

# R&S® SAM100 SYSTEM AMPLIFIER



A perfect combination of high power,  
large bandwidth and low noise



Product Brochure  
Version 01.00

**ROHDE & SCHWARZ**

Make ideas real



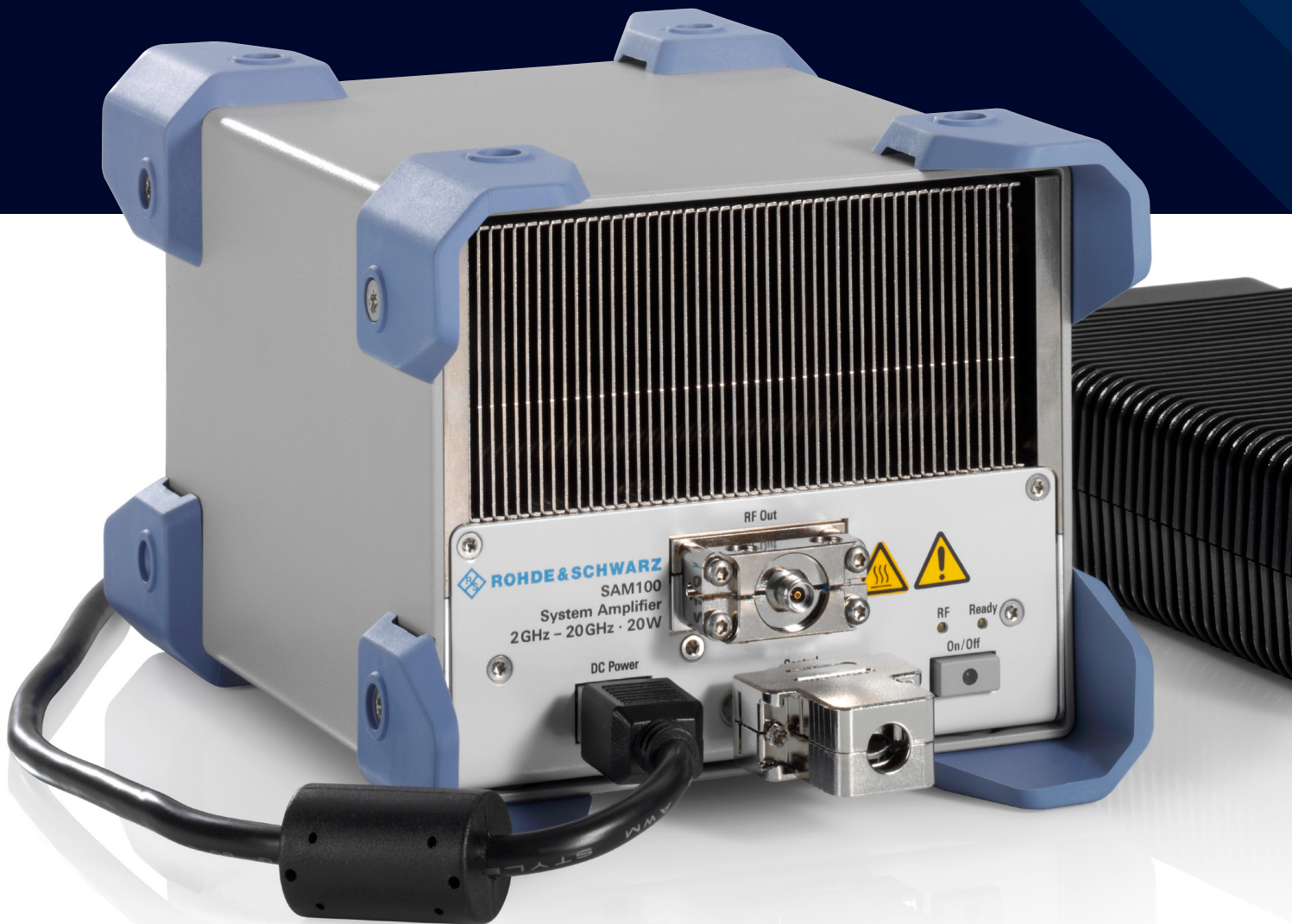
# AT A GLANCE

The R&S®SAM100 system amplifier is an ultrawideband microwave amplifier with a frequency range from 2 GHz to 20 GHz. With up to 20 W of power, outstanding linearity and very good noise characteristics, it is highly suitable for use as a compact system amplifier in a variety of test setups and system configurations. It is an excellent alternative to tube amplifiers and multifrequency band systems consisting of individual amplifiers.

