

MilCom testing

# TESTING SECURE RADIOS



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**ROHDE & SCHWARZ**

Make ideas real

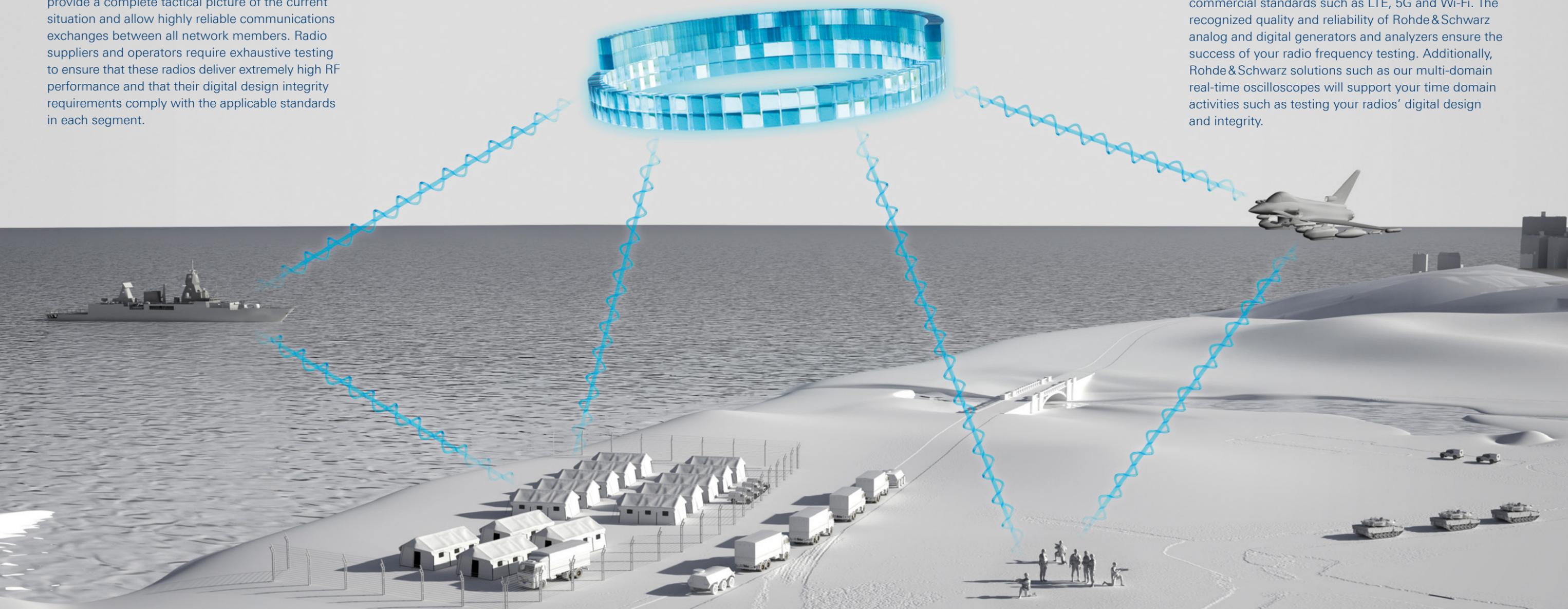


# YOUR CHALLENGE

The increasing number of cyber threats in warfare scenarios demands complex secure radios that can exchange analog and digital audio with extremely sensitive network data in real time. Radios should provide a complete tactical picture of the current situation and allow highly reliable communications exchanges between all network members. Radio suppliers and operators require exhaustive testing to ensure that these radios deliver extremely high RF performance and that their digital design integrity requirements comply with the applicable standards in each segment.

# OUR SOLUTION

Combine instruments and software in radio test sets and solutions to verify the performance of your handheld, portable or vehicular radios, automate testing and comply with specific military or security standards, as well as commercial standards such as LTE, 5G and Wi-Fi. The recognized quality and reliability of Rohde&Schwarz analog and digital generators and analyzers ensure the success of your radio frequency testing. Additionally, Rohde&Schwarz solutions such as our multi-domain real-time oscilloscopes will support your time domain activities such as testing your radios' digital design and integrity.



