R&S®CMWcards
Smart network emulation for all mobile device tests

ROHDE & SCHWARZ

Use R&S®CMWcards to prepare the tests you always wanted, but never found the time to set up.

Create wireless signaling and application tests on the R&S®CMW500 wideband radio communication tester just by setting up a hand of cards – no programming required. Revolutionary card wizards and unique game rules guide you through setting up test sequences that fully comply with test specifications.

Thanks to the R&S®CMW500 tester's unrivaled multitechnology capability, R&S®CMW-KT022 CMWcards can be utilized to rapidly reproduce signaling scenarios for various wireless communications standards.
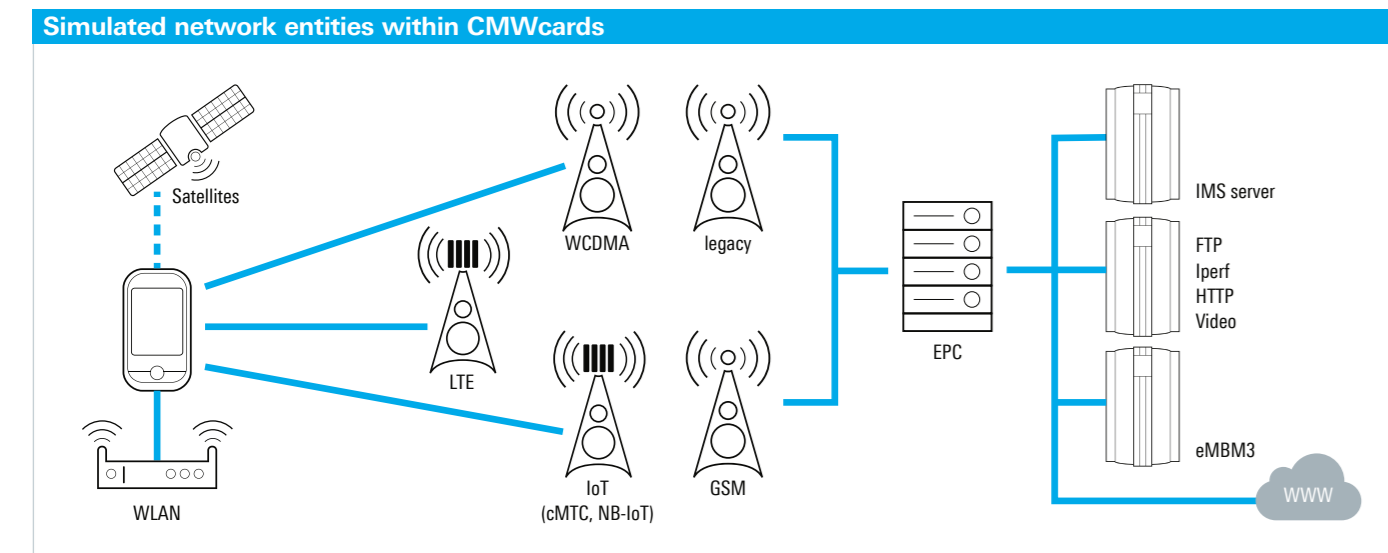
Benefits and key features

❙ Graphical test script definition tool for the R&S®CMW500 wideband radio communication tester
❙ Cards simplify the creation of wireless signaling tests
❙ No programming, no code compilation, just GUI
❙ Intelligent hopscotch card wizard for creating test sequences
❙ Intuitive game rules that guide the user through specification-compliant protocol signaling test sequences
❙ Test creation, parameterization, execution and analysis in a single tool
❙ Advanced mode option for peer message editing, Layer 3 Message Import or Receive message constraints
❙ Field-to-Lab logfile import option for automatic network parameter extraction from drive test logs
❙ LTE, WCDMA, GSM and WLAN multi-cell support for mobility and handover tests
❙ eMTC and NB-IoT support for testing cellular IoT modules
❙ Multicell support (more than eight independent cells on R&S®CMWflexx)
❙ Universal fader card for R&S®CMW500 internal baseband fading
❙ Conditional testing using customizable loops, timer, delays and verdicts
❙ Logfile and failure cause analysis with R&S®CMWmars message analyzer
❙ Full test script and UE automation
❙ Easy to learn, minimum training required
❙ More than 300 example test cases included
❙ Additional test script packages available for extensive testing of IMS, LAA (License Assisted Access), Cat-M1 (eMTC), Cat-NB (NB-IoT)

