

Smart Connectivity Test Solution, Power by R&S

CMX500/CMP180 – Radio Communication Tester

ROHDE & SCHWARZ

Make ideas real



COMPANY RESTRICTED

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Wi-Fi 7 Brief

2

Signaling solution - CMX500

3

Non Signaling solution – CMP180

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Wi-Fi 7 Brief

2

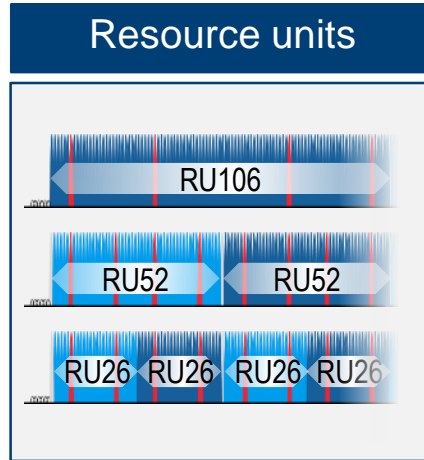
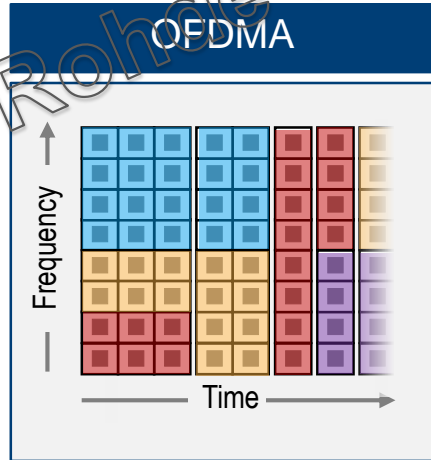
Signaling solution - CMX500

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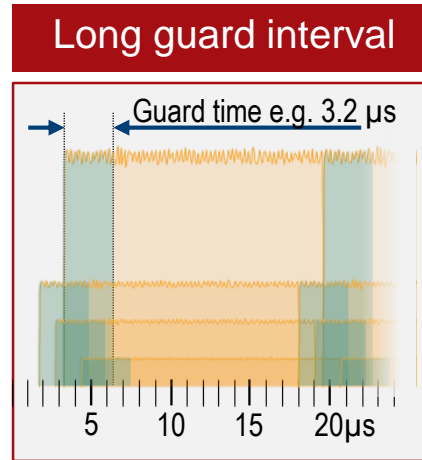
Non Signaling solution - CMX500

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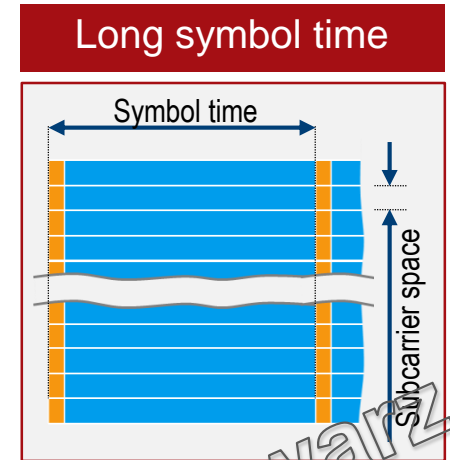
A short recap: Technology cornerstones of the WLAN 802.11ax revolution



- ◆ Efficient use of available spectrum
- ◆ Multi-user operation and latency reduction



- ◆ Avoiding inter-symbol interferences
- ◆ More efficient use of available resources



