

ROHDE & SCHWARZ

Make ideas real



POWER ELECTRONICS T&M SOLUTIONS

Component testing, product design,
production and compliance testing.

Flyer
Version 01.00



Rohde & Schwarz provides high-quality T&M equipment for all phases of power electronic equipment measurements. They cover design to delivery and beyond, with both passive and active components tested along with complete device service and maintenance.

When selecting suitable passive and active components in the early development phases, an LCR meter is ideal for assessing capacitors and inductors. Developing converters and inverters requires T&M equipment that is flexible and accurate. A high resolution oscilloscope provides both the necessary accuracy and the wide level range required.

Rohde & Schwarz supplies solutions for EMC requirements that range from initial EMI investigations in early-phase development to full EMC compliance measurements.

Rohde & Schwarz oscilloscopes and power analyzers are designed for the production environment and the instruments are well suited for typical manufacturing verification tests of major home appliances. For installation and service, Rohde & Schwarz supplies handheld oscilloscopes with the performance of laboratory instruments, ideal for all test requirements in the field.

Component testing



Converter and inverter design



EMI debug precompliance and compliance



Verification and production testing



Service and field testing



STANDARD LAB EQUIPMENT

Power supplies and multimeters are part of the standard equipment of every laboratory.

Power supplies

On a bench or in a test system, our versatile DC power supply portfolio with different power ratings, features and precision levels offers the right choice for your application.

- ▶ Multiple independent outputs provide separate power levels and characteristics, saving cost and space on the bench or in system racks
- ▶ Both parallel and serial operation to provide higher currents or voltages, covering more applications.
- ▶ Remote control supported by a variety of interfaces
- ▶ Intuitive operating concept, large high-resolution touchscreen
- ▶ Programmable safety functions protect the DUT and instrument
- ▶ Sophisticated features, such as battery simulation output delays, remote sensing, and data logging, speed up everyday measurements

Multimeters

Accuracy and speed are the most important parameters of multimeters, with usability a close third. With the R&S®HMC8012, Rohde&Schwarz offers a powerful 5 3/4 digit multimeter for laboratory use. Key benefits are:

- ▶ Measurement range from DC to 100 kHz
- ▶ Up to 200 measurements per second
- ▶ High basic accuracy of 0.015 %
- ▶ Simultaneous display of up to three measurement functions; DC + AC + statistics, for example

Solutions for COMPONENT TESTING

The real-life behavior of passive components has an essential impact on the design and achievable performance of power electronics designs. So verifying behavior is an important part of selecting components for use in production.

Verifying the real-life behavior of passives

The effective capacity of a capacitor depends strongly on its DC offset voltage for operations; the effective inductance of an inductor depends on the average DC current flowing through the inductor.

The R&S®HM8118 LCR meter can be used to measure the frequency-dependent complex impedance of passive components to derive accurate values for the equivalent circuit diagram of the component. This enables testing of components under DC bias voltage or current.

Key features:

- ▶ Very high basic accuracy of 0.05 %
- ▶ Frequency range from 20 Hz to 200 kHz
- ▶ DC bias up to 5 V/200 mA (internal) or 40V (external)
- ▶ Up to 12 measurements per second
- ▶ Kelvin cable and 4-terminal SMD test adapter



R&S®HMC8012
Digital Multimeter



R&S®NGP 800
Power Supply Series



R&S®HM8118
Programmable LCR Bridge

Solutions for POWER CONVERTER AND INVERTER DESIGN

Oscilloscopes are the main measuring instrument for testing power electronics designs during development. Rohde&Schwarz oscilloscopes meet all the performance needs of power electronics engineers:

- ▶ Very high resolution and low inherent noise for accurate measurements
- ▶ Deep memory to capture long startup phase and switching cycles at the same time
- ▶ Dedicated analysis functions such as Bode plots, PWM analysis (track), harmonics, or power analysis
- ▶ Wide range of performance and options

Measuring high-voltage and current signals

Accurate oscilloscope measurements require the right probes for the application. The R&S®RT-ZHD high-voltage differential probe family offers a bandwidth of up to 200 MHz, high-common-mode rejection ratio, low drift and low noise. Passive high-voltage probes from Rohde&Schwarz are excellent for ground-referenced measurements. R&S®RT-ZC clamp-on current probes provide current measurements over a broad range of parameters.

