R&S®CMX500
RADIO COMMUNICATION TESTER
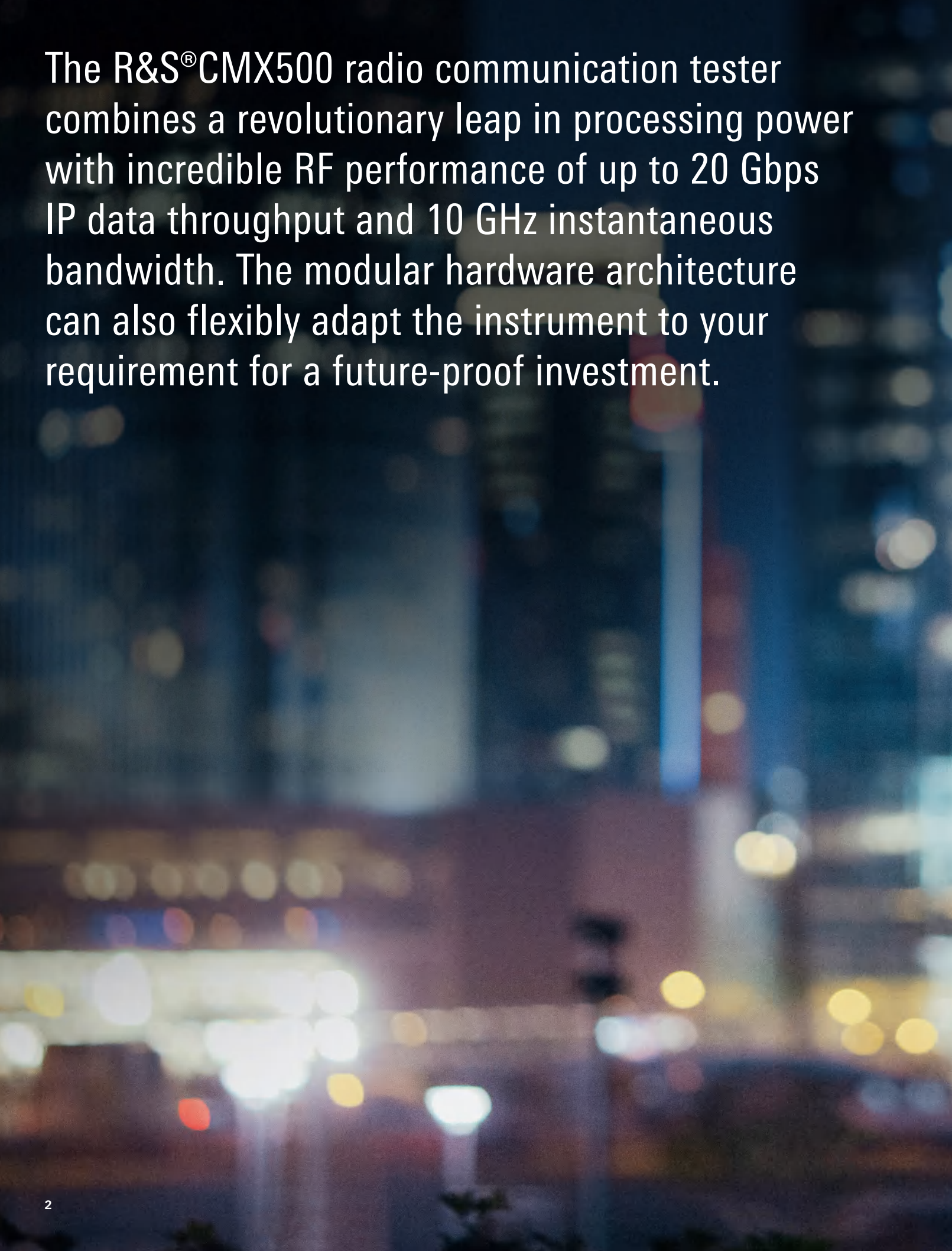
Rethinking 5G testing

Product Brochure
Version 04.00

ROHDE & SCHWARZ

Make ideas real

The R&S®CMX500 radio communication tester combines a revolutionary leap in processing power with incredible RF performance of up to 20 Gbps IP data throughput and 10 GHz instantaneous bandwidth. The modular hardware architecture can also flexibly adapt the instrument to your requirement for a future-proof investment.

AT A GLANCE

The R&S®CMX500 is designed to make 5G testing more simple and straightforward than ever before, even with complex test setups for all 5G NR deployments. It covers all 5G signaling test applications, supports a large variety of present and future 3GPP band combinations and end-to-end data rates of up to 20 Gbps – all in a single box. Fully independent LTE/FR1 and FR2 RF chains reduce complexity for your test setup and speed up the whole process with parallel testing.

The combined multi-band capabilities of the R&S®CMX500 one-box tester enables LTE, FR1 and FR2 band combination testing to verify RF, signaling and applications in 5G devices. With the RF unit's frequency range, scaling up to 8 GHz, the R&S®CMX500 is designed to support any further FR1 3GPP band extensions. Due to the advanced dynamic range of the RF unit, RF and callbox testing are much more stable and reliable.

The modular and scalable hardware architecture has the flexibility needed to configure the R&S®CMX500 to different testing needs. Should FR2 testing not be of interest, the R&S®CMX500 can be configured without R&S®CMX-B500A IF units, but upgraded with IF units and enable FR2 testing with the same instrument some time later.

State-of-the-art R&S®CMsquares software guides users with a simple and intuitive web interface through any sort of 5G testing. The web-based interface includes a Python scripting interface and enables highly automated remote testing.

The R&S®CMX500 comes with a wide range of accessories for MIMO and OTA testing in the FR1 and FR2 frequency ranges. Rohde & Schwarz has truly turnkey 5G testing solutions, ranging from small shielded boxes to large OTA chambers with remote radio heads and active combiners.

Front panel displaying modular RF and IF units.

A TRUE ALLROUNDER

The R&S®CMX500 is designed to match all test requirements that can occur over the entire product lifecycle of a mobile communications device.

5G NR TEST AND MEASUREMENTS

Supports non-standalone (NSA) and standalone (SA)

END-TO-END COMMUNICATIONS TESTING

User experience testing, including voice, video, IP data transfer and OTT

3GPP RF PRE-/ CONFORMANCE TESTS

Automated TX, RX and performance testing

GCF, PTCRB AND NetOp TESTS

Validated testing for specific network operators in compliance with 3GPP and operator test plans

INTER-RAT, ROAMING AND REJECT TESTING

Mobility with fading conditions and reject/error signaling scenarios

5G LOCATION-BASED TESTING

OMA secure user plane location (OMA-SUPL), certification tests including network operator tests

SIMPLIFIED SERVICE AND REPAIR TESTING

Easy and practical solution for 5G service and repair testing

BAND COMBINATION TESTING

Automated MRDC band combination testing for RF verification, signaling and end-to-end (E2E)

R&S®CMsquares – THE R&S®CMX500 CONTROL CENTER

A modern, web based user interface designed for remote and lab operation, R&S®CMsquares is the R&S®CMX500 control center for all measurement tasks. R&S®CMsquares simplifies device testing in all development stages from early prototyping, to form factor verification including RF callbox measurement tasks, protocol verification and data application testing.