Card labels (left to right, top to bottom):

HO to LTE — Handover LTE dedicated (WCDMA) | Stop Network Impairment — Stop Impairment | Detach Idle (dedi.) — Detach (LTE) | Stop IP Data Service — Stop Service | Redirection LTE dedicated — Redirect LTE (WCDMA) | Deregister from IMS — IMS Deregister | UICC Setup

Release Call — Release (GSM) | eMBMS Radio Network Setup — eMBMS N/w (LTE) | Reconfigure DCH to FACH — DCH to FACH (WCDMA) | LTE Throughput Setup — LTE Throughput | CS Fallback to WCDMA — CSFB WCDMA (LTE) | LTE Neighbor Cell Setup — LTE Neighbor Setup | Reject Primary PDP from Idle — Reject Prim PDP Idle (WCDMA)

Release GSM Cell (GSM) | Emergency IMS Call — IMS Emg Call (LTE) | CS Fallback to GSM — CSFB GSM (LTE) | Timer On | Modify LTE SIB | RL Failure LTE default — RL Failure to LTE (WCDMA) | Reconfigure FACH to PCH — FACH to PCH (WCDMA)

REG + Dedicated Bearer — Registration (LTE) | REG + Move to Idle — Registration (LTE) | Detach Emergency — Emg Detach (LTE) | Detach Connected (def.) — Detach (LTE) | Detach Connected (dedi.) — Detach (LTE) | Detach Idle (def.) — Detach (LTE) | Loop End

GSM Power Change (GSM) | LTE Service Reject (LTE) | Radio Link Failure — Link Failure (LTE) | Attach Reject (LTE) | Handover Failure — HO Failure (LTE) | TAU Reject (LTE) | PDN Connectivity Reject — PDN Reject (LTE)

R&S®CMWcards technology overview and features at a glance

Testing scope
- Layer 3 signaling tests for 3GPP LTE (Rel. 8 to Rel. 13), WCDMA (Rel. 99 to Rel. 10), GSM and inter-RAT
- 3GPP LTE-Advanced and LTE-Advanced Pro feature support, including verification of data throughput beyond 1 Gbps
- All 3GPP LTE-Advanced carrier aggregation combinations up to 5CC, including FDD/TDD joint operation
- Support of unlicensed bands (LTE-U) and LAA
- C-IoT tests for Cat-M1 (eMTC) and Cat-NB (NB-IoT)
- All 3GPP security and ciphering algorithms
- Intraband and interband cell selection/reselection/handover

- Inter-RAT mobility procedures
- IMS and VoLTE calls including CS fallback, SRVCC and reverse SRVCC (rSRVCC)
- IMS supplementary services
- LTE WLAN traffic offload
- Voice over WLAN (WLAN calling)
- Evolved multimedia broadcast multicast service (eMBMS)
- Extensive UE failure test scenarios such as attach rejects, handover failures and out-of-coverage simulation
- CMAS (WEA) and ETWS public warning system
- AGNSS location based services (LBS) verification for C-plane and U-plane

Simulated network entities within CMWcards

Satellites, WCDMA, legacy, IMS server, FTP, Iperf, HTTP, Video, EPC, WLAN, LTE, IoT (cMTC, NB-IoT), GSM, eMBM3, WWW