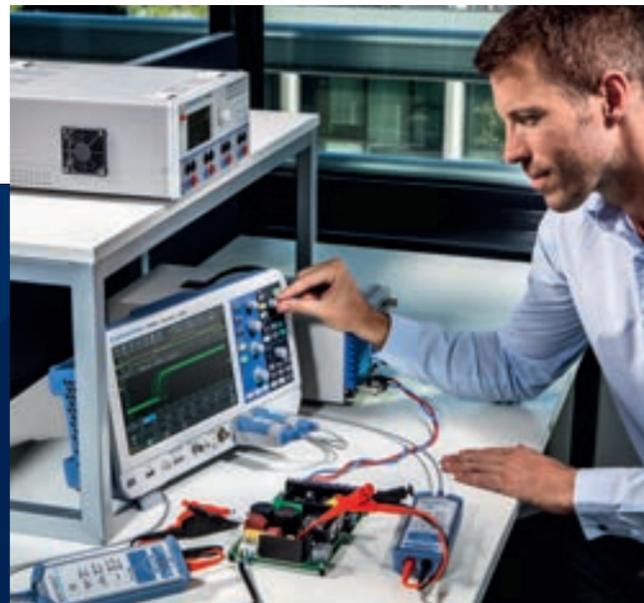
Verifying control loop stability

At the core of each power converter or inverter, a control loop makes sure the output voltage stays stable independent of input voltage variations or load jumps at the output. Verifying stability of the control loop under different operating points of the system is an essential test during design. The R&S®RTx-K36 frequency response analysis (Bode plot) option allows you to perform this directly with the oscilloscope, providing essential features such as direct plotting of the phase and gain margin and as amplitude profiling.

Power integrity – verifying ripple and noise

Stable and clean power rail signals are the basis for reliable electronic device performance. With decreasing operating voltages and smaller tolerance windows, verification becomes more and more difficult. Rohde&Schwarz offers dedicated solutions for power integrity testing:

- Very high offset compensation range
- ▶ Extremely high sensitivity with 1:1 attenuation factor
- ▶ Integrated high-accuracy DC voltmeter
- ▶ Very high bandwidth to capture fast glitches



Selection guide for high performance oscilloscopes

| Parameter | R&S®RTH1000 | R&S®RTB2000 | R&S®RTM3000 | R&S®RTA4000 | R&S®RTE1000 | R&S®RTO2000 |
|------------------------|--|---|---|---|---|---|
| Bandwidth | 60 MHz to 500 MHz | 70 MHz to 300 MHz | 100 MHz to 1 GHz | 200 MHz to 1 GHz | 200 MHz to 2 GHz | 600 MHz to 6 GHz |
| Probe interface | BNC | BNC | R&S®Probe Interface | R&S®Probe Interface | R&S®Probe Interface | R&S®Probe Interface |
| Key features | <ul style="list-style-type: none"> ▶ 10 bit ADC ▶ Galvanically isolated channels ▶ Battery operated | <ul style="list-style-type: none"> ▶ 10 bit ADC ▶ 20 Msample memory ▶ Powerful FFT | <ul style="list-style-type: none"> ▶ 10 bit ADC ▶ 80 Msample memory ▶ Power analysis option ▶ Powerful FFT ▶ Bode analysis ▶ PWM track analysis | <ul style="list-style-type: none"> ▶ 10 bit ADC ▶ 200 Msample memory ▶ Power analysis option ▶ Powerful FFT ▶ Bode analysis ▶ PWM track analysis ▶ Very good signal fidelity | <ul style="list-style-type: none"> ▶ 16 bit HD Mode ▶ 200 Msample memory ▶ Power analysis option ▶ Advanced measurement and analysis functions (e.g. PWM track, FFT) ▶ Excellent signal fidelity | <ul style="list-style-type: none"> ▶ 16 bit HD Mode ▶ 2 Gsample memory ▶ Power analysis option ▶ Advanced measurement and analysis functions (e.g. PWM track, FFT) ▶ Excellent signal fidelity |
| Application | Service & maintenance but also R&D | Production testing and R&D (basic requirements) | Production testing and R&D (advanced requirements) | R&D if digital design is another use case | R&D Specialized production testing EMI debugging & testing | R&D Specialized production testing EMI debugging & testing |
| Speciality | Field testing | | | Power integrity testing | Power integrity testing | Power integrity testing |