Common graphical user interface

All R&S®CMX500 services are integrated in R&S®CMsquares, the common graphical user interface. It has a dashboard where all types of applications can be accessed. This unique user interface is controlled via web GUI. The standardized GUI provides a unified user experience for all Rohde & Schwarz 5G radio communication testers. All measurements can be operated manually in the workspace or built as test sequences in the integrated R&S®CMsequencer graphical scripting interface. Test routines can be remotely controlled via XLAPI and SCPI interfaces.

Browser based test software solution

R&S®CMsquares is a unified test software solution with browser based user experience that combines all that is needed for 5G NR testing. It provides everything from test configuration, parameterization, measurements as well as test execution in a single dashboard style environment with quick access to various applications. A standardized GUI can control all new 5G radio communication testers.

The interactive callbox mode helps rapidly connect to a device under test, alter network parameters on the fly, analyze real-time RF TX/RX measurements and trace protocol stack messages on all protocol layers or generate statistics for data throughput testing with a variety of chart diagrams. It also has a sequencer mode to run preconfigured 5G NR test scripts or simply create 5G NR test scripts from scratch with a simple drag and drop. Ultimately, an interactive mode and a sequencer mode can run in parallel to provide the same test results.

Squares concept

With R&S®CMsquares, users can access measurement tasks in separate measurement squares. The DUT is always in focus with R&S®CMsquares. With this DUT-centric approach, it is very easy to keep an overview of even complex test scenarios, test environments and measurement tasks. The next change is just one click away.

R&S®CMsquares includes as many squares as needed: for measurements, graphical outputs and statistical views, network layout and configuration, RF connection, message analyzer, test sequencer, scripting – you name it. The R&S®CMsquares layout can be configured for your personal preferences at any time.

DUT-centric operating concept

5G is taking mobile communications by storm. But since most use cases expand on existing cellular technologies such as LTE, device testing has become even more complex and time-consuming. A simple and efficient solution is needed to keep the transition to 5G as smooth as possible. Rohde & Schwarz puts the DUT in the center of the test environment.

In the test environment, the DUT is placed in the center of the four squares. Simply configure your device and network parameters to create your preferred 5G network for non-standalone or standalone mode, data services for throughput tests, RF connector cabling of the device as well as required RF measurements.
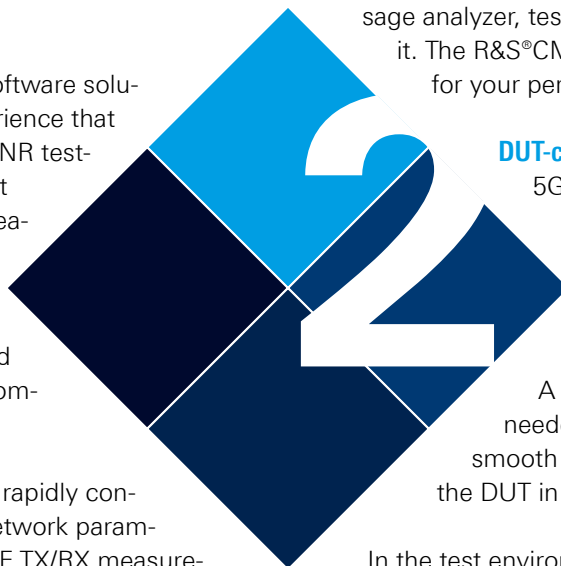
R&D TEST SUITE WITH ALL UTILITIES UNIFIED IN ONE PLACE

The R&S®CMsquares test software platform has an intuitive control architecture based on test environment, measurement workspace, sequencer and message analyzer.

TEST ENVIRONMENT
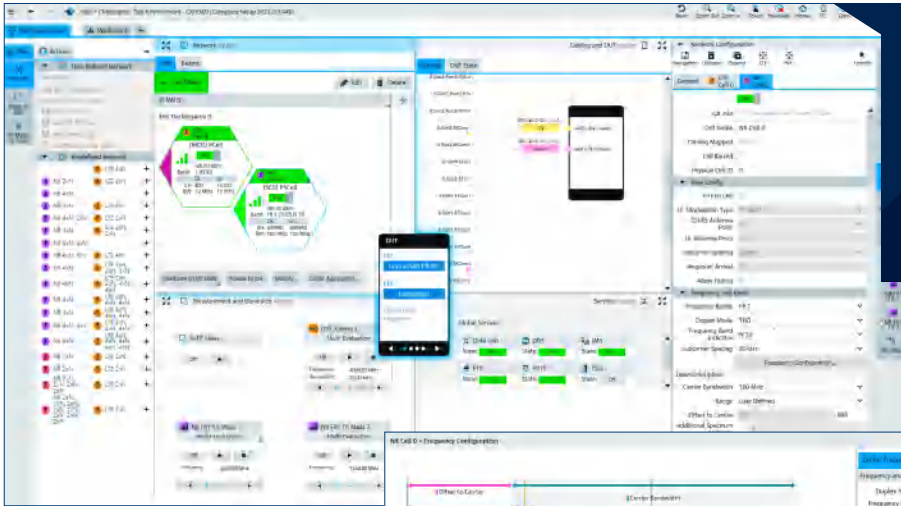
The test environment provides a comprehensive overview of all configurations and measurements with customized settings adapted to DUT needs. It is the control hub for network creation, parametrization, DUT control and cabling.
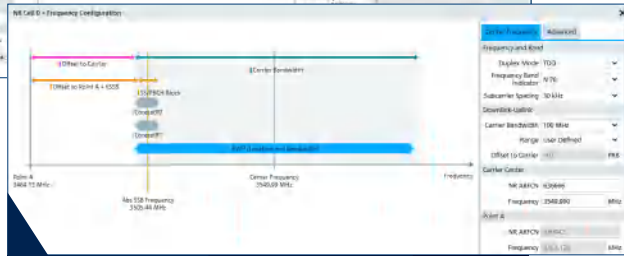
Utilities like the graphical frequency configuration dialog guide users to a valid 5G network configuration, no matter how complex 3GPP specifications may seem.

SEQUENCER
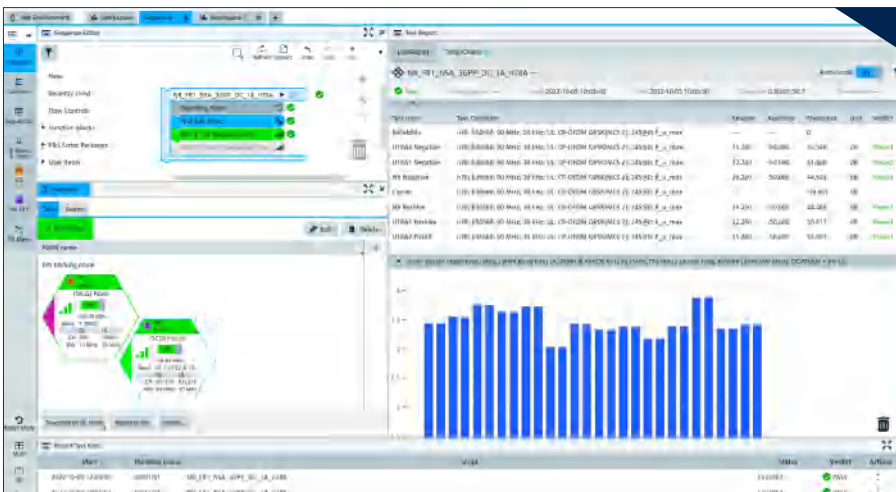
The R&S®CMsequencer features a unique graphical user interface and simplified workflows for creating and executing test scripts and complete test plans/campaigns. The built-in campaign manager offers all tools required for automated testing, parameterization and result reporting. Users are free to add other measurement squares in the sequencer for a seamless user experience with all kinds of RF, protocol and application tests.