Thanks to its high linearity, the ultrawideband microwave amplifier is ideal for developing and testing RF components. In test setups with generators, frequency analyzers or network analyzers, it acts as a driver or booster and amplifies the measurement signals. The R&S®SAM100 compensates for line losses, increases the dynamic range, and can be used as a driver for characterization and testing of power components such as transistors, filters and frequency splitters.

With its compact, modular design, the R&S®SAM100 system amplifier fits perfectly in a 19" rack. Its form factor also allows installation in PXI frames. The digital control interface makes it especially suitable for integration in automatic test systems.

The input and output connectors are compatible with a variety of RF connector systems, including 2.92 mm and 3.5 mm. The arrangement of the RF connectors makes it easy to integrate the R&S®SAM100 system amplifier into every circuit and system structure.



# FEATURES

- ▶ Frequency range: 2 GHz to 20 GHz
- ▶ Output power: 20 W
- ▶ High, broadband gain with low noise and excellent linearity
- ▶ Suitable for AM, FM, PM,  $\phi$ M, multitone and OFDM
- ▶ Manual operation or remote operation via digital control interface
- ▶ Withstands overtemperature and mismatch at the RF output
- ▶ Three-year warranty

# BENEFITS

## Intuitive controls

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## One amplifier for many applications

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## Easy and flexible control and operation

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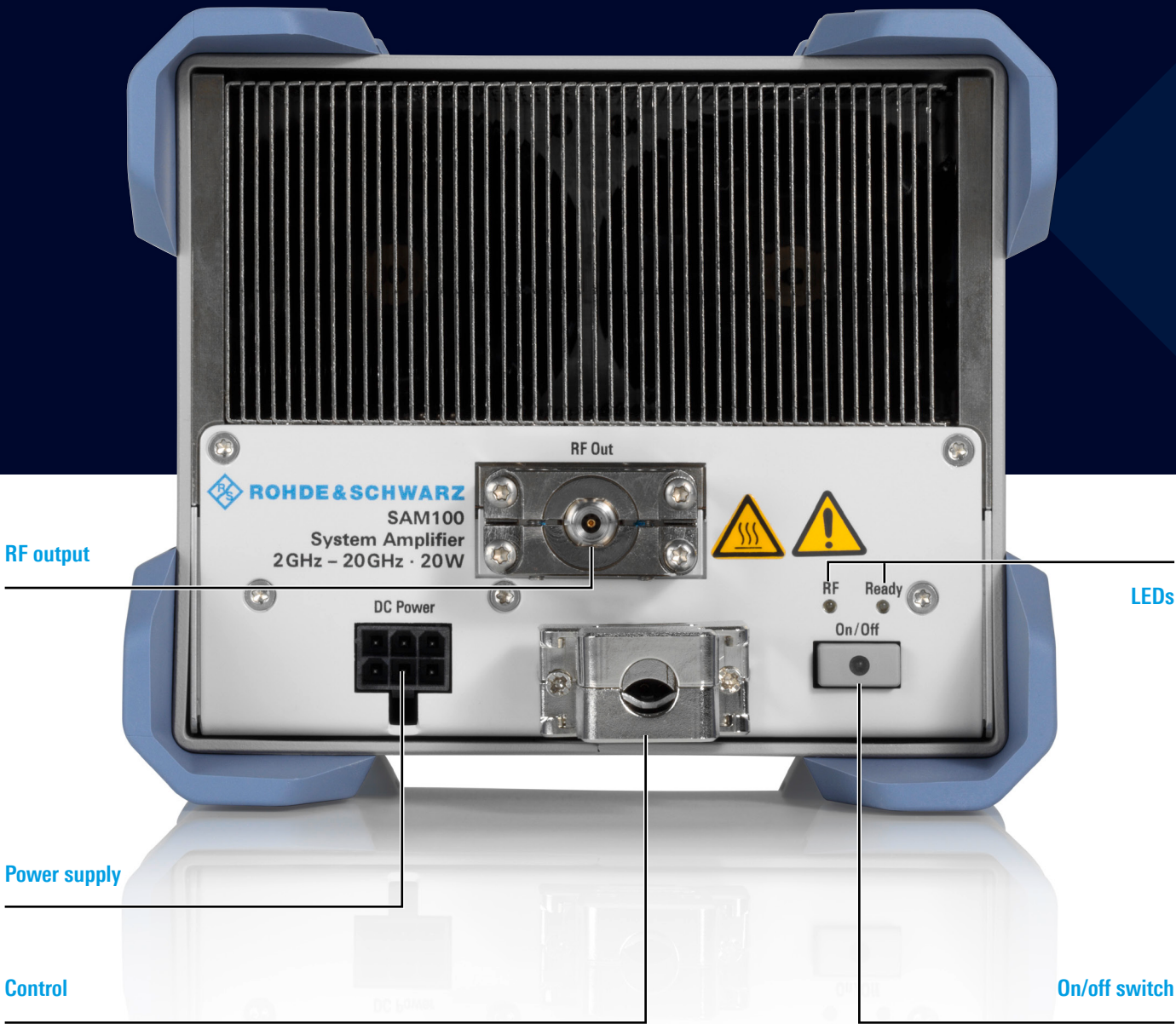
## Developed with experience and competence

