

R&S EMC PRODUCT INFORMATION UPDATE_2021

RSTW
AE Edmund Yen

ROHDE & SCHWARZ

Make ideas real



COMPANY RESTRICTED

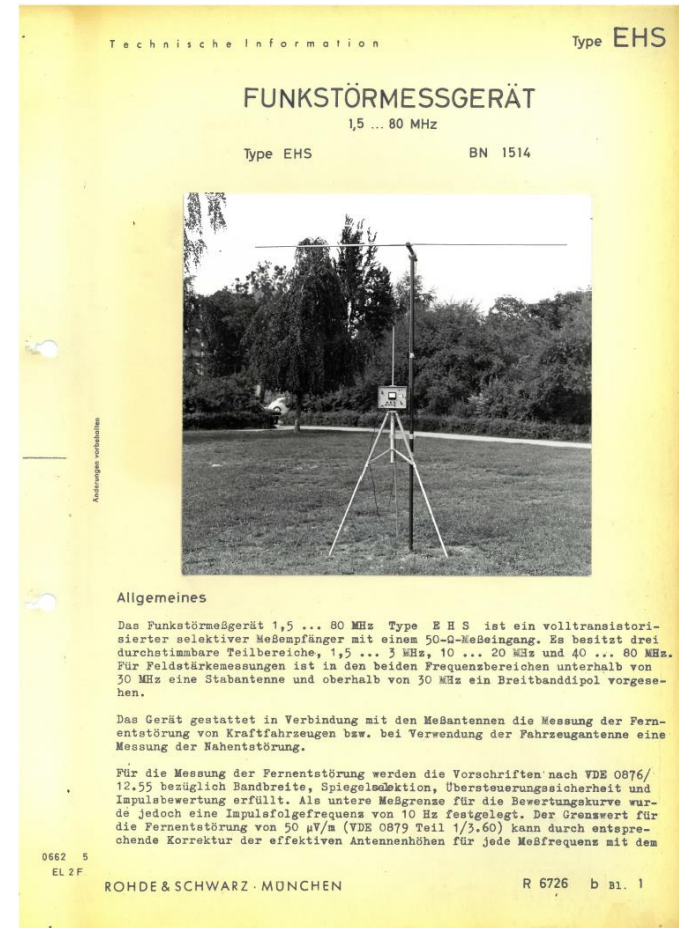
AGENDA

- ▶ EMI Test Receiver ESx (ESW/ESR) Product information updated
- ▶ New Power Amplifier Product SAM100 function and feature introduction
- ▶ Conclusion
- ▶ Q&A

ROHDE & SCHWARZ HISTORY IN EMC

- ▶ EHS EMI Test Receiver from 1962
 - 1.5 to 80 MHz
 - Quasi peak detector

- ▶ 60 years of innovation in EMI testing and continuously evolving



COMPLIANCE RECEIVERS

- ▶ Receivers compliant to latest international EMI standard CISPR 16-1-1 **Edition 4**
 - Specified **6 dB bandwidths, detectors** (Quasi-Peak, CISPR-Average, RMS-Average)
 - High **dynamic range** required
 - Repetition frequency of pulses down to single pulse
 - Measurement Applications (**Click Rate, (Multi) APD, Bargraph**)
 - **Limit Line** checking and **Transducer correction**

R&S ESW



R&S ESR



R&S®ESW EMI TEST RECEIVER



Highlights

- ▶ **Sensitivity:** Built-in preamplifier, optional LNA and notch filters
- ▶ **Speed:** Unique time-domain scan with parallel CISPR detectors
- ▶ **Usability:** Big high resolution touch screen
- ▶ **MultiView:** All needed measurements in one display

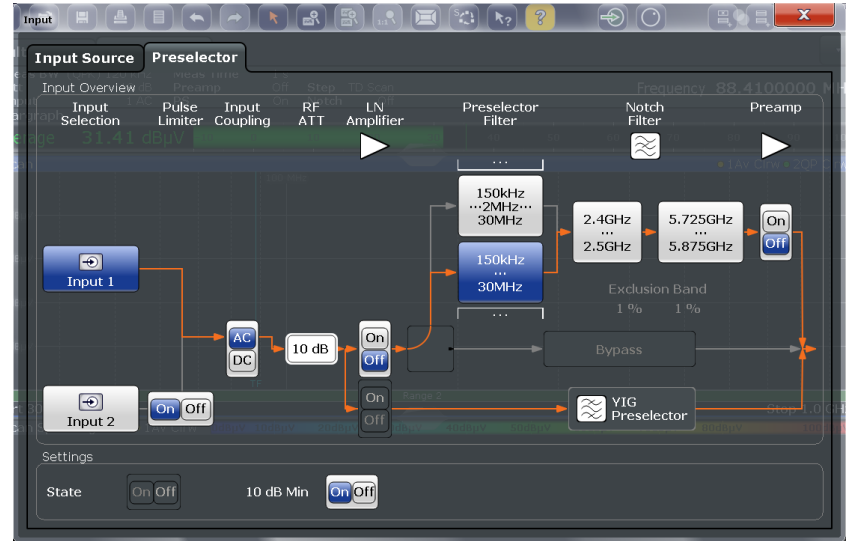
High-end compliance receiver based on proven FSW platform

- ▶ 1 Hz to 8 / 26.5 / 44 GHz
- ▶ All relevant standards from commercial to military
- ▶ Best HF performance receiver and spectrum analyzer in one device



R&S® ESW HF PERFORMANCE

- ▶ High dynamic range and sensitivity
 - 1 dB compression point: **+15 dBm**
(< 3 GHz, Presel., Preamp and LNA off)
 - Third-order intercept point (TOI): **> 20 dBm**
(< 1 GHz, Presel., Preamp and LNA off)
 - Displayed average noise level (DANL): **< -149 dBm**
(Between 1 MHz and 1 GHz, Presel., Preamp and LNA off)
 - Very low spurious responses: **< -110 dBm**
(1 MHz - 8.9 GHz)
- ▶ Preselection and notch filters
 - **2.4 - 2.5 GHz** and **5.725 - 5.875 GHz**
for ISM band suppression



Configurable input signal path of ESW

R&S® ESW MEASUREMENTS BEYOND 44 GHz

- ▶ **Automotive radar** testing

- e.g. 77 GHz

- ▶ **A&D applications** analyzing interferer

- 110 GHz or higher

- ▶ **FCC compliance test**

- Measurement up to 5th order harmonics
- Up to 200 GHz for carrier frequency above 30 GHz

- ▶ R&S ESW-B21 & FS-Zxx harmonic mixers extend the frequency coverage of the ESW26 / 44 up to 500 GHz.