TEST SEQUENCE AUTOMATION WITH R&S®CMsequencer

The R&S®CMsequencer graphical scripting interface creates, configures and executes test scripts on the R&S®CMX500. The R&S®CMsequencer is part of R&S®CMsquares.

Having individual applications for specific testing areas is a thing of the past. The future is a more unified approach, where all necessary 5G test functions are available in a single graphical user interface. The R&S®CMsequencer provides users with a unique and intuitive way to create test sequences for a wide range of use cases, including 5G RF parametric testing, 3GPP RF testing, protocol verification and E2E IP testing. By working seamlessly with R&S®CMsquares interactive mode, R&S®CMsequencer makes it simple to create and execute test scripts and test plans in an automated environment. For a very straightforward process, users configure their tests by simply arranging color-coded functional blocks one after another. 5G testing has never been easier.

Key facts

► Automated environment to execute test scripts or test campaigns created with graphics or the python scripting interface
► 3GPP RF TX/RX tests in line with IEEE 38.521
► R&D RF signaling measurements including multi-evaluation measurements, BLER search, maximum power (both for FR1 and FR2)
► End-to-end throughput testing including IMS, VoLTE and VoNR
► 5G signaling feature capabilities (for e.g. carrier aggregation, mobility) with flexible configuration possibilities
► Automatic iteration over DUT-capable band combinations and result summary for each combination
► Online and offline measurement reports including charts and graphs in various data formats (e.g. csv, pdf)
► Seamless context switching to and from R&S®CMsquares interactive mode for unlimited testing flexibility

R&S®CMsequencer workspace within R&S®CMsquares web user interface.

R&S®CONTEST – SOPHISTICATED TOOLS FOR ALL PREDEFINED TESTS

R&S®CONTEST is test system software with versatile automated test properties, for both network operator test scenarios and conformance testing in line with 3GPP.

Automated testing

R&S®CONTEST is proven test system software for 24/7 automated testing of network operator testing scenarios and conformance testing in line with 3GPP. R&S®CONTEST provides comprehensive analysis for evaluating test campaigns, generates easy-to-understand reports and has many useful tools.

Even complex test plans can be quickly defined with drag-and-drop and any needed intuitive parameter applications, such as frequency band combinations.

RF AND 3GPP PRECONFORMANCE TESTING

RF measurements or measurements of the transmit and receive characteristics, are the basis for device testing. The R&S®CMX500 offers a user-friendly test solution for lab applications that delivers reliable and reproducible results.

Flexible scheduling

A chipset manufacturer has different RF measurement requirements than a network operator. The R&S®CMX500 with the R&S®CMsquares user interface takes into account the differences between the various applications. Details for many test scenarios can be flexibly and interactively set "on the fly". R&S®CMsquares and the integrated R&S®CMsequencer offer everything needed to successfully perform RF measurements: the necessary flexibility and large predefined libraries. Test solutions needed for specific RF measurements are easy to create. RF measurements are possible in the FR1 and FR2 frequency ranges, in chambers and with remote radio heads (RRH). Users have access to all parameters, can flexibly adjust them and reproduce results at any time.

Automated 3GPP preconformance tests

R&S®CMsequencer offers 3GPP RF test cases in line with TS 38.521 (preconformance) as a simple and automated one-click test execution solution. Special 3GPP blocks that comply with the configuration and test points in 3GPP TS 38.521 offer a ready-made way to test device RF functions. R&S®CMsequencer 3GPP blocks also allow modification of default configurations and the flexibility to test non-compliant configurations.

Interactive RF tests can be flexibly compiled with R&S®CMsquares. In the screenshot, LTE measurements are to the left and the 5G FR1 measurements on the right can also be created with R&S®CMsequencer.
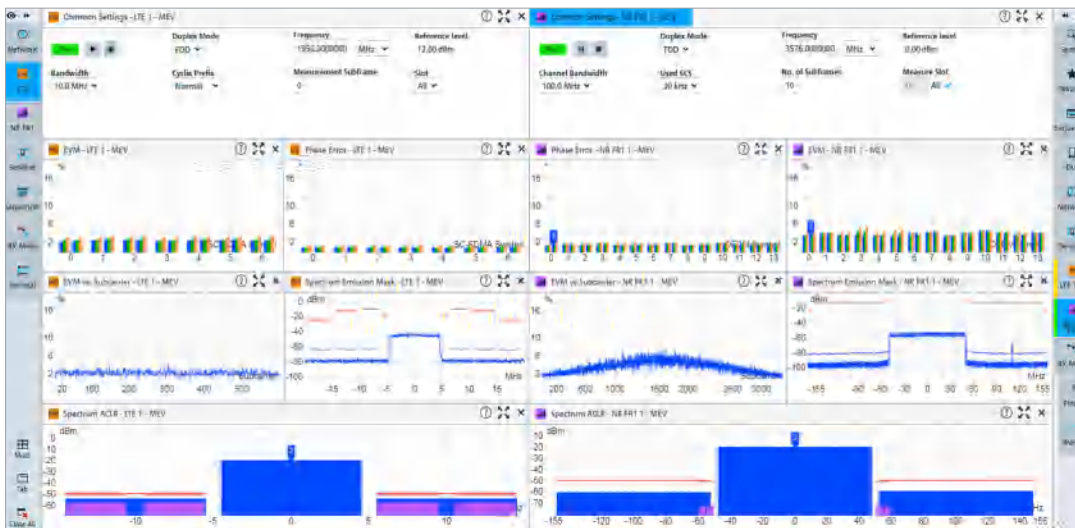
TESTING USE CASES FOR APPLICATION TESTING

The R&S®CMX500 has a unique and fully integrated 5G mobile device application testing solution. A pre-optimized IPv4/IPv6 test environment provides the R&S®CMX500 with maximum reproducibility and stability, dramatically shortening test setup preparation and configuration times for application and connectivity testing of the most common internet transport protocols.

INTERNET/ USER BACKEND
IPv4/IPv6
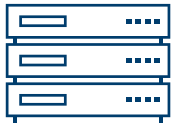
SERVER FUNCTIONALITY
Integrated web services

DNS

FTP

IMS

ePDG

HTTP

Video

APPLICATIONS
Measurements and tools

Iperf

Ping

SNIPPETS – MORE THAN SAVE AND RECALL

R&S®CMsquares Snippets are a unique way to minimize frequent actions into single click buttons for rapid test use case verification.