## Ensure correct digital designs

Soldier and public safety radios need to be reliable and robust. The loss or decline of capabilities of these devices may result in fatalities. Therefore, as radio devices increase in complexity and decrease in size and weight, the verification of the integrity of internal high speed digital buses, multicell high-capacity batteries and internal power delivery, with instruments such as the R&S®RTO oscilloscope family, has become a key challenge for current and future handheld and portable developments.

## Test interoperability and jamming resilience

Stay up to date with new secure and commercial digital communications to increase the situational awareness of soldiers or homeland public safety forces. Perform protocol, production and conformance testing for analog and digital radios up to 20 GHz with the R&S®CMX500, the all-in one test solution for commercial wireless standards such as Wi-Fi, Bluetooth®, LTE and 5G.

## Leverage model based and rapid prototyping

Speeding up development often requires working with different teams in parallel: adopting rapid prototyping with consistent co-design verification and testing instruments to ensure they match the requirements of all development teams is the key to success. For software or waveform engineers, our instruments integrate with development environments such as MATLAB® and Python with a single click. For hardware engineers, Rohde&Schwarz instruments offer streamlined connections to the most common software defined radio development boards.

## Ensure test consistency from design and development to maintenance

Using different instruments often creates inconsistent results for development and maintenance teams. With an all-in-one radio test set such as the R&S®CMA180, developers at their desks and operators using the portable options can use a single instrument to automate all the test cases in a scenario and, if needed, replicate a specific test case. As a result, customer experience and feedback will reach developers much faster.

# MODEL BASED ENGINEERING

## Introduction

Streamline waveform verification throughout integration testing with desktop design environments such as MATLAB®, Python 3.x, C#, LabVIEW and CVI. Selecting the most suitable instruments to support you – from design workflows such as waveform creation and rapid prototyping with your SDR development boards to final hardware testing – is not an easy task. This is because companies need to take into account technical requirements as well as parameters such as reusability, multi-domain capabilities and easy integration with current internal development methods and tools.

## Your challenge

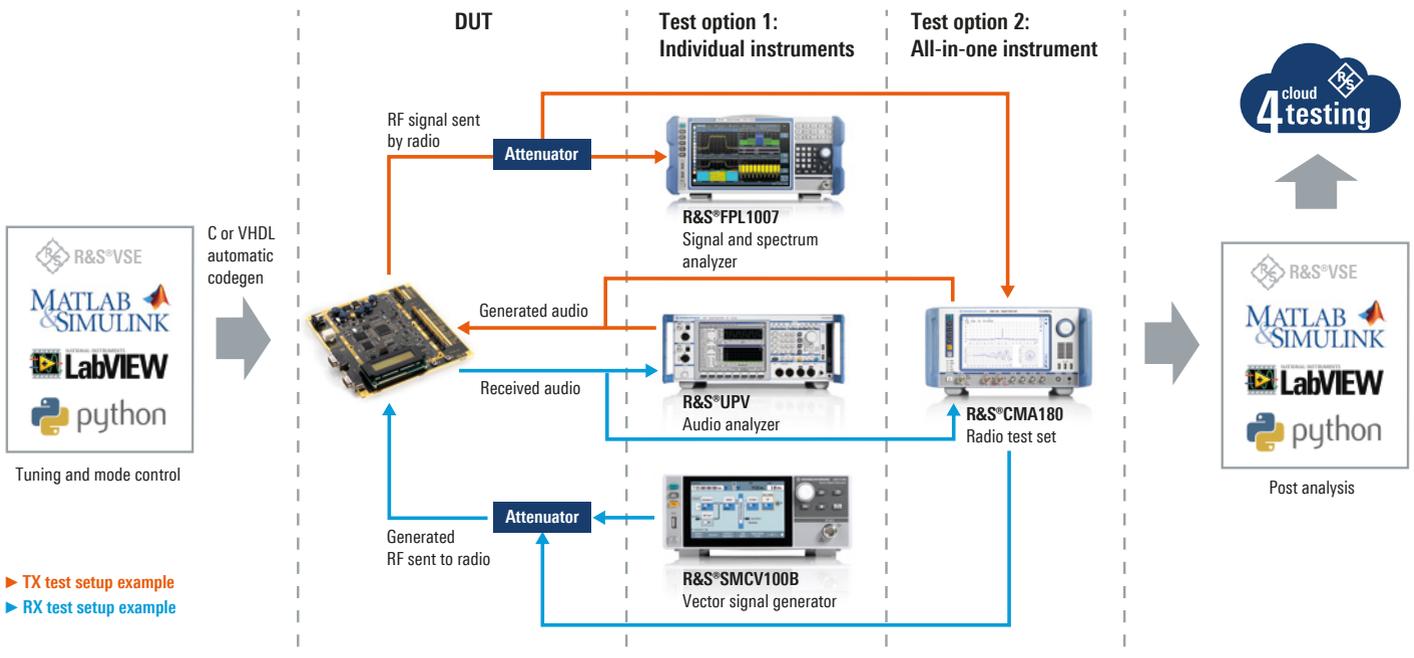
Depending on customer needs, military waveforms can be highly customized. In order to ensure robust and secure communications, new SDR development boards provide high design flexibility. Accurate and consistent