Over two generations a six fold increase of max throughput

	Wi-Fi 5 (802.11ac) <i>Very High Throughput (VHT)</i>	Wi-Fi 6E (802.11ax) <i>High Efficiency (HE)</i>	Wi-Fi 7 (802.11be) <i>Extreme High Throughput (EHT)</i>
Supported bands	5 GHz	2 GHz, 5 GHz, <u>6 GHz</u>	2 GHz, 5 GHz, 6 GHz
Channel bandwidth (MHz)	20, 40, 80, 80+80, 160	20, 40, 80, 80+80, 160	20, 40, 80, 160, <u>320</u>
Transmission scheme	OFDM	OFDM, <u>OFDMA</u>	OFDM, OFDMA
Subcarrier spacing	312.5 kHz	<u>78.125 kHz</u>	78.125 kHz
Guard interval	0.4 μ s, 0.8 μ s	0.8 μ s, <u>1.6 μs</u> , 3.2 μ s	0.8 μ s, 1.6 μ s, 3.2 μ s
Spatial streams	8x8 (incl. DL-MU-MIMO)	8x8 (incl. MU-MIMO)	<u>16x16</u> (incl. MU-MIMO)
Modulation (highest)	256QAM (8 bit)	<u>1024QAM</u> (10 bit)	<u>4096QAM</u> (12 bit)

*dependent on configuration (GI) and incl. signaling overhead

Receiver and transmitter requirement based on IEEE802.11be

Spectral flatness

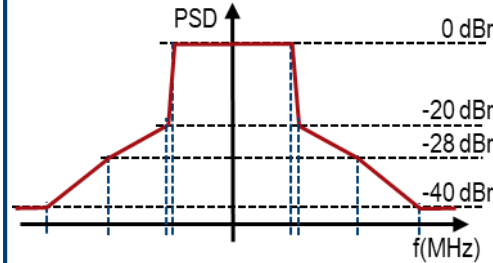
Center frequ. leakage

Min. input sensitivity

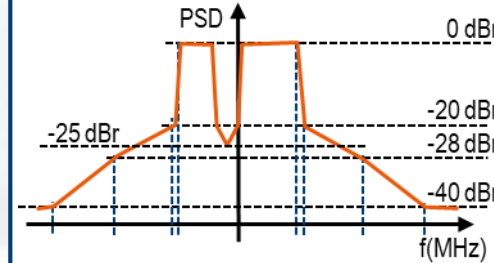
Channel rejection

Maximum input level

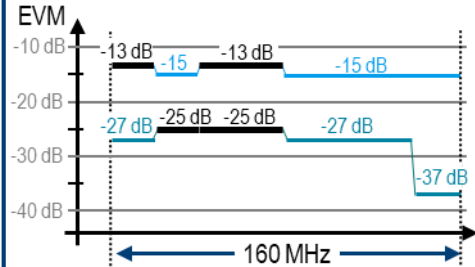
320 MHz spectrum mask



Punctured spectrum mask



MRU unused tone error



Transmitter constellation error

MCS	Mod.	Coding	Error Vector Magnitude of		
			EHT MU PDDU	EHT TB PDDU	
			P > MCS7	P ≤ MCS7	
12	4096-QAM	3/4	-38 dB	-38 dB	-38 dB
13	4096-QAM	5/6	-38 dB	-38 dB	-38 dB

