Wide range of mobile device application!

- Low latency
- High power
- High cost
- High data throughput

High end requirements

Low end requirements

- High latency
- Low power
- Low cost
- Low data throughput

5G
LTE-A
WCDMA
GSM

NB-IoT
EC-GSM-IoT
WLAN
IoT
Bluetooth
Zigbee

ROHDE & SCHWARZ
R&S CMW platform covering the entire lifecycle of wireless devices
Mobile radio testing – for R&D and production
One tester for all layers and phases of a mobile device lifecycle

- **RF - Tester**
  - TX/RX signal analysis
  - Network emulation or VSA/VSG mode
  - Integrated fading and audio
  - RF conformance tests

- **Protocol - Tester**
  - Protocol stack development (PHY and L3 test scenarios)
  - Protocol conformance tests
  - Network operator acceptance and interoperability tests

- **IP - Tester**
  - Integrated IP-services (IMS, ePDG, eMBMS, video server…)
  - IP throughput analysis
  - IP traffic analysis
  - User experience testing
CMW Platform overview

CMW500
LTE-A, WCDMA, GSM, CDMA2000, TD-SCDMA
WLAN, Bluetooth, GNSS, Broadcast technologies (Arb files), Signaling, non-signaling mode, fading

CMW290
LTE-A, WCDMA, GSM, CDMA2000, TD-SCDMA
WLAN, Bluetooth, GNSS, Broadcast technologies (Arb files), Signaling, non-signaling mode,

CMW270
WLAN, Bluetooth, GNSS, Broadcast technologies (Arb files), Signaling, non-signaling mode,

CMW100
LTE-A, WCDMA, GSM, CDMA2000, TD-SCDMA
WLAN, Bluetooth, ZigBee / GNSS, Broadcast technologies (Arb files), Non-signaling mode,
Radio development - Callbox

<table>
<thead>
<tr>
<th>Technology</th>
<th>TX, RX and performance measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE/LTE-A (FDD, TDD)</td>
<td>3GPP TS 36.521-1, chapters 6, 7, 8, 9</td>
</tr>
<tr>
<td>WCDMA, (HSPA, HSPA Evolution)</td>
<td>3GPP TS 34.121-1, chapters 5, 6, 7, 9, 10</td>
</tr>
<tr>
<td>GSM (GPRS, EGPRS)</td>
<td>3GPP TS 61.010-1, chapters 12, 13, 14</td>
</tr>
<tr>
<td>TD-SCDMA (HSPA, HSPA Evolution)</td>
<td>3GPP TS 34.122-1, chapters 5, 6</td>
</tr>
<tr>
<td>CDMA20001xRTT and CDMA2000*EV-DO</td>
<td>3GPP TS C.50011-C, chapters 3, 4</td>
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<tr>
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<td>3GPP TS C.50033-B, chapters 3, 4</td>
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</tbody>
</table>

Functional blocks of the R&S CMW callbox

- RF testing
- Network emulation
- IP throughput analysis
- Resource, parameterization tool
- Application server

Air interface

ROHDE & SCHWARZ
Protocol development and testing of any signaling scenario

Multitechnology protocol stack testing
- CMW500 provides a low level (LLAPI) and a medium (MLAPI) script based programming interface
- Or using more than 1500 predefined test cases
- Or using CMWcards test script

R&S CMW500 protocol tester offering:
- Multicell and multi-RAT capability for all cellular standards and WLAN
- Fading with internal fading simulator
- Maximum throughput tests up to 800 Mbps…
Tester for GCF and PTCRB certification – for maximum assurance for wireless device interoperability

GCF and PTCRB – provide the framework for a worldwide wireless device certification scheme by referencing test cases from 3GPP, OMA or GSMA for:

- RF conformance tests
- Protocol conformance tests
- Radio resource management conformance tests
High efficiency through parallel testing, high measurement accuracy and optimized test times

<table>
<thead>
<tr>
<th>Optimized UE throughout gain with the R&amp;S® CMW100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single DUT</td>
</tr>
<tr>
<td>Calibration (TX and RX)</td>
</tr>
<tr>
<td>Verification (TX and RX)</td>
</tr>
</tbody>
</table>

Different test modes
User experience and Quality of Experience (QoE) testing

- Audio and VoLTE performance testing
- Video testing
- Data throughput testing
- Battery life measurements
- Over-the top (OTT) application
IP application testing and traffic analysis
Emergency services testing in a laboratory environment

- Testing emergency call 112 / 911

- Verification of eCall and ERA Glonass modems for automotive requirements

- Tests of wireless emergency alert systems like
  - CMAS—commercial mobile alert system in US,
  - ETWS—earthquake and tsunami warning system

- Automated verification of high power UE
  - for applications that use group call functionality, defined in LTE Rel. 11 (max. $P_{out} = 31$ dBm)
Testing of LTE-WLAN traffic offload in a lab environment

Requirement for the testers:
- Uninterrupted rerouting between the cellular standards and WLAN

Necessary CMW500 core components:
1. LTE emulation + core network
2. Emulated WLAN access point
3. Gateway/firewall (ePDG)
4. IMS server
5. Message analyzer

Possible tests:
- Lower protocol layers in development phase
- Signaling tests incl. CMWcards
- Functional tests
- Analyze the LTE and WLAN protocol messages
Powerful and cost-effective RF measurements and functional tests for IoT devices

- Use cases
  - Functional tests of cellular and non-cellular devices in M2M modules and services
  - Calibration of cellular devices in service

- Simultaneous support of all common wireless communications standards – cellular and non-cellular up to 6 GHz on up to two channels

- Basic RF measurements with/without signaling and functional tests

- IP application verification with realistic network emulation

- Configurable R&S®CMWrun user interface for efficient test sequence execution
“If you want to go fast, go alone.
If you want to go far, go together!”

African proverb