testing is essential to both meet customer requirements and comply with international standards. Large companies may use different teams and labs that are geographically distributed in order to ensure homeland security or protect national interests for large-scale development programs. However, design and testing methods can be defined and approved by a common internal independent authority.

## Rohde & Schwarz solution

Create test samples from your algorithms, store them in ARB files and integrate your model based design and automatic code generation workflow with Rohde & Schwarz instruments. Leverage our SCPI and VISA drivers to remote control Rohde & Schwarz instruments with our R&S®Cloud4Testing solution to exchange results between different teams, integrate with your internal methods and tools and automate verification activities. You can use your test cases designed by the waveform software teams, import them to arbitrary waveform generators, let hardware engineers run all test cases in the final transceivers, and finally use spectrum analyzers connected to your R&S®Cloud4Testing analytics platform to evaluate how these waveforms behave on your prototype or on the production device.

## Solutions for model based systems engineering (MBSE)



# LIFECYCLE CONSISTENCY

## Introduction

Using different test instruments during development, production and maintenance may lead teams to end up with inconsistent results. Instruments with similar performances could provide different results, depending on how the internal computation and conversions are performed.

## Your challenge

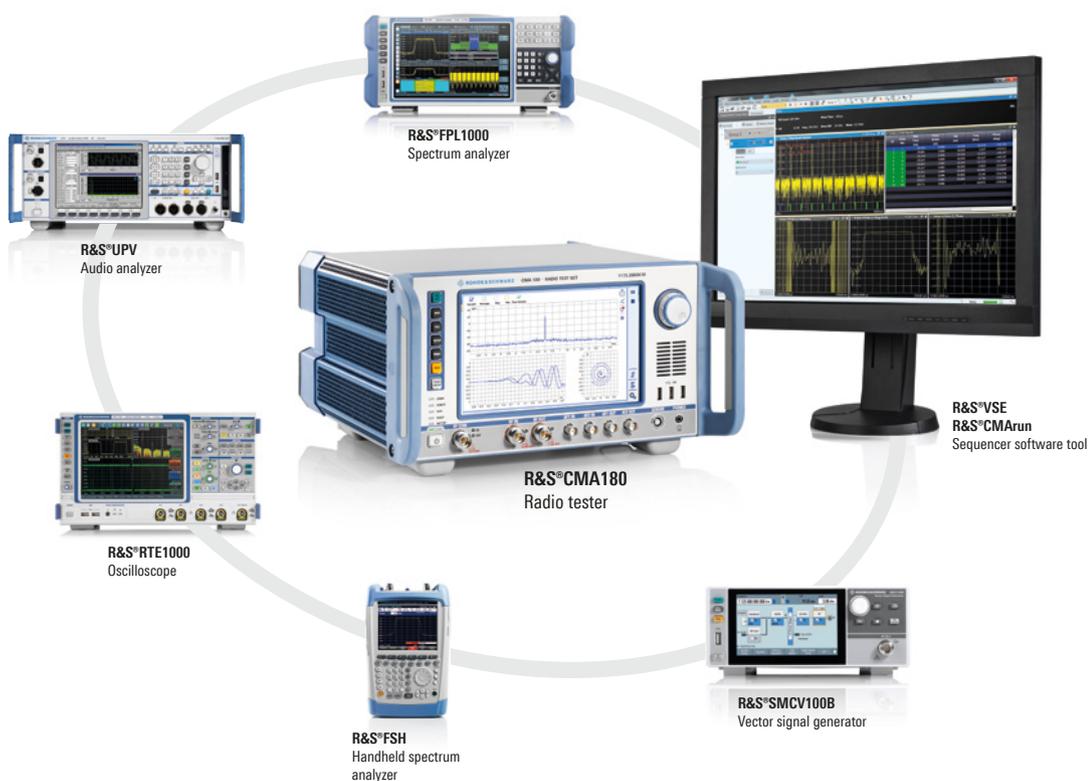
Our experience in the communications market has taught us that, as the frequency and performance of devices increases, groups using different test and measurement instrument suppliers to test their devices spend a longer amount of time identifying the root cause of inconsistencies. Often the main cause is an inconsistent test setup, due to different probes, cables or attenuators. In this case, the instruments themselves cannot produce reliable results. However, often the root case is the usage of