Absolut power accuracy

Relative power accuracy

RSSI meas. accuracy

Carrier frequency offset

Timing drift



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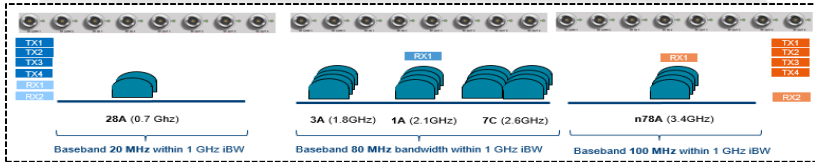
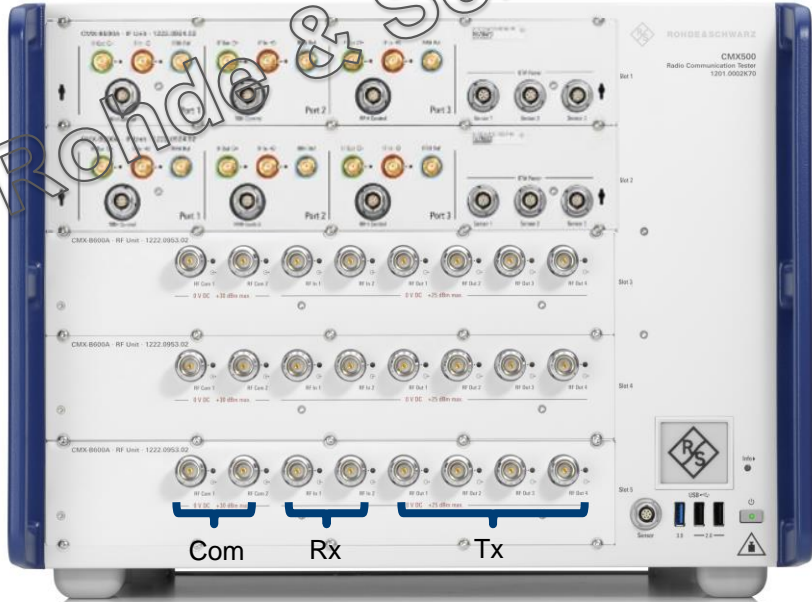
CMX500 - OBT CONFIGURATIONS

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5G NR RADIO COMMUNICATION TESTER



Future proof 5G NR signaling test platform

Independent Operating System (**Linux**)

Modular and **scalable** HW-Architecture

LTE, NR and **WLAN** multiband capabilities up to 8 Ghz

FR2 Multiband Remote Radio Support (24 – 50GHz)

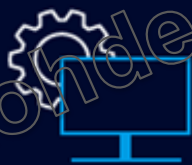
20 Gbps+ End-to-End IP Data Performance capability

Single Web-based **GUI** for RF, Protocol and App Tests

Extensive **IP** and Application Test feature set **onboard**

LTE Anchor support for up to 8CC LTE

CMX500 SUPPORTS MANY USE CASES



3GPP RF TESTING



MOBILITY, FAILURE &
REJECT SCENARIOS



IMS AUDIO &
VIDEO TESTING



IP THROUGHPUT
TESTING



BATTERY LIFE
TESTING

REDcap Rel.17



Security Analysis



Backend Service Test



WLAN Offloading

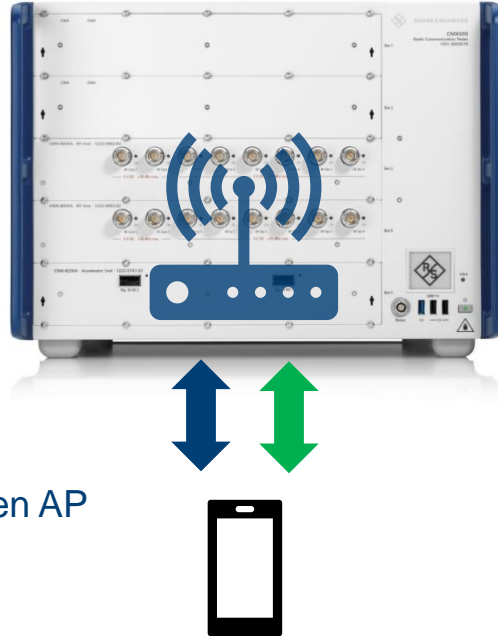


Many more...