Cellular Internet of Things (IoT) protocol and application testing with R&S®CMWcards
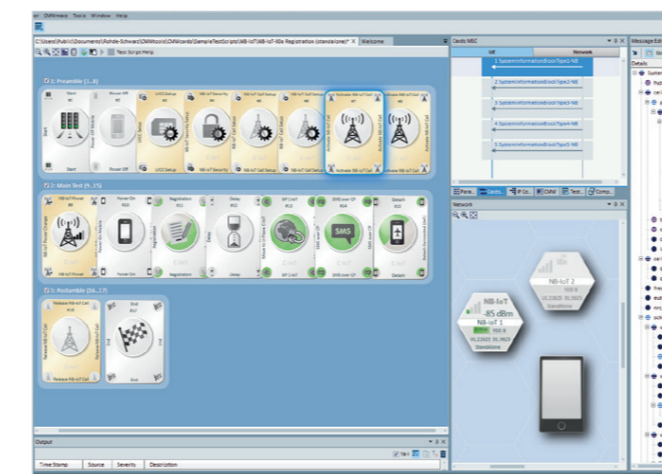
Objective
- Create functional protocol and application test cases as well as regression campaigns for cellular IoT devices that support LTE Cat1, Cat-M1 (eMTC) and Cat-NB1 (NB-IoT)
- Verify that the device can correctly perform network attach, establish a data connection (SMS, IP and non-IP data) and perform mobility procedures
- Investigate devices interoperability capabilities for different IoT deployment modes, especially for NB-IoT standalone, in-band and guard band mode.
- Create typical negative testing failure scenarios that are hard to reproduce in real-world networks, e.g. attach reject, mobility failures, repeated rejections of the device under test
- Rel-14 NB-IoT LBS location verification using NPRS (OTDOA)

Testing scope
- Network simulation of LTE cells as well as 3GPP Rel-13 eMTC and NB-IoT enhancements
- Support of UE category 1, Cat-M1 and Cat-NB1
- eMTC, NB-IoT CE mode A and B (coverage enhancement)
- Flexible configuration of NB-IoT deployment modes (standalone, in-band and guard band)
- Crucial timer settings (e.g. T3412 or T3324) for sleep mode such as discontinuous reception (eDRX) and power saving mode (PSM)
- Cell selection and reselection scenarios
- Definition of reject causes for network reject scenarios (EMM attach reject) or mobility failures
- Test positioning for IoT devices
- Data end-to-end tests for IP and non-IP applications as well as SMS
- Maximum IP throughput tests

	R&S®CMWcards KT022 basic	R&S®CMWcards KT044 IoT
GUI only usage	●	●
Campaign management	●	●
Test result handling	●	●
Support of Cat1, eMTC, NB-IoT	●	●
Support of legacy, WCDMA, GSM	●	-
WLAN support	●	-
LTE and WCDMA fading support	●	-
Optional R&S®CMWcards advanced	●	-
Runs on R&S®CMW500	●	●
Runs on R&S®CMW290	-	●
Pricing	€€	€

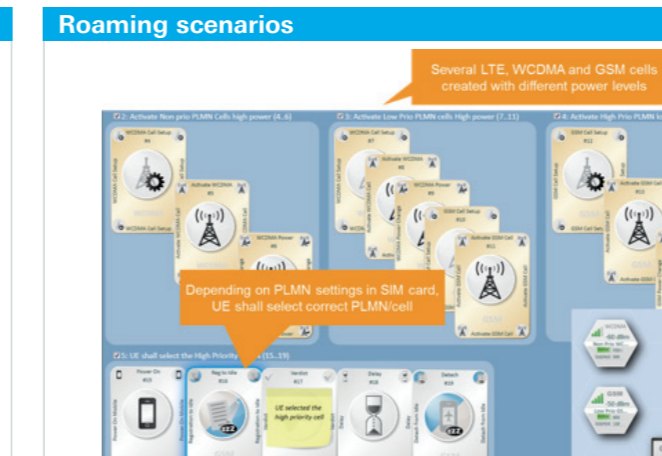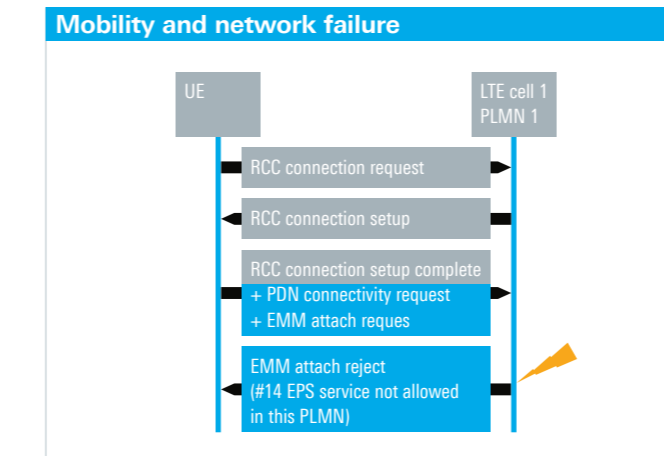Example of an NB-IoT signaling testcase in R&S®CMWcards with two NB-Iot cells