instruments with different accuracies or performances. Instead, it is recommended to use the optimal instrument in each case.

## Rohde & Schwarz solution

The R&S®CMA180 radio test set for the generation and analysis of analog/digital signals and audio signals operates from 100 kHz to 3 GHz (increased to 6 GHz with the R&S®CMA-XRT100 option) and covers most MilCom and public safety use cases. With a single radio test set, waveform and hardware developers can test directly at their desks, operators can use the radio testers in the final assembly lines and automate all final test cases, and operators can add the portable and protective options and use the test set in the field and run maintenance checks in any scenario. The recording capabilities allow all test cases to easily be replicated in any lab and enable the customer's experience, feedback and recommendations to reach developers much faster.

## Solutions for all aspects of lifecycle testing



# HIGH SPEED DIGITAL COMPONENTS

## Introduction

Modern radios increasingly integrate more functionality and more (wired and wireless) interconnectivity into less space, and at the same time access to high-performance networks requires higher processor speeds, clock and data rates while signal levels decrease. All these developments result in a growing need for more detailed and accurate testing at the component and board level.

## Your challenge

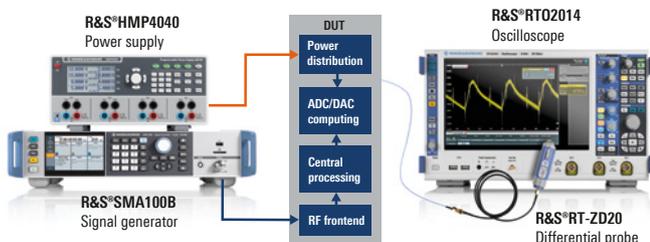
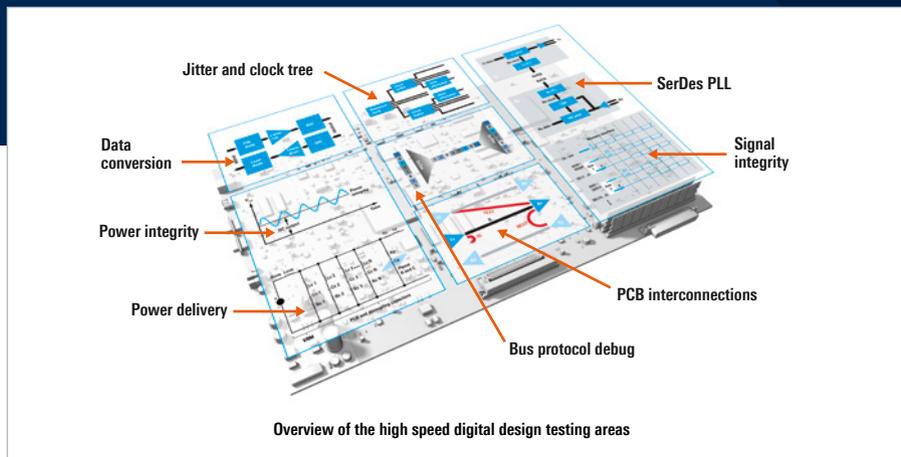
One approach for the high-speed digital design verification of communications device is to divide the process into four areas: jitter and clock tree, signal and power integrity, SerDes and data converters, and high speed bus protocols. When radios move into higher frequen-