Never before has it been easier to seamlessly switching from interactive testing to scripting and vice versa. R&S®CMsquares offer this unique capability and more with Snippets. R&S®CMsquares Snippets are a one-click pre-defined system configuration solution that guide a DUT into a certain state. Afterwards, users can continue testing in interactive mode. Save time and effort with R&S®CMsquares Snippets by avoiding monotonous user actions during the interactive operation mode. Simply place your test sequence in a customized button and run it whenever needed.

Key facts
▶ Avoid monotonous steps and bring DUT to a desired state with just one-click
▶ Many use cases possible, e.g.:
  – One-click ENDC connection
  – One-click maximum throughput
  – One-click maximum power configuration
▶ Utilize user created and verified test scripts in interactive mode

User workflow on creating and using R&S®CMsquares Snippets

Save/recall feature offers a similar function in Callbox, but only for configuration data that can be saved and retrieved. R&S®CMsquares Snippets help take a further step to configure cells and settings and change the DUT to the desired state without manual intervention.

Create Snippet in R&S®CMsequencer

Add Snippet to interactive mode of R&S®CMsquares

CERTIFICATIONS AND CARRIER ACCEPTANCE TESTS

3GPP protocol conformance testing

Protocol conformance testing (PCT) is a part of GCF and PTCRB device certification. The R&S®PCT NR test solution based on the R&S®CMX500 is test platform 292. Equipped with RF units (R&S®CMX-B600A) the R&S®CMX500 can support LTE and FR1 frequencies along with available IF units (R&S®CMX-B500A) for FR2 frequencies. This allows for all test cases defined in 3GPP TS 38.523-1 and 3GPP TS 34.229-5 to be run on a single R&S®CMX500.

3GPP RF and RRM conformance testing

The R&S®TS8980FTA-M1 full type approval test system with R&S®CMX500 and R&S®ATS1800M anechoic chamber supports testing for FR2 1 × angle of arrival (AoA) and 2 × AoA to the integrated test system. It is operated by R&S®CONTEST sequencer software and generates highly efficient and precise, reproducible measurement results. The R&S®ATS1800M enables multiple AoA measurements compliant with the enhanced indirect far field (IFF) test setup from 3GPP with two side chambers and a large, overlapping quiet zone.

3GPP LBS protocol and minimum performance tests

Minimum performance, OMA-secure user plane location (OMA-SUPL) and protocol testing (location based services, LBS) are a part of GCF and PTCRB device certification. The R&S®TS-LBS-NR location based services test solution for NR based on R&S®CMX500 are test platforms 299 and 292.

R&S®CONTEST provides conformance test case selection, configuration and execution possibilities.
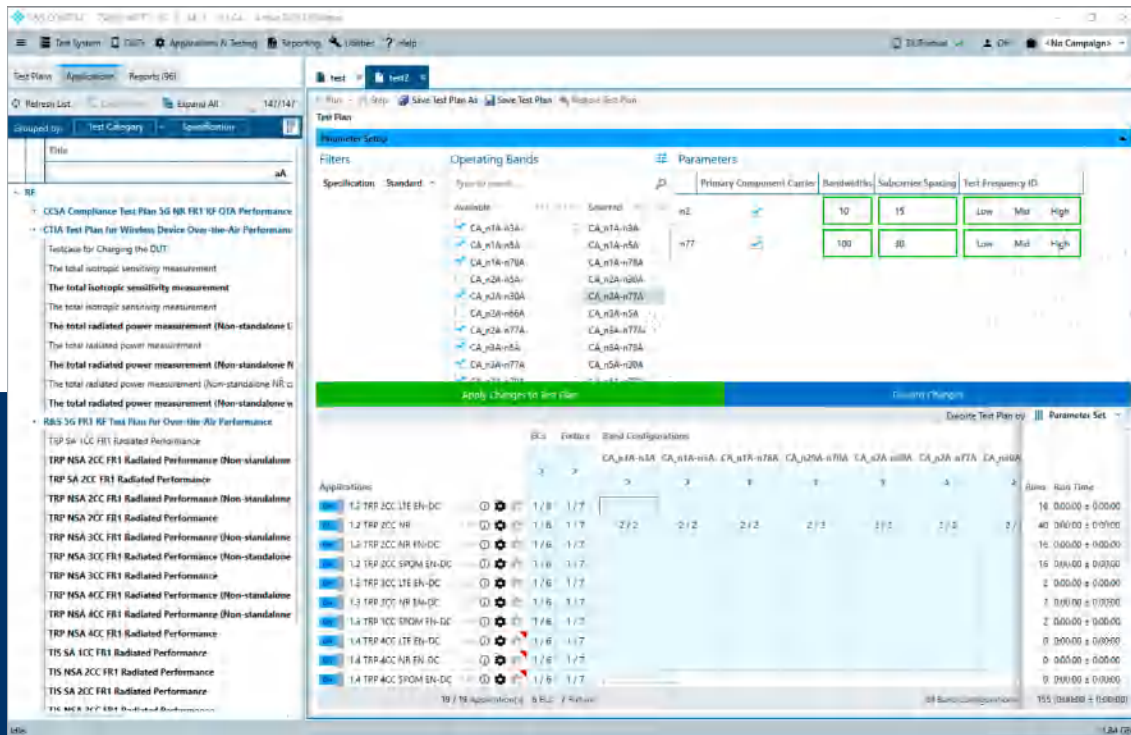
COMPLEMENTARY PRODUCTS FROM ROHDE & SCHWARZ

Rohde & Schwarz offers system components for 5G NR signaling testing in the FR2 frequency range. In addition to the R&S®CMX500, these include antennas, cables, feedthroughs, power sensors, shielding chambers, antenna test systems and remote radio heads. Rohde & Schwarz manufactures all system components in own plants, ensuring optimal system parameters. The following provides you with a detailed overview of four of these complementary products. See the Rohde & Schwarz website for other products.

R&S®CMX-Z25 RF PORT EXTENDER

The R&S®CMX-Z25 is a compact and rack-mountable port extender that doubles the number of R&S®CMX500 ports. The R&S®CMX-Z25 expands connectivity options without taking up additional space. It has user-friendly color coding to effectively enhance workflows and manage connections.

R&S®CMX-Z25.

R&S®CMXHEAD50 REMOTE RADIO HEAD

R&S®CMXHEAD50 remote radio head is an upconverter and down-converter for 5G FR2 frequencies to verify RX and TX measurements. The remote radio head concept allows short RF cable lengths for an optimal link budget in radiated test environments. The multiband R&S®CMXHEAD50 covers all important FR2 bands.

R&S®CMXHEAD50.

R&S®CMQ500 SHIELDING CUBE

The R&S®CMQ500 shielding cube is a compact and fully integrated solution that covers most 5G devices in various applications. The robust mechanical design ensures reliable measurements in R&D environments. The flexible cube design covers applications for smart devices, CPEs, RFIC and prototypes. The R&S®CMQ500 is ready for 5G and other technologies in the frequency range from 0.7 GHz to 77 GHz. The R&S®CMQ500 can easily be scaled for different DUT sizes and requirements. Small antennas make it easy to test relatively large DUTs in the compact shielding cube. Flexible mounts allow antennas and probes to be mounted and aligned in any position. The mounts have a swivel head to cover various quiet zones.