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R&S®CMWcards for testing mobility and simulation of network failures

Objective
- Simulate real-world roaming behavior to check if the device under test selects the correct roaming partner and to check the correct timing of network selection, including under cell edge conditions (example country borders)
- Test mobility procedures across technologies such as LTE, WCDMA and GSM from a signaling perspective, also including real data such as speech or IP data.
- Reproduce prominent network failures and error scenarios such as attach rejects, service rejects and congestion failures

Testing scope
- All types of mobility and handover scenarios between LTE, WCDMA, GSM and WLAN, including carrier aggregation scenarios up to 5CC downlink
- Network reject scenarios, e.g. attach reject
- Roaming scenarios

Mobility and network failure

UE — LTE cell 1 PLMN 1
- RRC connection request
- RRC connection setup
- RRC connection setup complete + PDN connectivity request + EMM attach reques
- EMM attach reject (#14 EPS service not allowed in this PLMN)

Roaming scenarios

Several LTE, WCDMA and GSM cells created with different power levels

Depending on PLMN settings in SIM card UE shall select correct PLMN/cell

	LTE	WCDMA	GSM	WLAN
LTE	Cell reselection, Handover, GUTI reallocation, Tracking area update, Measurement report	Cell reselection, Redirection, Handover, CSFB, SRVCC, aSRVCC, bSRVCC	Cell reselection, Redirection, CSFB, SRVCC	Coexistence, WLAN offloading
WCDMA	Cell reselection, Redirection, Handover, rSRVCC	Cell reselection, Routing area update, Handover, Measurement report	Cell reselection, Redirection, CS handover	Coexistence
GSM	Cell reselection, Redirection	Cell reselection, Redirection, CS handover	Cell reselection, Routing area update, CS handover	Coexistence
WLAN	Coexistence, WLAN offload, VoWiFi offload	Coexistence	Coexistence	Coexistence

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Field-to-lab (F2L) and virtual drive testing with R&S®CMWcards