ESW-B21



EMI Test Receiver ESW26/44



FS-Zxx



R&S®ESW CUSTOMIZABLE MULTI-VIEW



R&S®ESW INTUITIVE GRAPHICAL USER INTERFACE

► Test Automation Overview Block Diagram

1. Scan table

- Customizable frequency ranges
- Measurement time
- Resolution Bandwidths (RBW)

2. Peak Search

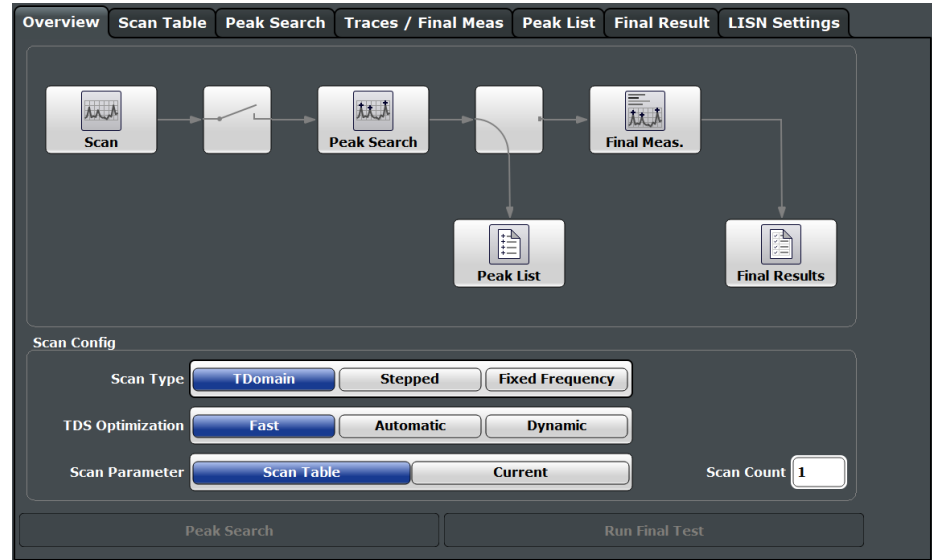
- Record to Peak List
- Choose Limit Line according to standard

3. Final Measurement

- Interactive Mode

4. Final Results

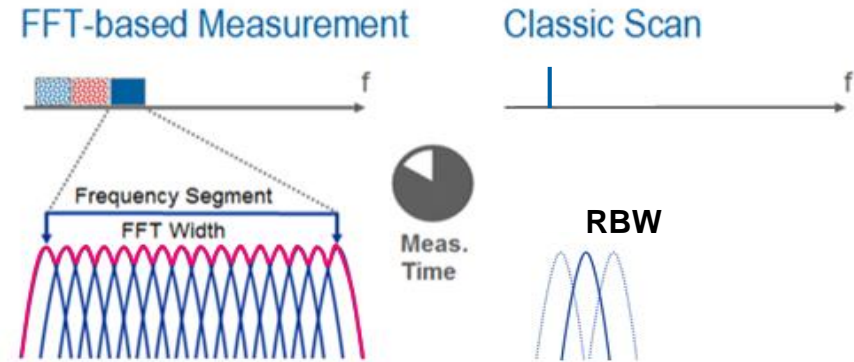
- Report generation



R&S®ESW TIME DOMAIN SCAN FOR MIL-STD & COMMERCIAL

- ▶ Rohde & Schwarz was the lead manufacturer in the Tri Services Working Group on the integration of Time Domain Scan within MIL-STD-461G
- ▶ Conducted band (150 kHz – 30 MHz) fits in **one** FFT analysis BW
- ▶ Perform QP & CISPR Avg in real-time on the conducted band

FFT is faster by numbers of magnitude than the classic scan



R&S®ESW MEASUREMENT SPEED

► Time domain scan with 3 optimization modes

– **Automatic**

full compliant to CISPR 16-1-1

– **Fast**

Compliant to CISPR 16-1-1 for pulses with a repetition frequency ≥ 10 Hz

– **Dynamic**

Enhanced dynamic in CISPR band D for applications with requirements beyond CISPR 16-1-1

Measurement times	R&S ESW	
	Automatic TDS (full compliant)	Fast TDS
150 kHz – 30 MHz 9 kHz, QP + CAV, 1 s	2 s	2 s
150 kHz – 30 MHz 9 kHz, Peak, 100 ms	110 ms	110 ms
30 MHz – 1000 MHz 120 kHz, Peak, 10 ms	380 ms	380 ms
CISPR 25 Automotive 30 MHz – 1000 MHz 9 kHz, QP + CAV, 1 s	64 s	40 s - 37%
CISPR 11 Microwave oven 30 MHz – 1000 MHz 120 kHz, QP + CAV, 1 s	50 s	40 s - 20%
1 GHz – 6 GHz 1 MHz, Peak + CAV, 100 ms	216 s	111 s - 51%
1 GHz – 18 GHz 1 MHz, Peak, 10 ms	8 s	8 s
FCC 1 GHz – 26.5 GHz 1 MHz, Peak + AV, 10 ms	13 s	13 s
MIL 1 GHz – 40 GHz 1 MHz, Peak, 10 ms	21 s	21 s