WLAN TEST SCENARIOS

WLAN 11be Multilink

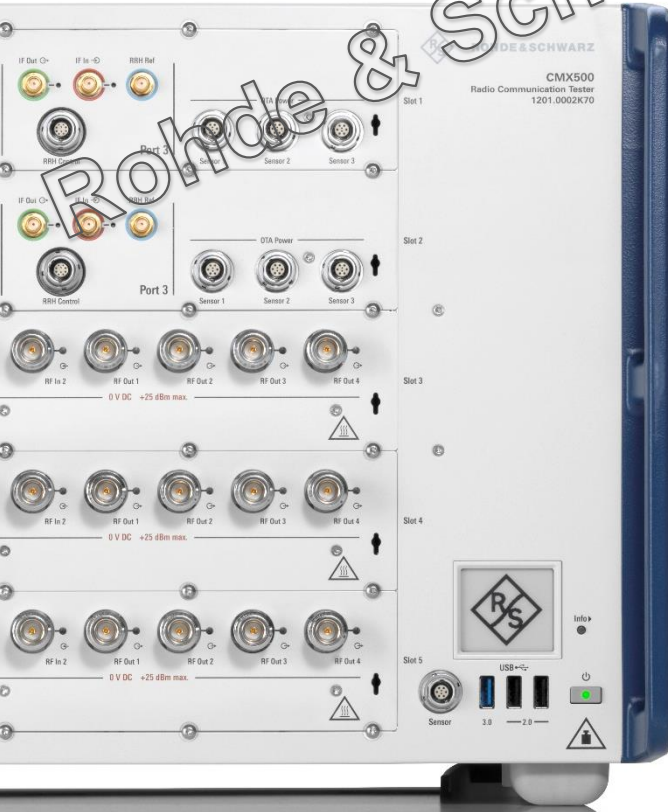


- Associates on one band
- Simultaneous links between AP and STA on multiple bands/channels

- One association on some band
- Simultaneous links on multiple channels/bands

Rethink Testing

The synergy of best performance and ease of use in one box.



All-in-one high performance 5G testing solution packed in a single box

- 10 Gbps and more end-to-end IP throughput
- All possible 5G NR (SA/NSA) FR1/FR2 deployments
- All frequency ranges and technologies (NR, LTE and WLAN)
- Up to 16CC LTE/NR and Up to 64 FR1/LTE Layers
- Flexible configuration for extend RF and BB capability
- Designed to cover all 5G NR use cases: VoNR, IP, messaging, Video, LBS, and more
- One box solution allows simplified test set-up and reduces re-cabling and footprint

Rethink Testing

The synergy of best performance and ease of use in one box.

All information CMSquares GUI

The screenshot displays the CMSquares GUI with several panels. On the left, there are tabs for 'Networks', 'Signals', and 'Parameters'. The main area shows a graphical representation of a test setup with components like 'RF Unit' and 'RF Port'. A 'Log Analysis' window is overlaid on the right, showing a table of test results.

Service	Port	Msg	Test	Unit	Msg	Pass	Fail	Grace	PDU	dBm
MsgInfoData	Req	732	1	0						130
MsgInfoData	Req	732	7	1						130
MsgInfoData	Req	732	7	0						130
NAS 5G SEC PROF PEER & Req					REGISTRATION ACCEPT					
CredDataMsg	Req				D1InformationTransfer					
MsgInfoData	Req				D1InformationTransfer					
MsgInfoData	Req	732	1	1	0					130
MsgInfoData	Req	732	7	1	0					130
CredDataMsg	Req				D1InformationTransfer					130
CredDataMsg	Req				D1InformationTransfer					130
MsgInfoData	Req	732	7	0	1					130
MsgInfoData	Req	732	7	0	1					130

