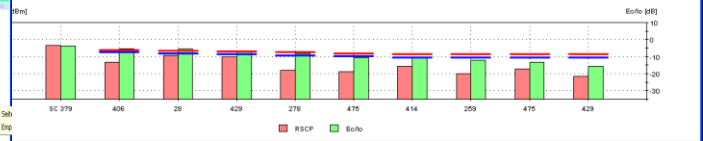


PNS Top N View-1

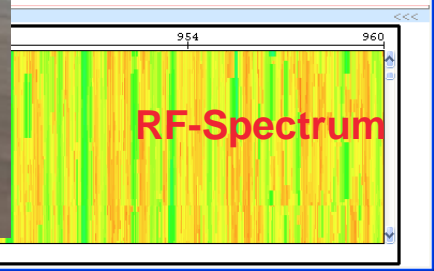
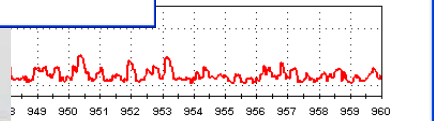
Top N: [Top 10 Sorted Count 10 - Sorted Yes - Mode Average - Time 1.3s - Hyst. 1.0dB]

Rank	SC	Ec/Io [dB]	SR [dB]	RSCP [dBm]	ISCP [dBm]	Ptotal [dBm]	Channel	Drift [Hz/s]	Dev. Drift [Hz/s]	Del. Spread [Chp]	HPP	SPP	CI	MCC	MNC	Node B	LL1 [dBm]
1	1	379	-3.9	22.5	-87.1	-85.5	Operator 2...	-9.0	35.0	0.5	---	0.0	---	---	---	---	---
2	2	406	-5.4	20.1	-86.4	-82.4	Operator 1...	6.0	19.0	0.9	---	---	---	---	---	---	-105
3	3	28	-5.5	20.0	-78.7	-74.7	Operator 4...	---	---	1.0	---	---	---	---	---	---	-107
4	4	409	-6.8	18.3	-80.0	-74.3	Operator 1...	---	---	0.9	---	---	---	---	---	---	-105
5	5	278	-8.3	16.5	-95.7	-88.1	Operator 4...	---	---	0.4	---	---	---	---	---	---	-104
6	6	475	-10.6	13.9	-98.0	-87.6	Operator 3...	4.0	13.0	0.4	---	---	---	---	---	---	-104
7	7	414	-10.3	14.2	-91.3	-81.9	Operator 1...	3.0	53.0	0.5	---	---	---	---	---	---	-105
8	8	259	-12.2	12.1	-99.7	-87.7	Operator 3...	5.0	53.0	0.9	---	---	---	---	---	---	-104
9	9	415	-13.2	11.1	-94.2	-81.2	Operator 1...	9.0	19.0	2.1	---	---	---	---	---	---	-107
10	10	258	-15.6	6.7	-103.0	-87.6	Operator 3...	4.0	20.0	2.6	---	---	---	---	---	---	-107

Top N list



Marker4: disabled



Thank you for listening – any questions?

Visit us on booth #5

Cable & antenna testing



ZVH:

- ✓ Fastest CAT
- ✓ No errors (Wizard)
- ✓ No calibration needed

PiMPro Tower:

- ✓ Lightest PIM tester
- ✓ 40 W, battery op. mode
- ✓ Dual band models
- ✓ Price!

Spectrum, signal and OTA analysis



FSH:

- ✓ Fastest multi-standard
- ✓ CAT, SPA, OTA (Best MIMO tester!)

FPH:

- ✓ Low-cost spectrum analysis

Interference & spectrum clearance



PR100:

- ✓ Receiver with preselector
- ✓ Fast scanning

FPH:

- ✓ Low-cost SPA-based interference hunting

BTS functional test



Qualipoc Android:

- ✓ Reflects user perception
- ✓ Voice, data & video testing
- ✓ Channel and cell locking

Network scanning



T SMA:

- ✓ Passive (no SIM card)
- ✓ Automatic channel detection
- ✓ Full on-air network visualization



R&S Mobile Network testing information, App. Notes, Videos, etc.

www.rohde-schwarz.com/mobile-network-testing

Network Optimization & Benchmarking for Mobile Operators

In order for network operators to achieve optimum efficiency and ensure the required coverage, RAN optimization is required.



Drive tests, walk tests or fixed probes are used to measure network coverage and performance, and the results are analyzed using sophisticated software such as R&S[®]ROMES4 to identify potential areas for network improvement.

Benchmarking is the evaluation of the relative performance of each network based on the simultaneous measurement of multiple cellular. This process shows the operator the strengths and weaknesses of his own and competitor networks for the purpose of strategic network development and marketing. Rohde & Schwarz and SwissQual offer a wide variety of optimization and benchmarking solutions for all measurement scenarios – from small cell networks in indoor environments to full macro cell measurements.

[Products for Optimization and Benchmarking](#)

- ▶ Overview
- ◀ Mobile Operators
- ▶ Infrastructure Vendors
- ▶ Testing Service Providers
- ▶ Regulators and Authorities

Contact Us

[Request Information](#)

Products for RAN Optimization / Drive Test

- ▶ R&S[®]TSMW Universal Radio Network Analyzer
- ▶ R&S[®]TSME Ultracompact Drive Test Scanner
- ▶ R&S[®]TSMA Autonomous Mobile Network Scanner
- ▶ R&S[®]TSML Radio Network Analyzer
- ▶ R&S[®]ROMES4 Drive Test Software
- ▶ SwissQual QualiPoc Android
- ▶ SwissQual QualiPoc Freerider III
- ▶ SwissQual NetQual NQView
- ▶ SwissQual NetQual NQDI

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