MIL-STD-461G SCAN TIMES

TIME DOMAIN SCAN ESR AND ESW COMPARED TO STEPPED SCAN

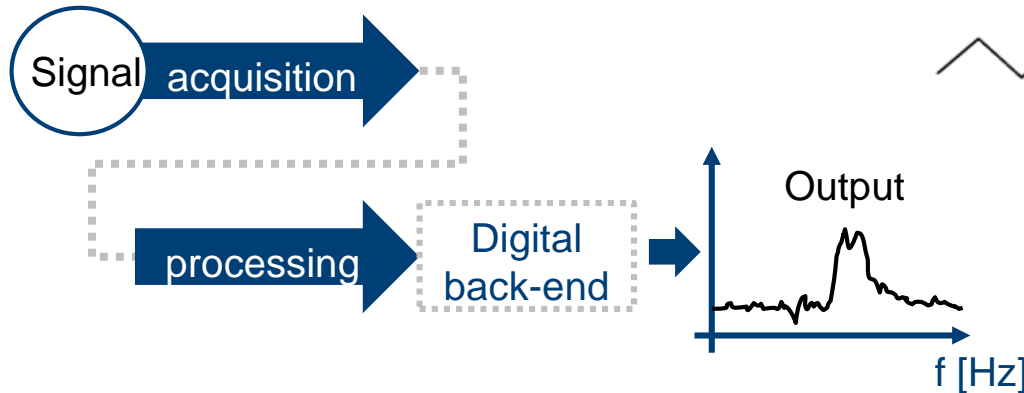
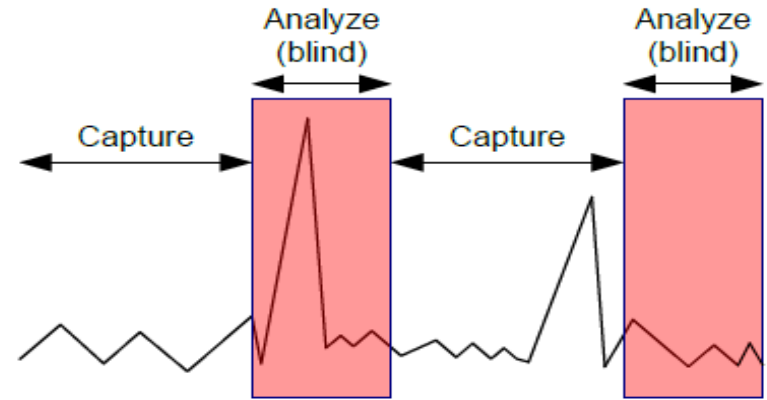
Frequency Band	RBW	Detector	Dwell Time	ESR	ESW	Stepped Scan
30 Hz - 1 kHz	10 Hz	Peak	1 s	1.42 s	1.42 s	137 s
1 kHz - 10 kHz	100 Hz			1.06 s	1.06 s	13 s
10 kHz - 150 kHz	1 kHz			1.01 s	1.01 s	7 s
150 kHz - 10 MHz	10 kHz			1.02 s	1.02 s	39 s
10 MHz - 30 MHz			150 ms	0.17 s	0.17 s	79 s
30 MHz - 1 GHz	100 kHz			7.7 s	4.0 s	6 min
1 GHz - 18 GHz	1 MHz		15 ms	26.4 s	8.9 s	11 min
18 GHz - 40 GHz						14.5 s

REAL-TIME SPECTRUM

- ▶ Data acquisition and processing **in parallel** with **80 MHz bandwidth**

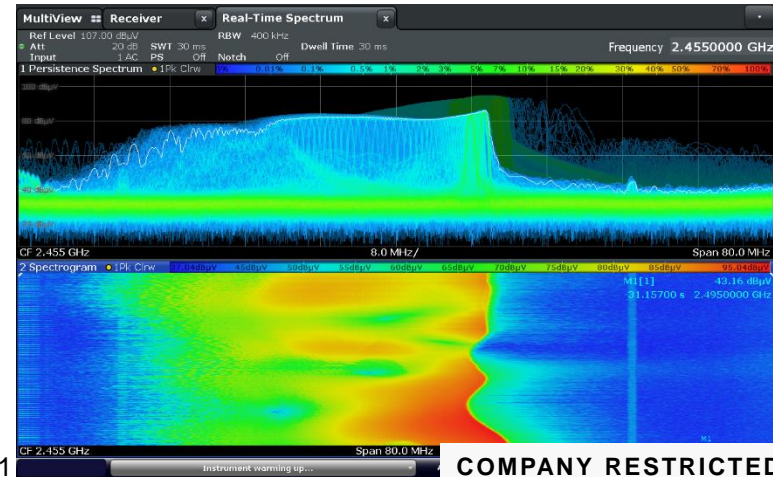
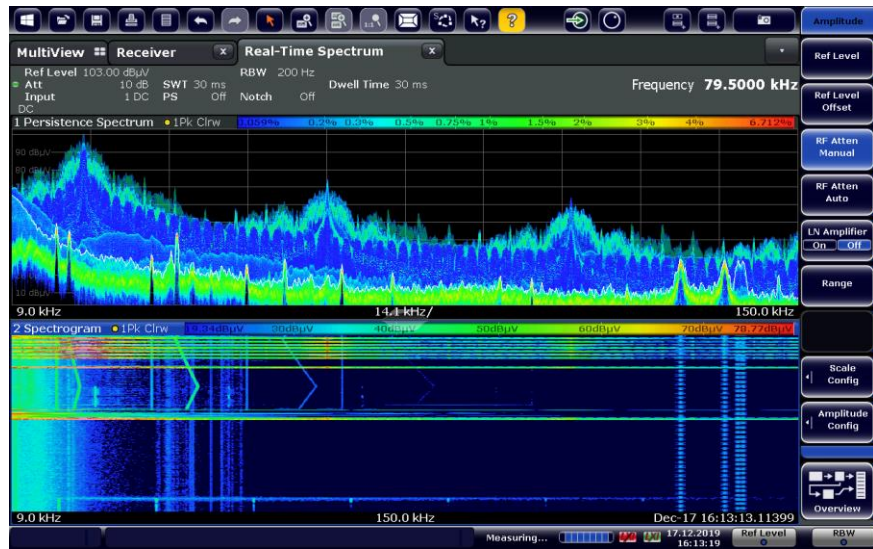


- ▶ Measurement without blind time
 - Fully gapless
 - Resolves even shortest pulses