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# INTUITIVE CONTROLS

## FRONT VIEW



# REAR VIEW



# ONE AMPLIFIER FOR MANY APPLICATIONS

## Highly versatile

The R&S®SAM100 system amplifier is a small, compact amplifier designed for developers and integrators of RF components and systems. With up to 20 W, the amplifier delivers the required power where it is needed, compensating for system losses and increasing the available power in RF and microwave test systems. The large bandwidth of 2 GHz to 20 GHz allows users to replace multiple small-bandwidth amplifiers by a single instrument.

The R&S®SAM100 system amplifier can be used as a preamplifier for high-power tube amplifiers. It can also be deployed as a transmit antenna amplifier, for example to verify the RF shielding effectiveness of EMC test chambers and to determine the screening attenuation of building materials and structures. Its lightweight and compact design makes it ideal for mobile use.

## Extremely high power density with outstanding RF characteristics

The R&S®SAM100 is a lightweight, rugged and extremely compact microwave amplifier with very high power density. State-of-the-art microwave circuit design with advanced gallium nitride high electron mobility transistor (GaN HEMT) technology and high-performance heat sinks with heat pipe technology enable power levels up to 20 W with a very low noise power density of  $\ll -100$  dBm (1 Hz) over a one-decade bandwidth. The optimal class A bias point provides excellent linearity with high gain over the entire frequency range. With its exceptionally low noise factor versus bandwidth and high gain, this microwave amplifier considerably improves the system noise factor and dynamic range. Integrated protection circuits safeguard the amplifier against overtemperature and mismatch at the RF output.

## Compact and modular design

The R&S®SAM100 system amplifier is supplied with a compact external power supply unit for lab deployment. A 19" mounting frame is available for integration in measuring systems with 19" racks. The mounting frame occupies four height units and can accommodate up to three R&S®SAM100 system amplifiers. The RF connectors are arranged to enable easy integration of the R&S®SAM100 in every system. Under certain conditions, installation in PXI frames is also possible. An assembly kit is provided for this purpose.

# EASY AND FLEXIBLE CONTROL AND OPERATION

## Easy operation of the instrument

In the lab, the R&S®SAM100 is switched on and off using the buttons on the instrument. Two LEDs indicate the operating state and instrument state.

## Remote control via digital control interface

The R&S®SAM100 can be remotely controlled via a digital control interface, providing all relevant control and status signals, as well as lines for interlock and mute functions.

The R&S®SAM100 can be switched on and off by a digital control line. The "Continuous On" control line enables automatic restart of the R&S®SAM100 after a power interruption.

The operating status is indicated by "Amplifier Ready", "Error" and "Interlock Status" signal lines. The digital control interface is specially designed for integration in automatic test systems. If remote control is not desired, a dummy plug on the interface port closes the interlock loop.

## Interlock and mute functions

The interlock function facilitates integration in interlock loops. It is designed as a floating interface with a built-in 24 V power source. The interlock function blocks the RF output within a few microseconds after the interlock loop is opened. Once the interlock loop is closed, the full RF power is again available at the output.

For the mute function, an interface is provided to which a pulsed control signal can be applied. A rising edge switches on the R&S®SAM100 within 120 µs, while a falling edge switches it off within 12 µs.

The mute input is ground-referenced and compatible with voltages from 0 V to 5.5 V (TTL level). The RF output is blocked when a high-level voltage is applied. Full RF power is again available when the voltage drops below 1.5 V.