Objective
- Replaying recorded drive test data in a reproducible lab environment
- Recreate network characteristics (SIBs and L3 messages) from real networks
- Minimize drive test effort by replaying recorded drive test data in a reproducible lab environment
- Increase reality level by adding location data via satellite simulation or moving propagation via fading profiles
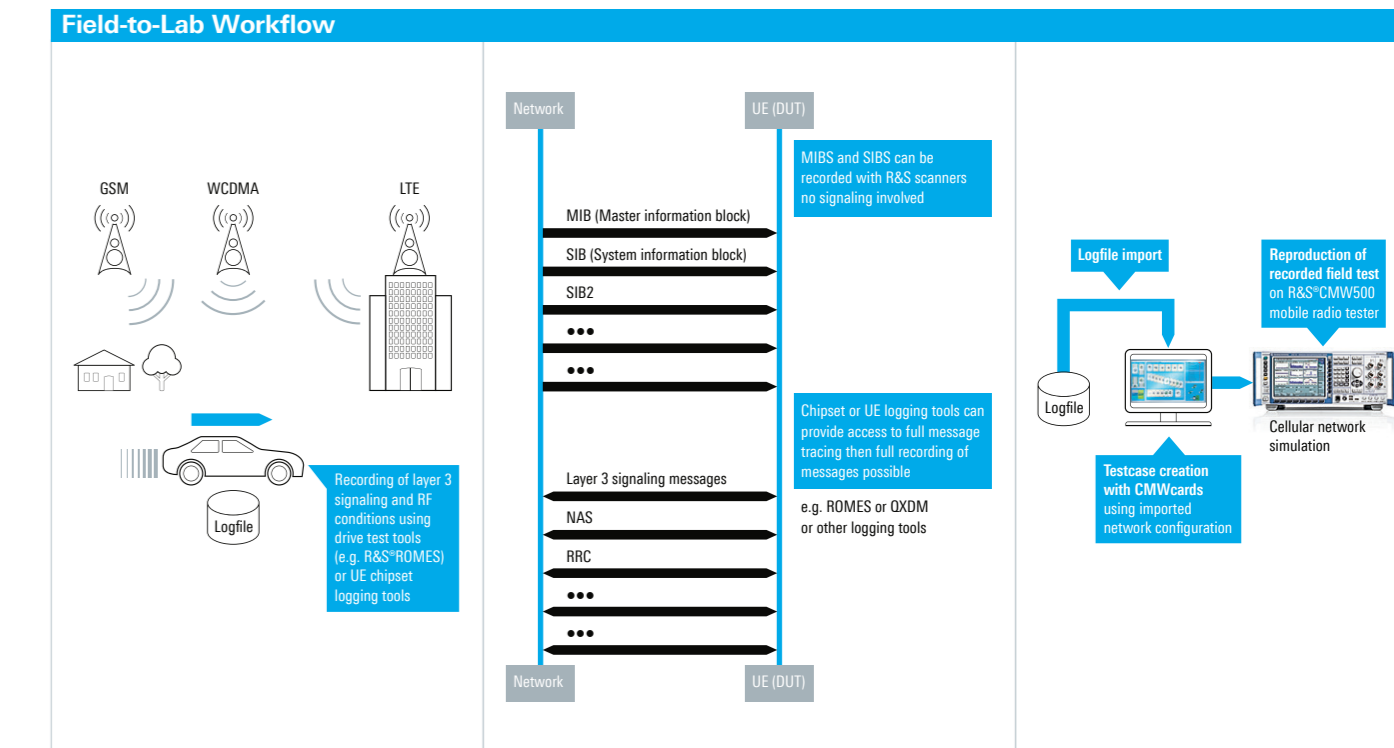
Testing scope
- Message editing functionality
- Change peer message content for RRC or NAS downlink messages
- Access all ASN.1 information elements for LTE, WCDMA and GSM
- Modify ASN.1 information elements in line with 3GPP and immediately rerun the test case with modified content

Message import (SIBs, MIBs, L3 messages)
- Copy message content from live network traces (UE logs such as QXDM or drive test tools such as R&S®ROMES)
- Recreate real network cells as recorded in the field
- Import information message by message or via import wizard

Network operator profiles
- Save most important network operator settings in own mobile network operator (MNO) database
- Apply settings to new or existing test cases and entire test campaigns (without touching the original test case)
- Changes in the live network? => record the message and apply the setting

Field-to-Lab Workflow

GSM, WCDMA, LTE, Network, UE (DUT)

MIBs and SIBS can be recorded with R&S scanners, no signaling involved

Recording of layer 3 signaling and RF conditions using drive test tools (e.g. R&S®ROMES) or UE chipset logging tools

MIB (Master information block), SIB (System information block), SIB2

Chipset or UE logging tools can provide access to full message tracing than full recording of messages possible

Layer 3 signaling messages: NAS, RRC

Logfile import

Logfile

Testcase creation with CMWcards using imported network configuration

e.g. ROMES or QXDM or other logging tools

Reproduction of recorded field test on R&S®CMW500 mobile radio tester

Cellular network simulation

About Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries. The electronics group is among the world market leaders in its established business fields. The company is headquartered in Munich, Germany. It also has regional headquarters in Singapore and Columbia, Maryland, USA, to manage its operations in these regions.

Sustainable product design

ı Environmental compatibility and eco-footprint
ı Energy efficiency and low emissions
ı Longevity and optimized total cost of ownership

Certified Quality Management	Certified Environmental Management
ISO 9001	ISO 14001

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