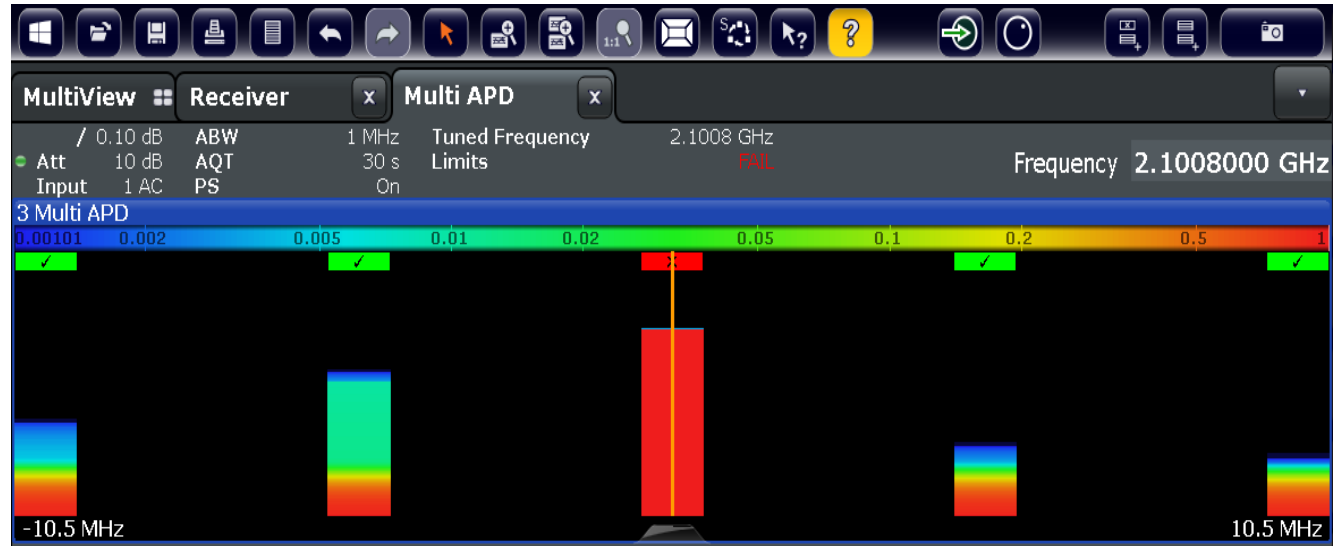
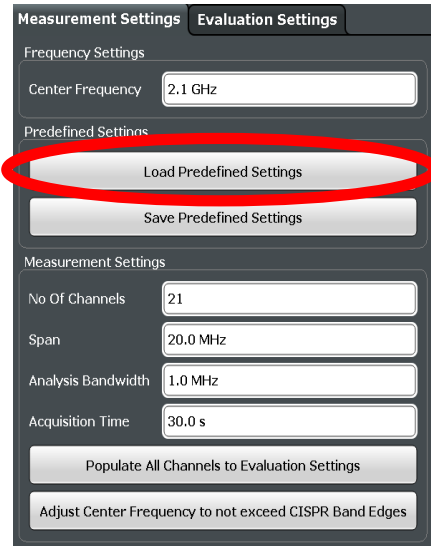
REAL-TIME SPECTRUM

- ▶ Detect complex signals at first
- ▶ Persistence mode
 - Shows probability of amplitude appearance with colors. Signals with different behavior in time become visible even if hidden behind broadband interferers
- ▶ Spectrum mode
 - Displays behavior of traces in time for easy identification of drifting or pulsed signals



R&S®ESW MULTI CISPR APD (OPTION K58)

- ▶ Microwave oven testing according to CISPR 11
- ▶ R&S®ESW-K58 APD Multi-channel measurement function provides predefined Setup for CISPR 11 testing



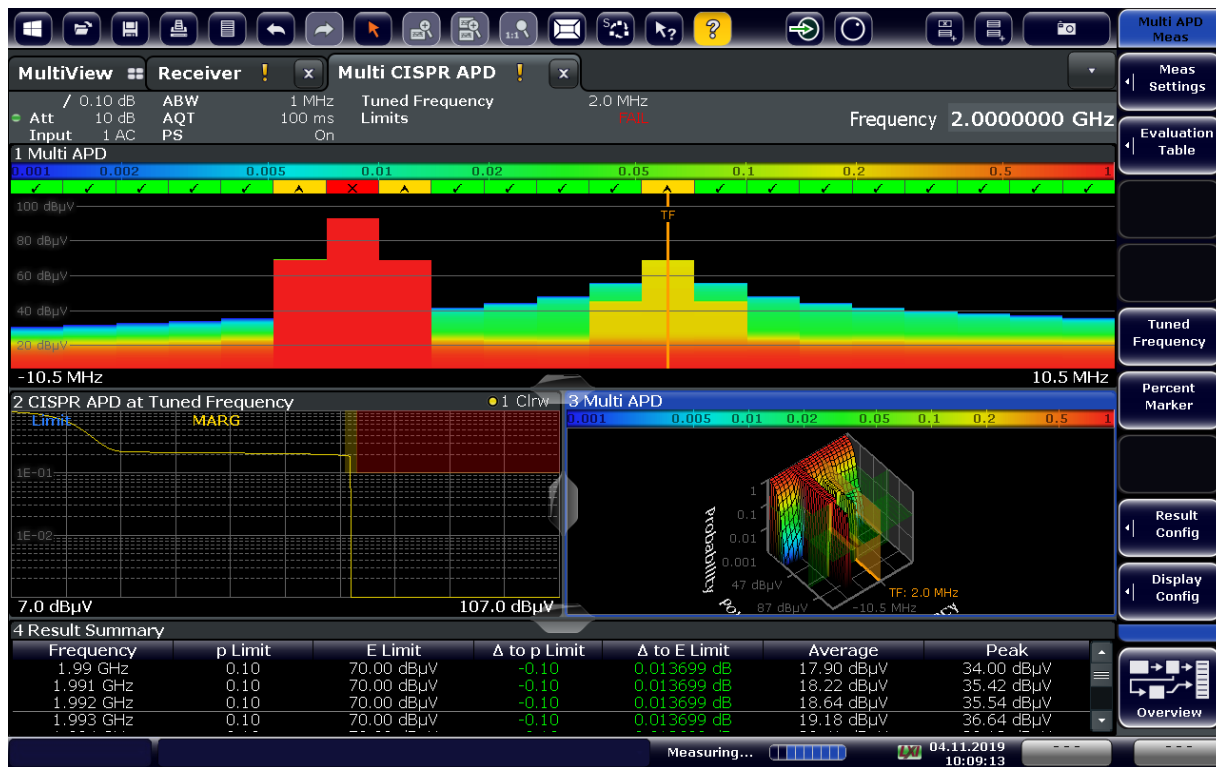
R&S®ESW MULTI CISPR APD (OPTION K58)

Up to **20 MHz span**
(21 channels at 1 MHz ABW)

or **8 MHz span**
(67 channels at 120 kHz ABW)