The R&S®SAM100 system amplifier enters into power save mode if the RF output is blocked more than 30 seconds.

| Status display by front panel LEDs |                                                                                                                                                                         |                        |                                                                                                      |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------|
| Status                             | Ready LED                                                                                                                                                               |                        | RF LED                                                                                               |
| Power on                           |                                                                                      | yellow                 | —                                                                                                    |
| Amplifier ready                    |                                                                                      | green                  | —                                                                                                    |
| Overtemperature                    |   | yellow/green, blinking | —                                                                                                    |
| Amplifier overload                 |                                                                                      | green                  |  yellow           |
| Interlock open                     |                                                                                      | green                  |  yellow, blinking |
| RF on                              |                                                                                      | green                  |  green            |

# DEVELOPED WITH EXPERIENCE AND COMPETENCE

## Outstanding expertise in amplifier development based on decades of experience

Rohde&Schwarz has decades of experience in developing reliable solid-state power amplifiers for sound and TV broadcast transmitters, rugged broadband amplifiers for EMC, and high-quality T&M in the gigahertz range.

Our market leadership in amplifier and T&M equipment is based on outstanding functionality, advanced design, high quality and reliability since 1933. With the R&S®SAM100 system amplifier, Rohde&Schwarz is entering the high frequency range up to 20 GHz and offering compact, reliable solid-state power amplifiers for maximum user benefits.

## State-of-the-art RF design

The use of state-of-the-art design and simulation programs during development, the use of power semiconductors from internationally leading manufacturers, and the decades of experience of Rohde&Schwarz engineers in developing amplifiers result in the most advanced amplifier design currently available. Semiconductor dies directly bonded onto printed boards make it possible to achieve high output power in the frequency range from 2 GHz to 20 GHz, effectively preventing the parasitic effects caused by housed transistors.

## Series production in the most advanced plants in Europe

The R&S®SAM100 system amplifiers are series-produced in the most advanced plants in Europe. The Rohde&Schwarz plants offer superior manufacturing depth. From precision mechanical engineering and metalworking to printed board production and final assembly, all manufacturing steps are united under one roof. Automated final test rigs ensure that only products that comply with specifications leave the plant.

Rohde & Schwarz Teisnach plant



# SPECIFICATIONS IN BRIEF

## Specifications in brief

### RF specifications

|                                        |                                                      |                                                                                   |
|----------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------|
| Frequency range                        | continuous                                           | 2 GHz to 20 GHz                                                                   |
| Nominal output power                   | 2 GHz to 20 GHz                                      | 20 W (43 dBm)                                                                     |
| Nominal output load                    |                                                      | 50 $\Omega$                                                                       |
| Output power ( $P_{sat}$ )             | 2 GHz to 3 GHz                                       | min. 17 W (42.3 dBm)                                                              |
|                                        | 3 GHz to 4.5 GHz                                     | min. 26 W (44.1 dBm)                                                              |
|                                        | 4.5 GHz to 8 GHz                                     | min. 20 W (43 dBm)                                                                |
|                                        | 8 GHz to 13.5 GHz                                    | min. 15 W (41.8 dBm)                                                              |
|                                        | 13.5 GHz to 19.5 GHz                                 | min. 10 W (40.0 dBm)                                                              |
|                                        | 19.5 GHz to 20 GHz                                   | min. 9 W (39.5 dBm)                                                               |
| Output power at 1 dB compression point | 2 GHz to 3 GHz                                       | min. 7 W (38.5 dBm)                                                               |
| (P1dB)                                 | 3 GHz to 4.5 GHz                                     | min. 12 W (40.8 dBm)                                                              |
|                                        | 4.5 GHz to 6 GHz                                     | min. 10 W (40.0 dBm)                                                              |
|                                        | 6 GHz to 10 GHz                                      | min. 8 W (39.0 dBm)                                                               |
|                                        | 10 GHz to 14.6 GHz                                   | min. 6 W (37.8 dBm)                                                               |
|                                        | 14.6 GHz to 16.2 GHz                                 | min. 4 W (36.1 dBm)                                                               |
|                                        | 16.2 GHz to 19.5 GHz                                 | min. 6 W (37.8 dBm)                                                               |
|                                        | 19.5 GHz to 20 GHz                                   | min. 5 W (37.0 dBm)                                                               |
| Gain                                   | at 15 GHz                                            | 47 dB (nom.)                                                                      |
| Gain flatness                          |                                                      | $\pm 4.5$ 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                                                                         |
| Spurious                               | carrier offset > 100 kHz,<br>depending on AC adapter | -80 dBc (nom.),<br>max. -70 dBc                                                   |
| Nominal forward output power           | at VSWR $\leq$ 2:1                                   | continuous, without foldback                                                      |
|                                        | at VSWR > 2:1                                        | continuous, with gradual foldback of output<br>power, depending on load impedance |
| Output mismatch protection, VSWR       |                                                      | 100 %, without damage                                                             |
| Input                                  |                                                      |                                                                                   |
| Nominal input load                     |                                                      | 50 $\Omega$                                                                       |
| Input level                            | at nominal output power                              | -4 dBm                                                                            |
| Input VSWR                             | at 50 $\Omega$                                       | max. 2:1                                                                          |
| Maximum input level                    | RF cable                                             | +15 dBm                                                                           |
|                                        | DC                                                   | 0 V                                                                               |
| Connectors                             |                                                      |                                                                                   |
| RF input                               | front panel                                          | 2.92 mm/3.5 mm female                                                             |
| RF output                              | rear panel                                           | 2.92 mm/3.5 mm female                                                             |