R&S®CMQ500 with open drawer.

ORDERING INFORMATION

| Designation	Type	Order No.
Base unit		
Radio communication tester; instrument with following accessories: power cords, operating manual (getting started), R&S®CMX-B300A cables, R&S®CMX-PB70B cables	R&S®CMX500	1201.0002K70
Hardware options		
R&S®CMX500 basic assembly	R&S®CMX-PB70H	1222.0676.09
R&S®CMX500 accelerator unit	R&S®CMX-B200A	1222.0747.02
R&S®CMX500 processing unit	R&S®CMX-B300B	1222.0801.03
R&S®CMX500 IF unit	R&S®CMX-B500A	1222.0924.02
R&S®CMX500 RF unit	R&S®CMX-B600A	1222.0953.02
Software options		
NR signaling, NSA mode enabler Basic level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS600B	1222.1672.02
NR signaling, NSA mode enabler Medium level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS600M	1222.1650.02
NR signaling, NSA mode enabler Xpert level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS600X	1222.1695.02
NR signaling, SA mode enabler Basic level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS601B	1222.2327.02
NR signaling, SA mode enabler Medium level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS601M	1222.2333.02
NR signaling, SA mode enabler Xpert level, 2x2 MIMO and 4x4 DL (one CC only), 256QAM UL	R&S®CMX-KS601X	1222.2340.02
NR SIG extension Basic, UL 2x2 MIMO, CA up to 8CC	R&S®CMX-KS610B	1222.3700.02
NR SIG extension Medium, UL 2x2 MIMO, CA up to 8CC	R&S®CMX-KS610M	1222.3717.02
NR SIG extension Xpert, UL 2x2 MIMO, CA up to 8CC	R&S®CMX-KS610X	1222.3723.02
NR signaling extension Basic, SUL and Rel. 16 features	R&S®CMX-KS611B	1222.3730.02
NR signaling extension Medium, SUL and Rel. 16 features	R&S®CMX-KS611M	1222.3746.02
NR signaling extension Xpert, SUL and Rel. 16 features	R&S®CMX-KS611X	1222.3752.02
NR signaling extension Basic, CA 9-16 CC	R&S®CMX-KS612B	1222.6574.02
NR signaling extension Medium, CA 9-16 CC	R&S®CMX-KS612M	1222.6580.02
NR signaling extension Xpert, CA 9-16 CC	R&S®CMX-KS612X	1222.6597.02
NR signaling extension Basic, Rel. 17	R&S®CMX-KS617B	1222.6600.02
NR signaling extension Medium, Rel. 17	R&S®CMX-KS617M	1222.6616.02
NR signaling extension Xpert, Rel. 17	R&S®CMX-KS617X	1222.6622.02
Application test featureset 1 (SL)	R&S®CMX-KA100	1222.1595.02
Application test featureset 2 (SL)	R&S®CMX-KA110	1222.4142.02
IP traffic analysis (SL)	R&S®CMX-KA150	1222.4159.02
Audio enabler	R&S®CMX-KA180	1222.4165.02
Audio POLQA measurements	R&S®CMX-KA181	1222.4936.02
NR LBS server, basic set 1	R&S®CMX-KA190B	1535.5874.02
NR LBS server, Rel. 16 feature	R&S®CMX-KA191	1222.5861.02
NR LBS OTA GNSS framework	R&S®CMX-KA195	1537.4198.02
Remote radio heads (RRH)		
Remote radio head for R&S®CMX500	R&S®CMXHEAD50	1201.0002K76
R&S®CMXHEAD50 hardware unit	R&S®CMXH-B73B	1430.9106.03
Remote radio head connection cable, length: 3 m	R&S®CM-Z30A	1212.1040.02
Extended frequency range up to 50 GHz	R&S®CMXH-K50G	1222.6568.02
Enable low noise RX port	R&S®CMXH-K51RX	1222.6551.02

CONTENTS

KEY FACTS

► LTE and FR1 multiband capabilities up to 8 GHz

► FR2 multiband remote radio support
(24 GHz to 50 GHz)

► 20 Gbps and end-to-end IP data performance
capability

► Single web based GUI for RF, protocol and
application tests

► Extensive IP and application test feature set
onboard

► LTE Anchor support for up to 8CC LTE

USE CASES

► RF callbox measurements

► Signaling protocol verification

► End-to-end data testing

► 3GPP conformance testing

► Network operator acceptance tests
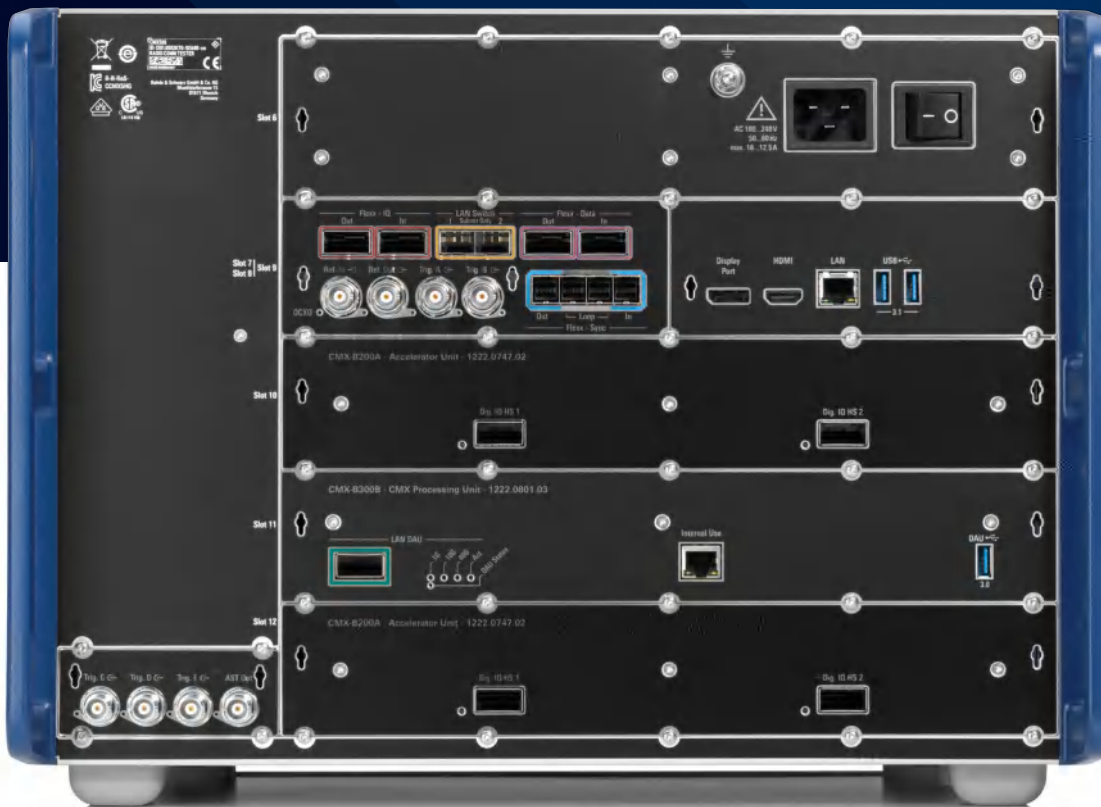
Back panel providing all necessary connectors along with modular accelerator units.