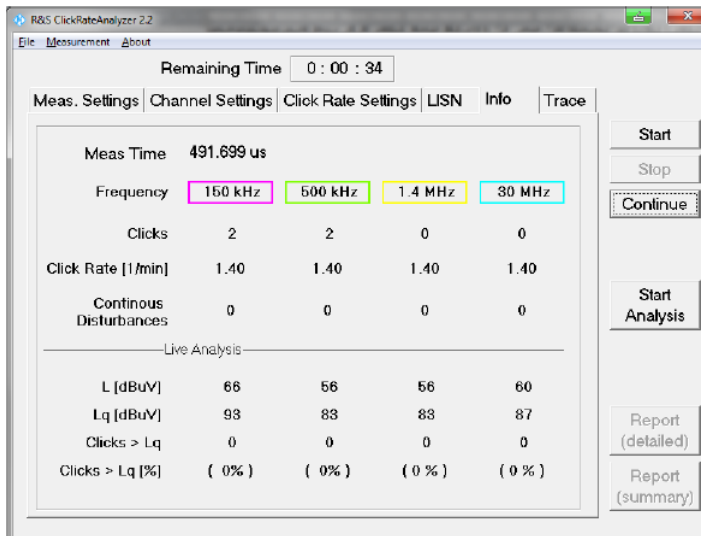
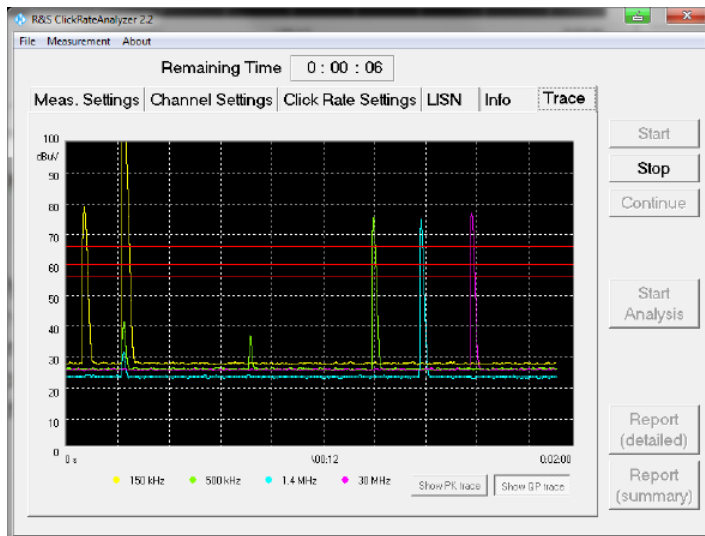
Cumulative Amplitude
Probability Distribution
@ **Tuned frequency**

Channel list with
limit check

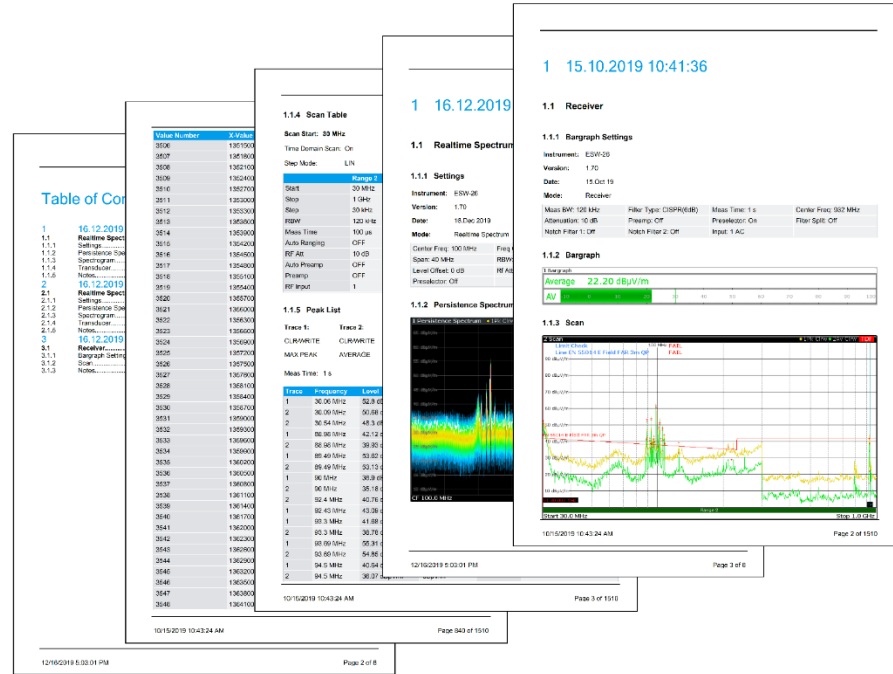
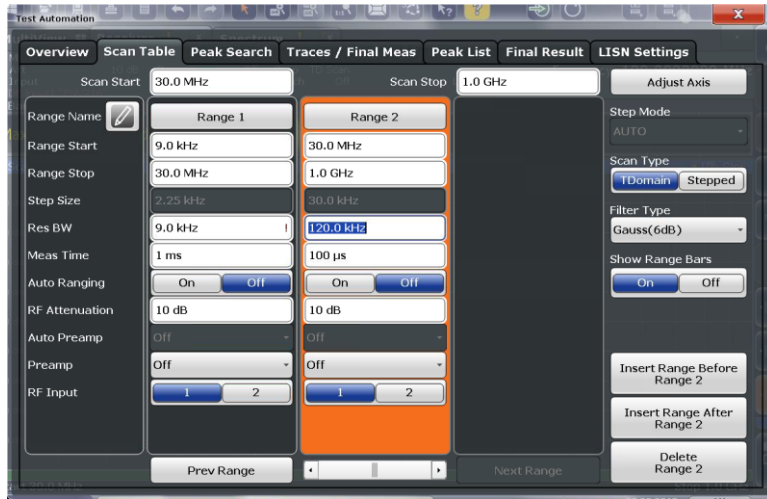