### Remote control

|                   |  |                                |
|-------------------|--|--------------------------------|
| Control connector |  | 9-pin D-Sub plug (digital I/O) |
|-------------------|--|--------------------------------|

### User interface

|                   |  |                   |
|-------------------|--|-------------------|
| Local LED display |  | ready LED, RF LED |
|-------------------|--|-------------------|

### General data

|                          |                                                                                                  |                                                                         |
|--------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Operating voltage        | external AC adapter, power cable with<br>low-temperature connector and country-specific<br>plugs | 100 V to 240 V AC $\pm$ 10 %, single phase,<br>50 Hz to 60 Hz $\pm$ 6 % |
| Air cooling              |                                                                                                  | forced air, built-in fans                                               |
| Environmental conditions |                                                                                                  |                                                                         |
| Temperature range        | operating temperature                                                                            | 0 °C to +40 °C                                                          |
|                          | storage temperature                                                                              | -20 °C to +70 °C                                                        |
| Humidity                 |                                                                                                  | +25 °C/+40 °C cyclic, 95 % relative humidity,<br>non-condensing         |

| Specifications in brief                    |                                                                 |                                                                                                                                                  |
|--------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Altitude                                   | operating altitude                                              | up to 2000 m                                                                                                                                     |
|                                            | storage altitude                                                | up to 4600 m                                                                                                                                     |
| Mechanical load capacity of desktop models | vibration, sinusoidal                                           | 5 Hz to 55 Hz, 0.15 mm amplitude,<br>> 55 Hz to 150 Hz, 0.5 g acceleration,<br>in line with EN60068-2-6                                          |
|                                            | vibration, noise                                                | effective acceleration $\leq 1.2$ g,<br>10 Hz to 300 Hz,<br>0.003 g <sup>2</sup> /Hz acceleration spectral density,<br>in line with EN60068-2-64 |
|                                            | shock                                                           | 18 sawtooth shocks, each 40 g in 11 ms,<br>in line with EN60068-2-27 and<br>MIL-STD-810E method 516.4, procedure I                               |
| Dimensions (W × H × D)                     | including fans and corner bumpers,<br>integratable in PXI frame | 121 mm × 100 mm × 150 mm<br>(4.8 in × 3.9 in × 5.9 in)                                                                                           |
| Weight                                     | without external power supply                                   | 3 kg (6.6 lb)                                                                                                                                    |

All parameters are specified at +25°C and 50  $\Omega$  input and output impedance.

# ORDERING INFORMATION

| Designation                                                               | Type         | Configuration No./Order No. |
|---------------------------------------------------------------------------|--------------|-----------------------------|
| <b>Base unit</b>                                                          |              |                             |
| System amplifier, 2 GHz to 20 GHz, 20 W output power ( $P_{\text{sat}}$ ) | R&S®SAM100   | SAM100-0220-20              |
| <b>Required extras</b>                                                    |              |                             |
| Adapter 2.92 mm                                                           | R&S®SAM-B102 | 5358.2900.02                |
| Adapter 3.5 mm                                                            | R&S®SAM-B103 | 5358.2900.03                |
| Desktop kit                                                               | R&S®ZR-SAM-D | 5358.2930.02                |
| Frame mounting kit                                                        | R&S®ZR-SAM-R | 5358.2923.02                |
| <b>Option</b>                                                             |              |                             |
| 19" frame for up to 3 × R&S®SAM100                                        | R&S®ZR-SAM-F | 5358.2917.02                |