BENEFITS

Supporting the entire product lifecycle
R&S®CMX500 radio communication tester hardware and software can handle all non-signaling and signaling scenarios for mobile communications devices, from early R&D design to final integration, verification and performance testing, final product validation in a test house as well as quality assurance and repair. The hardware modules are designed for versatile tasks, offering enormous flexibility to users who can perform different measurement tasks with the same test station.

Covering all use cases for 5G NR device testing
The R&S®CMX500 is the platform for signaling tests in the sub-8 GHz (FR1) and mmWave (FR2) frequency bands in chip development testing, module testing and device testing in regression stations, R&D or test labs. With additional RF units (R&S®CMX-B600A), the R&S®CMX500 can support LTE and FR1 frequency ranges. IF units (R&S®CMX-B500A) are available for FR2 frequency ranges. The powerful processors can host LTE and 5G technologies and the data application modules.

Ready for the future
Rohde&Schwarz permanently implements all new standardization and test house requirements making the R&S®CMX500 future-proof. The R&S®CMX500 has seven height units with plenty of space for future extensions.

Addressing all 3GPP bands in FR1
The all new R&S®CMX500 support a frequency range of up to sub-8 GHz. The R&S®CMX500 addresses all 3GPP bands in the FR1 frequency range. The R&S®CMX-B600A RF frontend supports existing LTE frequency ranges (licensed and unlicensed) along with existing 5G FR1 frequency ranges.

Countless CA and MIMO combinations
The R&S®CMX-B600A RF unit boasts an instantaneous bandwidth of 1 GHz per TX and can simultaneously host LTE and NR FR1 cells with a maximum carrier bandwidth of 200 MHz. Up to 32 layers can be configured with end-to-end (E2E) IP throughput verification. Four TX ports, two RX ports and two TRX ports can be used to flexibly link RF connectors to DUTs.

Offering a whole test environment from one vendor
Rohde&Schwarz offers complimentary chambers for FR1 and FR2 over-the-air (OTA) testing for any type of 5G OTA tests.

Customizable hardware
The modular hardware architecture can be configured for basic use cases such as RF parameter measurements, measurements under fading conditions and performance measurements with maximum data rates. The front panels of the IF and RF interfaces can be fully customized to specific 5G testing needs. Two IF boards and two RF boards can enable all RF parametric and application tests for LTE and FR1 and FR2 testing. Four IF boards and one RF can be added on the front to cover a broader testing range for FR2 . Such unmatched flexibility broadens your 5G testing variation spectrum.

► Two R&S®CMXB600A RF units, support up to 32 5G layers or up to 32 LTE layers
► Three R&S®CMXB200A accelerator units for baseband computing
► One R&S®CMXB300B processing unit for protocol stack computing and data application
► Optionally two R&S®CMXB500A IF units for FR2

- ▶ Dashboard style, simple entry point for all users

- ▶ Use case selection (e.g. NSA mode, SA mode)

- ▶ User defined squares

- ▶ Easy access to all types of applications: interactive mode, sequencer, installation manager

- ▶ One-click recall of saved sessions

- ▶ Easy parameter outline with the help of favorites

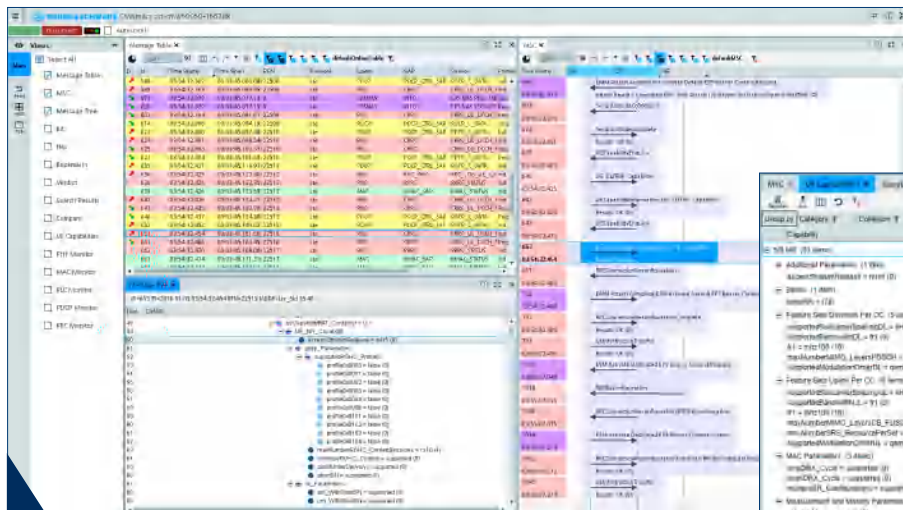- ▶ Snippet access (sequencer based macros) via dedicated buttons

Easy measurement setup with R&S®CMsquares; shown here: configuration of RF non-standalone measurements.
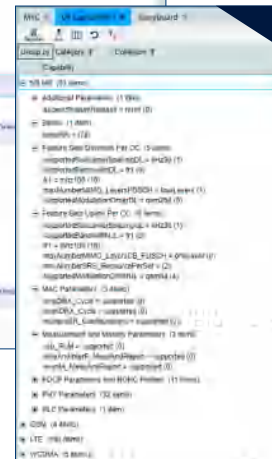
MEASUREMENT WORKSPACE
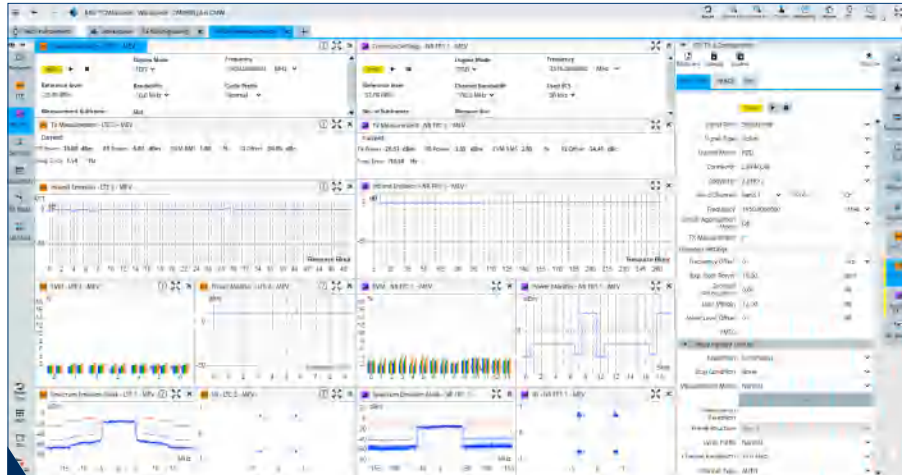
Measurements are performed in the workspace. It combines several squares for all technologies including LTE, FR1, FR2, TX and RX live measurements, data testing, monitoring, DUT control and throughput charts. The layout can be arranged to suit any use case. Users have immediate access to all signaling and measurement parameters within the workspace without leaving the measurement.