R&S®ESW CISPR 14 COMPLIANT 4 CHANNEL CLICK-RATE ANALYSIS

4-channel-click-rate analysis installed directly on the instrument



R&S®ESW AUTOMATED TESTING



► Automation on device with scan table, pre- and final test and LISN control

► Test report generation as .doc or .pdf

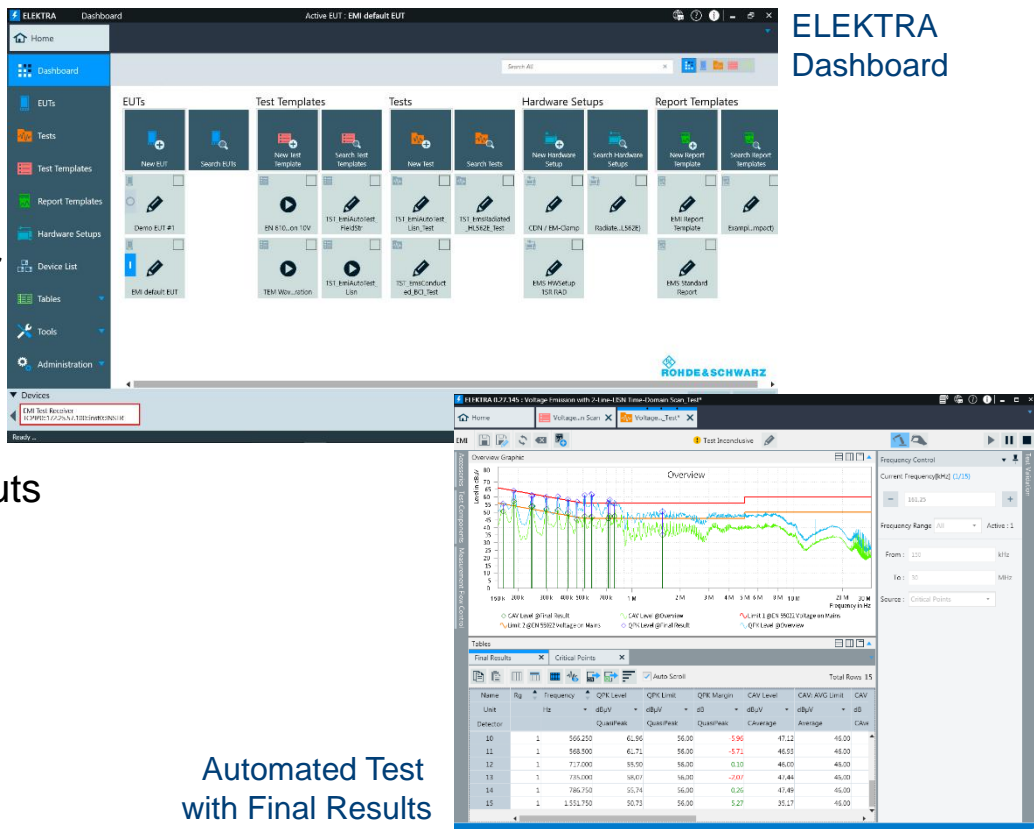
R&S®ELEKTRA EMI TEST SOFTWARE



- ▶ External PC software
- ▶ Successor of EMC32
- ▶ Modern easy-to-use user interface
- ▶ Supports
 - **EMI Test Receivers**
 - ESCI, ESPI, ESL, ESRP, ESU, ESR and **ESW**
 - **Spectrum analyzers**
 - FPL1000, FPC, FPH, FSL, FSV and FSW

R&S®ELEKTRA EMI TEST SOFTWARE

- ▶ Interactive and automated emission measurements for EMI debugging and pretesting
- ▶ Preconfigured measurement settings for relevant EMC standards
- ▶ Library with Limit Lines and transducer factors of antennas, LISNs, ...
- ▶ Flexible configuration of test report layouts fit for individual needs
- ▶ Controls external hardware as LISN, antenna mast, turn table, ...



ELEKTRA Dashboard

R&S® SAM100 – KEY FEATURES

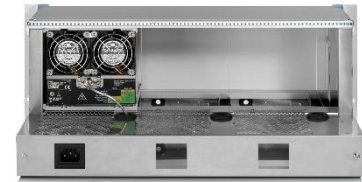
- ▶ Ultra-broadband frequency range: 2 GHz – 20 GHz
- ▶ Output power: up to 20W P_{sat}
- ▶ High gain with low noise and excellent linearity
- ▶ Very suitable for AM, FM, PM, ØM, OFDM
- ▶ Built-in-test monitors
- ▶ Compact, modular, robust
- ▶ Overtemperature protection
- ▶ Field-replaceable connectors
- ▶ 3 years warranty



R&S® SAM100 – SYSTEM AMPLIFIER FAMILY

▶ SAM100-0220-20 „First member of new system amplifier family“

- Market launch September 2020
- Frequency range: 2 – 20 GHz, up to 20 Watt, market-leading in RF performance & compactness
- available as desktop-unit or 19“ / PXI rack (with up to 3x SAM100)



▶ SAM100-0220-20 „Applications“

- Applications with RF power needs beyond standard signal generators (e.g. SMB, SMW, SMCV..) or network analyzers (e.g. ZVA/ZNA)

R&S® SAM100 – INTRODUCTION

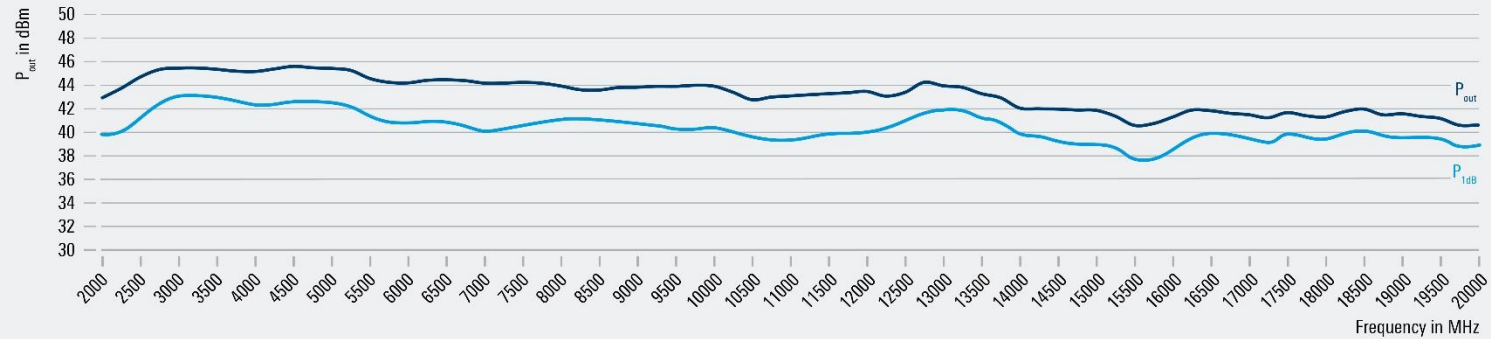
- ▶ New **System AM**plifier family:
 - to boost the output signal levels of signal generators, network analyzers and wireless communication testers in e.g. OTA-test for 5G
 - to compensate cable attenuation in system set-ups
 - as test amplifier for broadband power and gain applications