Log Analysis



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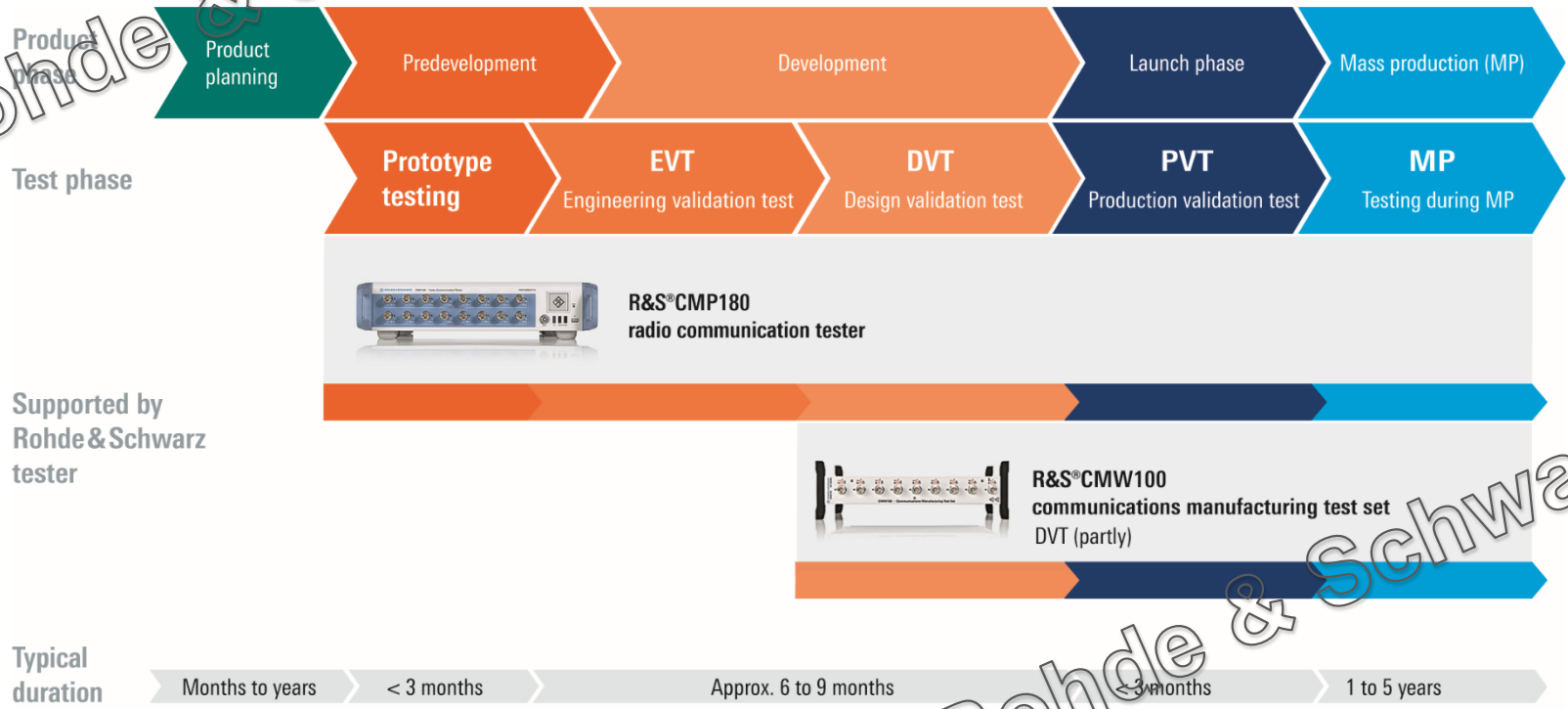
3

Non Signaling solution – CMP180

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Product development cycle

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R&S® CMP180 new member in the CMP/CMX family

► General

- High performance radio communication tester for R&D and production purposes
- Support of all well known production features
 - Smart Channel
 - Broadcast

► R&S CMP180

- up to 2 VSAs / 2 VSGs / 2 x 8 bidirectional & full duplex RF ports
 - Enable 2nd Channel (VSA/VSG/ 8 RF ports)
- Frequency range
 - 400 MHz up to 6/8 GHz, up to 250/500 MHz bandwidth
- High accuracy
- Extraordinary EVM values



► Platform

- OS: Linux
- GUI: CMSquares
- Look & feel of CMP200 and CMX500

CMP180 Overall Product Information

Compact design
→ 2 HU x 19 inch
→ 1x HU per Channel

Higher Bandwidth: 250 / 500 MHz

Improved HF parameters
→ increased Freq. up to 8 GHz
→ increase output power +8 dBm
→ increased EVM performance

Enable 2nd Channel

Doubled number of analyzers and generators (2xVSA/2xVSG / 2x 8 RF ports)