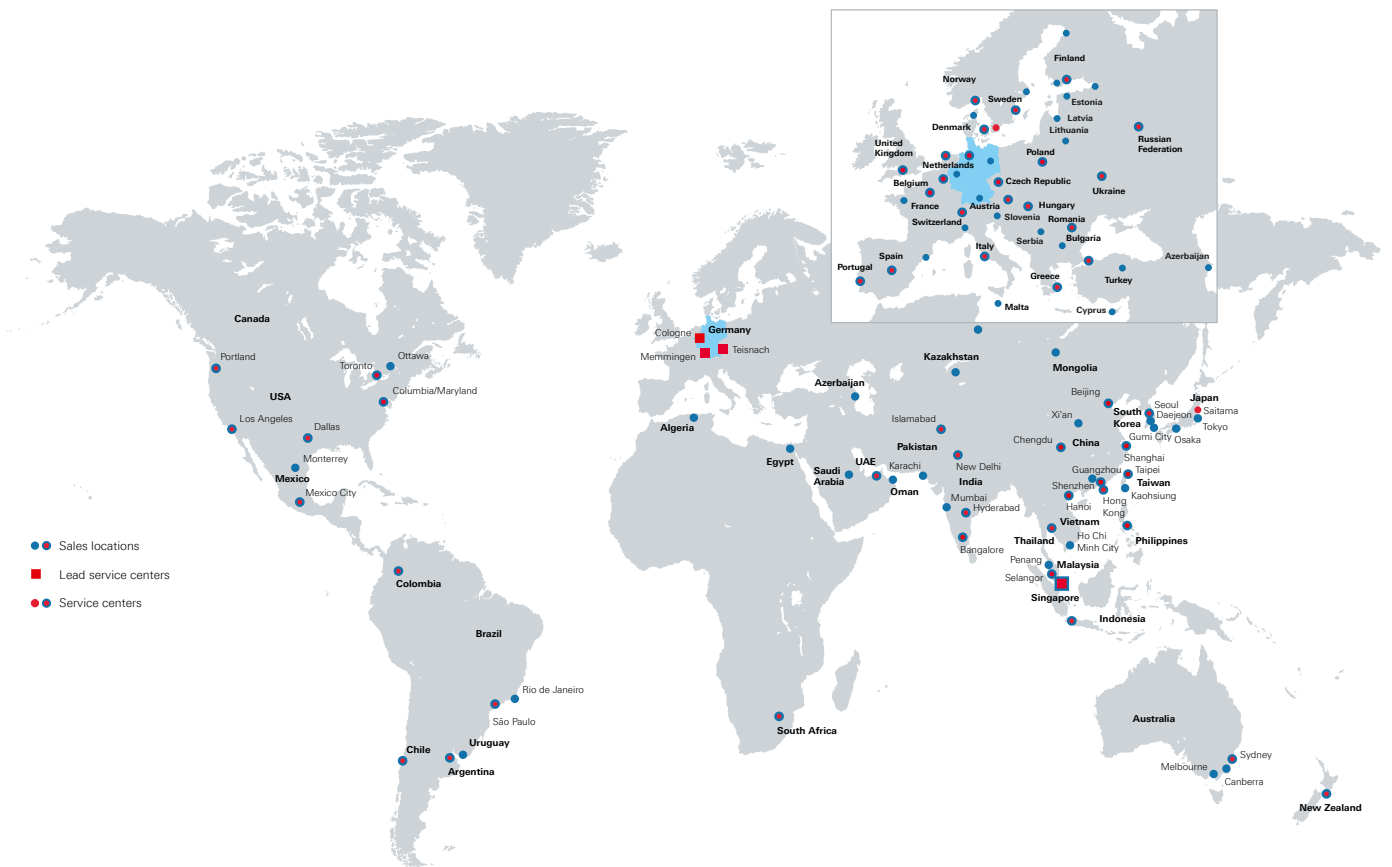
Your local Rohde&Schwarz expert will help you to determine the optimum solution for your requirements.  
To find your nearest Rohde&Schwarz representative, visit [www.sales.rohde-schwarz.com](http://www.sales.rohde-schwarz.com)

# FROM PRE-SALE TO SERVICE. AT YOUR DOORSTEP.

The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts.

User risks are reduced to a minimum at all stages of the project:

- ▶ Solution finding/purchase
- ▶ Technical startup/application development/integration
- ▶ Training
- ▶ Operation/calibration/repair



## Service that adds value

- ▶ Worldwide
- ▶ Local und personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

## Sustainable product design

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

Certified Quality Management

**ISO 9001**

Certified Environmental Management

**ISO 14001**

## Rohde & Schwarz training

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

## Rohde & Schwarz customer support

[www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support)