MESSAGE ANALYZER

UE capabilities: The message analyzer combines several auxiliary tools to investigate the DUT protocol stack. Users get instant access to UE capabilities and band combinations reported by the DUT.

The entire message exchange between the network and end device can be traced in real time and analyzed in detail using the message analyzer. The message analyzer is integrated into R&S®CMsquares and allows quick access to all signaling communications layers between the DUT and the simulated network. Users can quickly narrow down DUTs protocol stack issues in the event of errors.

PYTHON INTERFACE FOR WRITING REPEATABLE ROUTINES

Python is the most common scripting language and an industry standard for testing and automation frameworks. To configure and control the R&S®CMX500 and verify DUT behavior, Rohde & Schwarz provides the scripting interface in Python.

The simple and abstract interface enables users to spend their precious time testing rather than programming. For users who want to go deeper into configuration and peer message content, XLAPI also has a flexible configuration mode. Python test script packages created and maintained by Rohde & Schwarz provide a user-friendly starting point for device verification, whether for FR1, FR2, non-stand-alone or standalone modes.

Test campaigns and regression tests with Python test scripts can be created and executed in R&S®CMsequencer. Integration in user automation frameworks is easy, whether via R&S®CMsequencer or Python scripts executed directly from the user automation framework.

Key facts
► Self-sufficient installation (no effect on existing Python installations)
► Configure only what is needed (only necessary parameters are configured, the rest will be adjusted or default values used)
► Comprehensive help with extensive documentation on version upgrades
► Any other Python modules can be used
► Covers all functional tests including RF, throughput, mobility and multi-SIM

The scripts written in the integrated Python development environment can communicate with all device functions.
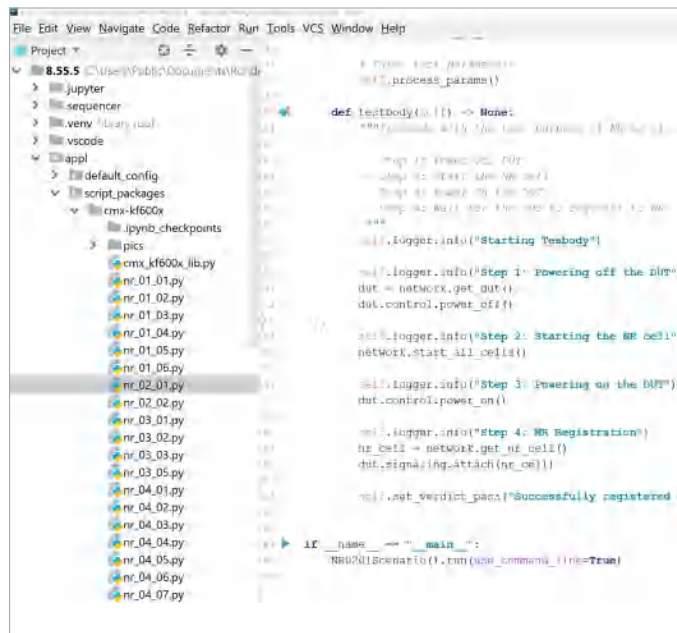
The integrated tutorials and information texts make it easy to use Python scripting interface.
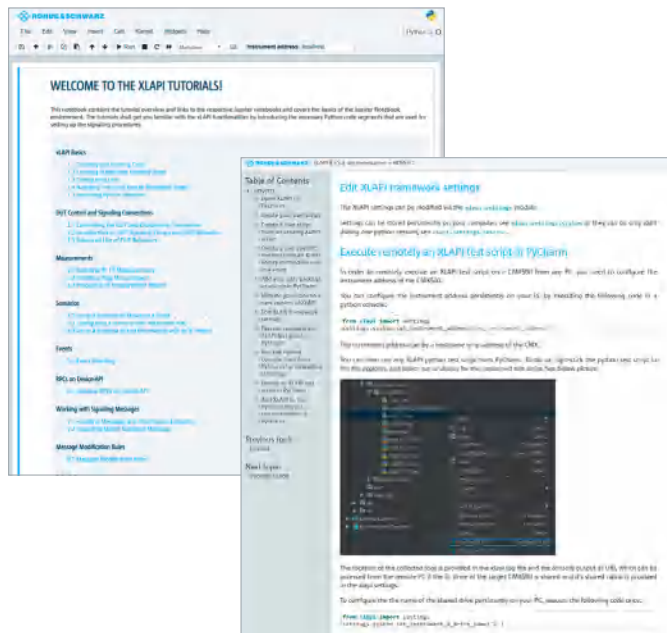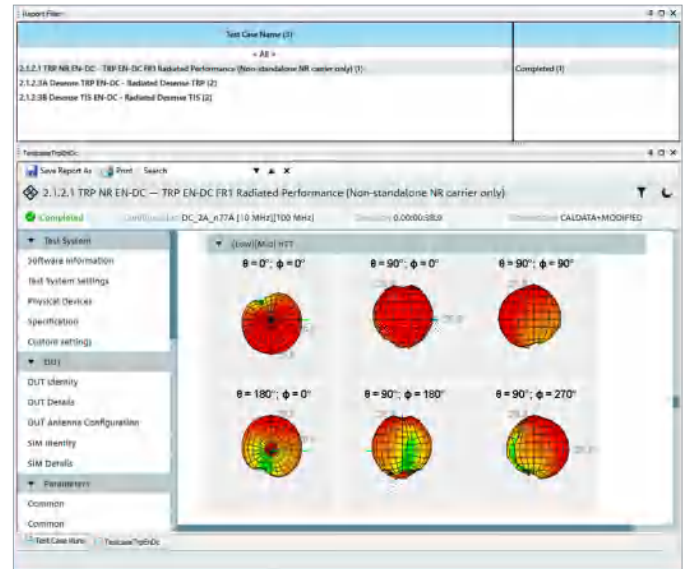
Performing carrier acceptance tests with R&S®CONTEST test software:
R&S®CONTEST enables fully automated performance of test cases and provides
extensive summary reports along with powerful analysis tools to evaluate test reports.

R&S®CONTEST provides 3GPP RF testing for FR2 and spherical coverage reports,
where applicable.

User-friendly operation
Cabling and antenna scenarios can be visually edited and
system operators easily guided through the test system
calibration process. User-friendly remote access and web-
based test system monitoring are also available.

Wide range of applications
R&S®CONTEST covers a wide range of applications and
system configurations, from a single R&S®CMX500 to a
full-blown R&S®TS8980FTA conformance test system.

System operators benefit from one sequencer platform for
the entire range of pre-defined test applications, such as
LBS, RF, RRM, protocol conformance testing and specific
test solutions for network operators (NetOp test solutions).

Test solution for 3GPP protocol and minimum performance tests
(both for FR1 and FR2) with an R&S®CMQ500 shielding cube, the
R&S®CMX500, two R&S®CMXHEAD50 remote radio heads, an
R&S®SMBV100B vector signal generator and a notebook.

Extendable for mmWave measurements

The standard R&S®CMX500 in the FR1 range can be upgraded into an mmWave setup by adding R&S®CMXHEAD50 remote radio heads and additional internal IF modules (R&S®CMX-B500A).