Integrated controller / processor

Increased number of RF ports (2x8)

R&S NRPx PowerSensors connectable

Integrated intuitive user interface CMSquares

Simple Option concept

Linux Operating System

Status Display

Broadcast mode enables simultaneous transmission on all RF ports/outputs for receiver tests/ RX tests on the DUT

Integrated power supply



GUI Cmsquares Wi-Fi 7 (802.11be)

Statistics

	Current	Average	Max	Std Dev
Burst Power [dBm]	-11.77	-11.74	-11.74	0.00
Peak Power [dBm]	-0.79	0.42	0.51	0.36
Crest Factor [dB]	10.98	10.93	11.28	0.36
EVM All Carriers [dB]	-48.38	-48.45	-48.15	0.11
EVM Data Carriers [dB]	-48.38	-48.44	-48.15	0.11
EVM Pilot Carriers [dB]	-48.54	-48.60	-48.03	0.18
Center Frequency Error [MHz]	-156.25	-156.38	-156.38	20.74
Symbol Clock Error [ppm]	0.02	0.03	0.03	0.00
IQ Offset [dB]	-73.50	-71.19	-71.19	1.29
DC Power [dBm]		-82.95		1.29
Gain Imbalance [dB]				
Quadrature Error [°]				

Configuration

- Standard: 802.11 be
- Receive Mode: SISO
- Bandwidth: 320MHz
- RF Routing: RF1.1
- Connection: RF1.1
- External Attenuation (Input): 0.00 dB
- Band / Center Channel: 6 GHz / 191 Ch
- Center Frequency: 6960.000000 MHz
- Expected Nominal Power: 0.00 dBm
- User Margin: 0.00 dB
- Power Level Offset: 12.00 dB
- Frequency Offset: 0.00



R&S® CMP180 supports RF testing of the primary wireless communication technologies

Technology	RF generator	RF analyzer
5G NR FR1	◆	◆
LTE-A	◆	◆
WCDMA/HSPA+	◆	◆
GSM/GPRS/EGPRS	◆	◆
eMTC	◆	◆
NB-IoT	◆	◆
C-V2X	◆	◆
CDMA2000, 1xRTT	◆	◆

Technology	RF generator	RF analyzer
IEEE802.11a/b/g/n/ac/ax/be	◆	◆
Bluetooth® BR, EDR	◆	◆
Bluetooth® Low Energy	◆	◆
Low Power IoT		
802.15.4 (Zigbee, Thread)	◆	◆
LoRa®	◆	(-)
SigFox	◆	(-)
GNSS	◆	(-)



Typical Test Coverage



Design Validation (EVT, DVT)

Goal: Validate the design as per the specification

Key Decision Factors:

- Tester Performance (eg EVM)
- Coverage Support (eg. MIMO support)
- Test times (Rx waveform generation, Tx test time)

Typical Test Items:

- TX & Rx Calibration,
- Power, Frequency, Spectrum
- Modulation quality (EVM)
- Rx sensitivity (PER)
- 2x2 MIMO Test, 4x4 MIMO Test (CMPflexx)
- OFDMA (timing, power, CFO)
- Sweeps over wide frequencies and power levels
- Simultaneous Radio Tests (2,4GHz, 5GHz, 6GHz, BT)

Production

Manufacturing tests

SMT test

Goal: RF performance check
Checking component defects

Key Decision Factors:

- Test times
- Number of ports & channels
- Coverage support
- Multi DUT

Typical Test Items:

- TX & Rx Calibration,
- Power, Frequency, Spectrum
- Modulation quality (EVM)
- Rx sensitivity (PER)
- 2x2 MIMO Test (Optional)
- OFDMA (timing, power, CFO)

FATP test

Goal: End product test
(Antenna, Regulatory) in
radiated environment

Key Decision Factors:

- Test times
- Coverage support
- Multi DUT

Typical Test Items:

- TX Power
- RX sensitivity



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thank
YOU
😊