- ▶ **Target markets:**
ICR, WIC, ADT, AUT in test & measurement applications, design validation and product validation (DVT/PVT)

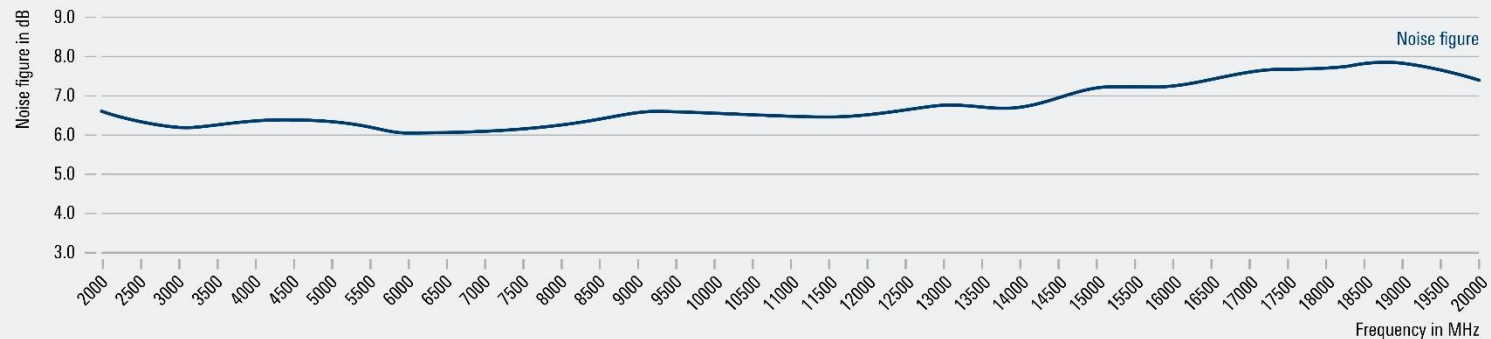


R&S®SAM100 – TECHNICAL PERFORMANCE

R&S®SAM100 RF output power in dBm



R&S®SAM100 noise figure in dB

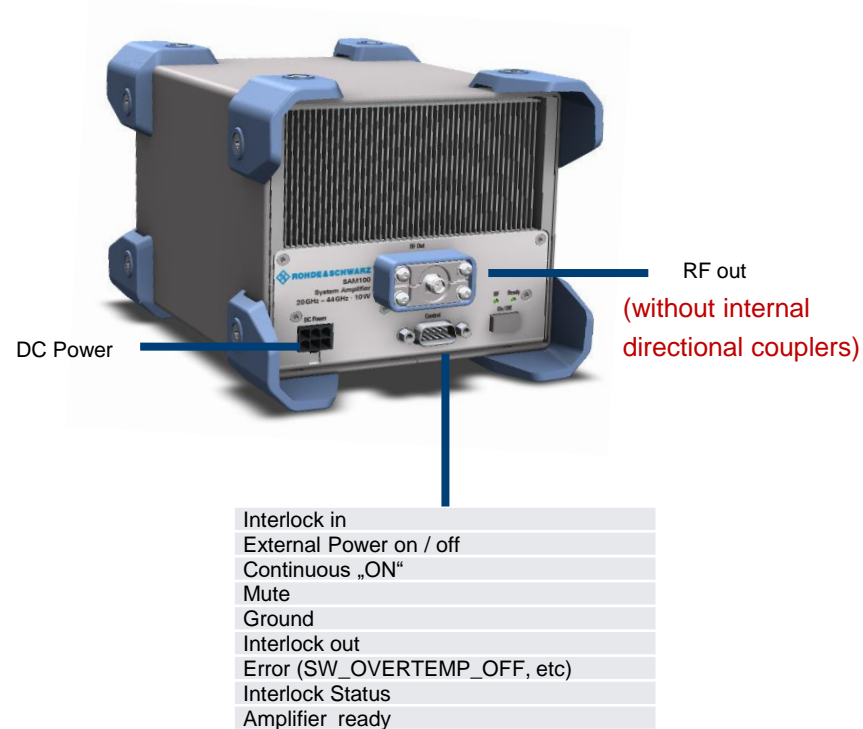


R&S® SAM100 – KEY SPECIFICATION

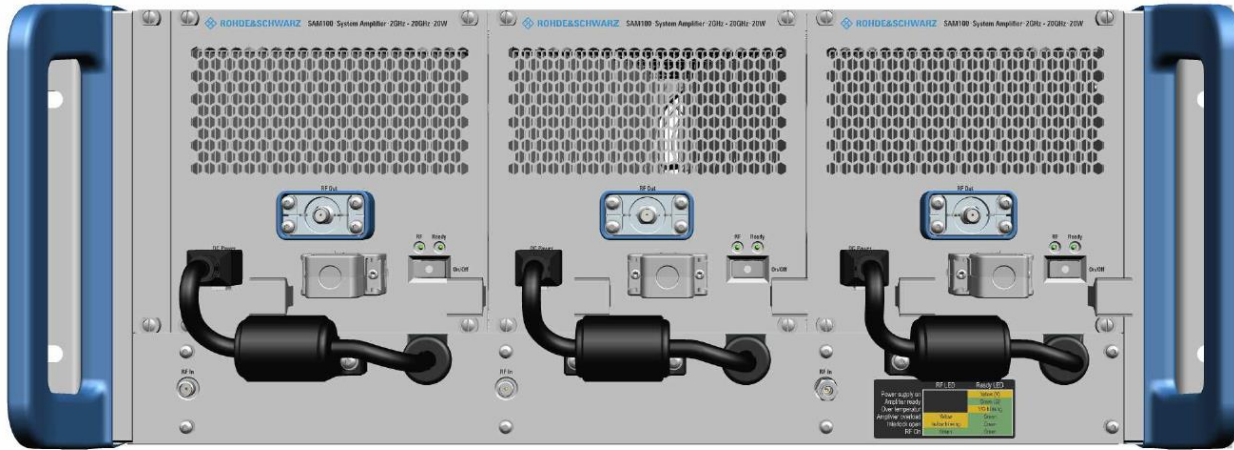
- ▶ **Gain at 15 GHz 47 dB (nom.)**
 - Gain flatness ± 4.5 dB
- ▶ **Noise figure < 8.0 dB (nom.)**
- ▶ **Harmonics at 1 dB compression output power < -20 dBc**
 - at 1 dB compression output power - 3 dB < -25 dBc
- ▶ **Nominal forward output power at VSWR $\leq 2:1$ continuous, without foldback**
 - at VSWR > 2:1 continuous with gradual foldback of output power, depending on load impedance
- ▶ **Output mismatch protection VSWR 100 %, without damage**