The R&S®CMXHEAD50 devices up- or downconvert respectively from the IF signal into the required mmWave RF spectrum to support the TX and RX signal at the dual polarized antenna inside the over-the-air (OTA) chamber. Depending on the test requirements, the setup can be connected to one of the Rohde & Schwarz OTA chambers (see Complementary products from Rohde & Schwarz on page 24). For typical RF tests, we recommend the R&S®ATS800R rack based CATR[1] antenna test system with optional positioner.

[1] CATR: compact antenna test range.

To boost the output power or increase the signal-to-noise ratio (SNR) or for bandwidth extensions, we offer the R&S®CMX-RF42 RF frontend, an active combiner. In line with 3GPP requirements, EIRP, CDF or TRP measurements can be reliably performed within the OTA chamber.

RF over-the-air testing for FR1 and FR2 using R&S®CMX500, R&S®ATS800R and R&S®CMXHEAD50.

The server functions and IP level applications allow users to verify IP functions on DUTs ranging from basic to advanced. The R&S®CMX500 one box solution addresses the following use cases:

IP throughput testing
The R&S®CMX500 allows traffic generation and monitoring of high 5G data rates and the different layers, including the physical and IP layers.

IMS audio and video testing
The integrated IMS server enables voice, video and SMS testing over NR and LTE.

Battery life testing
The seamless integration of power consumption measurements for unique insights together with RF, protocol and application testing.

WLAN offloading and VoWLAN
5G and WLAN are expected to seamlessly intermingle in future networks. WLAN offloading is vital to ubiquitous network availability.

IP traffic and security analysis
IP traffic analysis for a detailed look at 5G mobile device data traffic.

IP tune

IP analysis

IP logging

DNS monitor

QoS
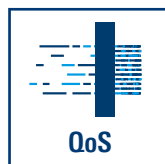
SHUFFLER – AUTOMATED BAND COMBINATION TESTING

R&S®CMsequencer Shuffler automatically tests all supported band combinations to verify signaling, RF and E2E functions with R&S®CMX500.

3GPP stipulates a combination of LTE and NR band combinations that far exceed 10 000 s. In functional or RF verification, verifying a device against all supported band combinations, would result in huge testing times with a lot of manual work.

The R&S®CMsequencer Shuffler easily performs automatic iteration across the bands and band combinations reported by the DUT, drastically reducing the time and effort needed to test RF, signaling and IP throughput performance for all supported combinations.

Any combination of LTE, NR FR1, NR FR2, ENDC, NRDC, NR-CA can be tested as long as the necessary resources are supported by R&S®CMX500 hardware. These combinations can be extracted directly from user equipment or users can feed these band combinations using a file.

Predefined and verified test scripts from Rohde & Schwarz, mean users do not have to start from scratch and tests can be adapted to user needs with minimal changes. This automation and flexibility makes iterating band combination testing quicker and easier than ever before.

Key facts
► Single click solution to iterate through all band combinations reported in user equipment capabilities
► Highly flexible testing of various device functions (TX/RX measurements, throughput, VoLTE/VoNR, etc.)
► All band combination results in one test report
► Users can enter band combinations from various input sources (e.g. csv file)

R&S®CMsequencer Shuffler
The R&S®CMsequencer Shuffler iterates through device MRDC band combinations for fully automated DUT health checks.

Carrier acceptance tests

3GPP conformance tests are complemented by operator specific tests required by individual network operators. The Rohde & Schwarz test packages for specific network operators (NetOp test solution) cover device acceptance test requirements for all major network operators.

Based on the R&S®CMX500, the NetOp test solution supports different test categories, such as the network operator protocol test (NPT), application/VoNR testing (ATE) as well as data performance and quality acceptance testing (PQA). All NetOp test applications can smoothly run on the same R&S®CMX500 platform for an optimized return on investment. The R&S®TS-LBS-NR test solution supports protocol testing, minimum performance testing, OMA-SUPL testing and A-GNSS testing as well as network based positioning testing for eCID, UL-TDOA, DL-TDOA, AoA and AoD.

The R&S®TS8980FTA-3A test system together with the R&S®ATS1800C CATR based compact 5G NR mmWave test chamber.

R&S®ATS800R RACK BASED CATR ANTENNA TEST SYSTEM

R&S®ATS800R.

The R&S®ATS800R rack based CATR[1] antenna test system is a very compact environment for 5G antenna, module and device characterization in the frequency range from 20 GHz to 50 GHz. It is an essential tool in R&D design verification for both active and passive devices. It has a gold-plated parabolic CATR reflector with rolled edges and a feed antenna. The DUT is placed on the device fixture on the bottom of the anechoic chamber for easy testing. The device fixture allows for flexible DUT mounting inside the 20 cm high quality quiet zone. This can be done using pin holes or threaded holes that match the mechanical interface of the Rohde & Schwarz calibration antennas. In combination with the R&S®CMX500, it ensures fast and smooth characterization in the mmWave frequency range. The R&S®ATS800R can be expanded with a 3D positioner or a climate option for extreme temperature tests.

[1] CATR: compact antenna test range.

R&S®ATS1800C CATR BASED COMPACT 5G NR mmWAVE TEST CHAMBER

R&S®ATS1800C.

The R&S®ATS1800C CATR based compact 5G NR mmWave test chamber is a turnkey chamber for far-field OTA RF measurements of 5G devices and components in the frequency range from 6 GHz to 90 GHz. The chamber itself is easily transportable with wheels and has a footprint small enough to pass through most doors, so it easily fits into R&D labs or test houses of all sizes. Inside the fully shielded chamber is the compact antenna test range (CATR) consisting of a feed antenna, a bidirectional parabolic reflector and a 3D positioner. The parabolic reflector is specially designed and manufactured with optimized rolled edges for well distributed collimated beam power after reflection. Moreover, the reflector has extremely high-precision surface roughness to minimize errors introduced by the reflection. This allows the reflector to be used in a very wide frequency range for accurate measurement results.

Designation	Type	Order No.
Extras		
5G NR UICC test SIM	R&S®CMX-Z01	1222.3917.02
Monitor mount	R&S®CMX-Z101A	1222.3098.02
R&S®CMX500 transport case	R&S®CMX-ZG501A	1222.3075.02
External media endpoint (USB sound card)	R&S®CMX-ZG180A	1222.4313.02
RF port extender, 8 GHz, N connector	R&S®CMX-Z25	1230.0007.02

Software maintenance contracts

Designation	Type	Order No.
Software maintenance for application test	R&S®CMX-PU100	1222.5690.81
Software maintenance for LBS server	R&S®CMX-PU190	1222.4488.81
Software maintenance for NR Basic and Medium level test scenarios	R&S®CMX-PU600	1222.4036.81
Software maintenance for NR Xpert level test scenarios and test cases	R&S®CMX-PU601	1222.4042.81
Software maintenance for NR signaling	R&S®CMX-PU610	1222.4059.81

Your local Rohde & Schwarz expert will help you find the best solution for you.
To find your nearest Rohde & Schwarz representative, visit www.sales.rohde-schwarz.com

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► Uncompromising quality
► Long-term dependability

Rohde & Schwarz

The Rohde & Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks & cybersecurity. Founded more than 85 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Sustainable product design

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

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ISO 9001

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