cies, the verification of the reference clock and clock distribution network accuracy needs to be in line with the overall performance of the radio. In this regard, spread spectrum clocking (SSC) could be implemented, adding a low frequency modulation to the clock signal to reduce unwanted emissions. Similarly, increased data rates mean that PCB traces, vias, connectors and cables will have to transmit undesired higher frequencies. As a result, reflections due to impedance mismatch, insertion loss, frequency response, propagation delay, skew and cross-talk on these signal paths have a fundamental impact on the overall signal integrity. Finally, internal high speed buses or external serial buses used to configure or access a radio's data can be difficult and time-consuming to debug, because the data is embedded in protocol frames.

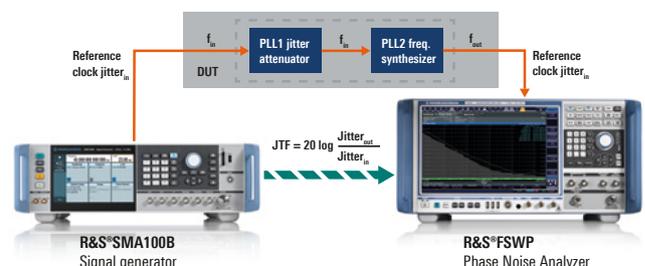
## Rohde & Schwarz solution

Our wide range of test instruments and solutions for high speed digital design includes oscilloscopes, spectrum and phase noise analyzers, signal generators, vector network analyzers and power supplies. Rohde & Schwarz products are the result of our industrial expertise in all aspects of electronic and RF design.

## Solutions for high speed digital design



Example of power integrity measurement on an AD/DA converter with an oscilloscope



Example of clock tree and jitter transfer function measurement with a phase noise analyzer

# INTER-OPERABILITY AND RESILIENCE

## Introduction

Modern MilCom radios support many standards in a small space, which can lead to interference due to occupying the same or adjacent frequency bands or due to harmonics. Ensuring standards-compliant operation and minimal mutual interference is crucial.

## Your challenge

Secure radios can integrate multiple RF systems. These can include analog secure audio antennas, digital secure waveform transceivers, cellular multiband antennas for LTE-A/3G/2G and even non-cellular technologies such as Wi-Fi, Bluetooth® and various GNSSs. Measurements of in-device coexistence determine the desensitization, i.e. decrease in the receiver sensitivity with and without a

strong internal interferer signal. For standard sensitivity tests, the receiver packet error rate (PER) has been adopted as the evaluation criteria. The scope of all these coexistence tests increases depending on the priorities and quality requirements of the customer.

## Rohde & Schwarz solution

The commercial R&S®CMW wideband radio communication tester platform offers all major radio access technologies in a single compact tester, making it ideal for testing handheld devices and even tactical mission tablets as well as public and private base stations and access points for 3G, LTE and 5G (with the R&S®CMX). The R&S®CMW is the universal wideband radio communication tester that offers you the flexibility to test in line with all major cellular and non-cellular standards.

Solutions for testing interoperability and jamming resilience



### Service that adds value

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

### About 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.

### 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)



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