R&S®SAM100 – INTERFACES AND FORM FACTOR

- ▶ External power supply, DC powered
- ▶ RF connectors (2 - 20 GHz):
 - Output at front, input at rear
 - 2.92mm (standard)
 - 3.5mm (alternative)
- ▶ Simple HW control (D-SUB 9 pin) (no software)
- ▶ Dimensions: 121 x 100 x 150 mm (4.75" x 3.93" x 5.90")
- ▶ Weight: 3 kg (6.6 lbs)



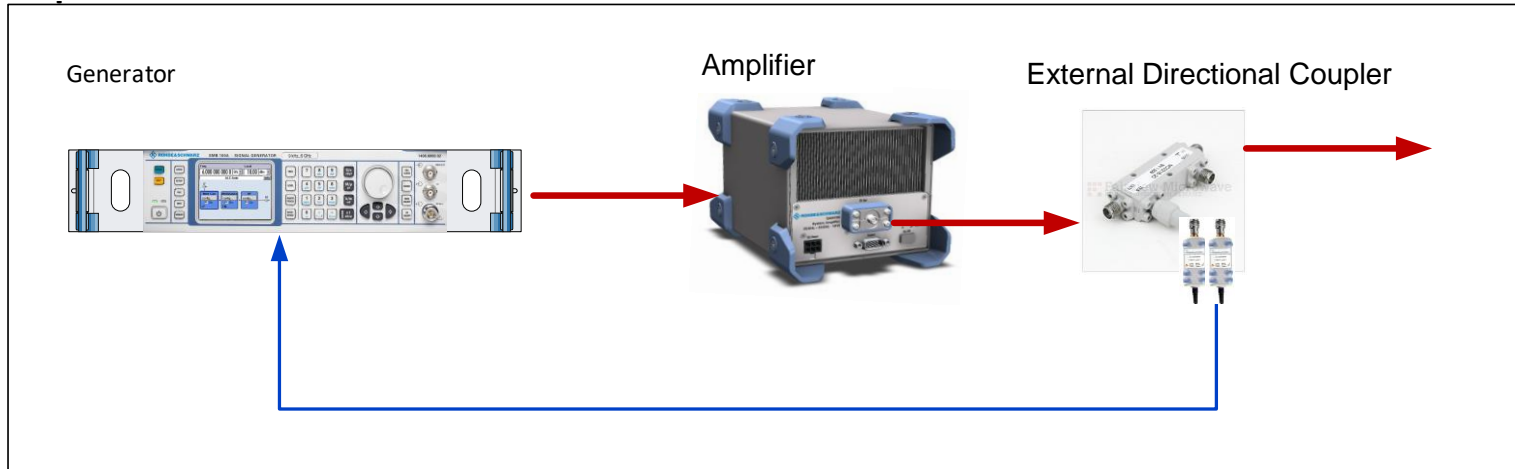
R&S®SAM100 – 19” RACK INTEGRATION



- ▶ Up to 3 SAM100 can be mounted in a 19” rack
- ▶ SAM100 can also be mounted in a PXI frame
 - No backplane allowed where the SAM100 is mounted

R&S® SAM100 – APPLICATION EXAMPLE (1) AUTOMATIC-LEVEL-CONTROL LOOP

Example: ALC



R&S® SAM100 – APPLICATION EXAMPLE (2)

DVT/PVT

- ▶ SAM100 used for
 - component testing in combination with R&S equipment like generators or VNAs
 - e.g. for hot s-parameter measurements
 - SAM100 can be simply controlled and monitored (via D-Sub-9 connector) by R&S ZVA/ZNA using:
 - D-SUB-25 connector (user control interface)
 - or I/O handler option ZVA-B14

R&S® SAM100 – APPLICATION EXAMPLE (3)

RADAR PULSE

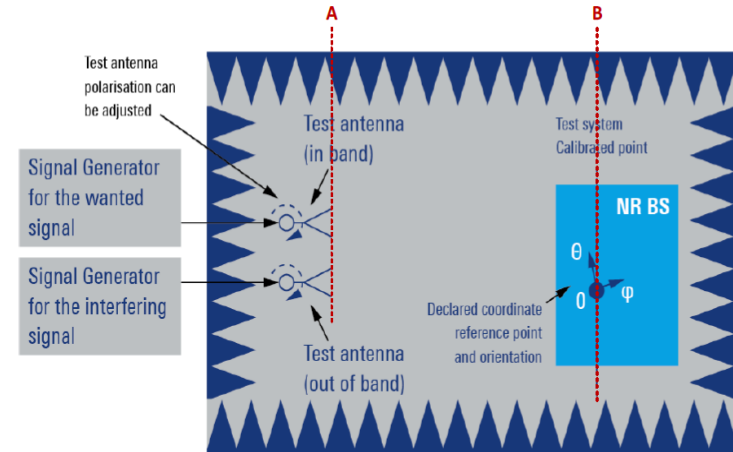
- ▶ SAM100 used for
 - component testing e.g. for TX/RX modules in combination with R&S generator e.g. SMW200
 - with rise / fall time < 4ns (radar pulses with 1 microsecond pulse width and DC 10%)

R&S® SAM100 – APPLICATION EXAMPLE (4)

OUT OF BAND BLOCKING TEST

- ▶ SAM100 used for
 - out-of-band blocking tests acc. to 3GPP 38141-2
 - SAM100 will be used to amplify the interfering signal

Test setup





Thank you !