Solutions for EMI DEBUGGING, PRECOMPLIANCE AND COMPLIANCE

Compliance with electromagnetic interference (EMI) standards has to be taken into account in the early concept phase of a product. The later EMI compliance is considered in the design phase, the more expensive the countermeasures.

Rohde&Schwarz provides T&M tools for EMI debugging from early in the design phase, for precompliance measurements on prototypes and for full compliance at the end of the development cycle.

EMI debugging and early testing

Oscilloscopes are the standard tool for development engineers in the electronics industry. Using oscilloscopes for EMI debugging as well is a cost-efficient solution for addressing EMI early in the design phase, in particular for power electronics designs.

Key benefits:

- ▶ Correlation between time and frequency domain
- ▶ Wide and instantaneous frequency coverage
- ▶ Synchronous spectrum measurement on up to four channels

Precompliance testing

Spectrum analyzers and basic EMI receivers are excellent tools in dedicated precompliance test setups. Our portfolio includes:

- ▶ spectrum analyzers for basic EMI pre-compliance test setups
- ▶ precompliance EMI receivers to prepare for final certification testing

Full compliance testing solutions

As the industry-leading supplier of EMC T&M equipment, Rohde&Schwarz offers solutions for measuring electromagnetic interference:

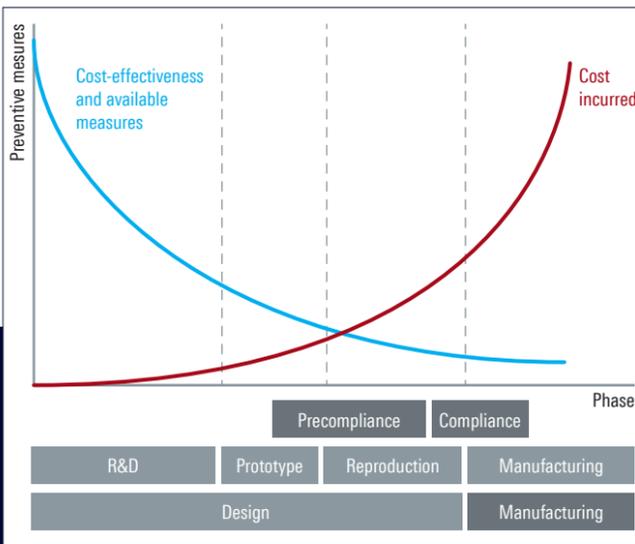
- ▶ EMI receivers for full compliance measurements
- ▶ Professional support in determining your requirements
- ▶ Integration, system training and on-site, aftersales expert support

The earlier EMI compliance is considered during product design, the lower the risk of costly design changes close to product certification.

Oscilloscopes with powerful FFT capabilities are a valuable tool for EMI debugging and testing, in particular for power electronics design where correlation to time domain is important.

Dedicated precompliance EMI receivers allow for accurate EMI testing immediately prior to final certification.

R&S®RTO2044 Oscilloscope



R&S®ESPR EMI Test Receiver



Solutions for VERIFICATION AND PRODUCTION TESTING

Starting from the early prototype phase, performance verification and preproduction testing are necessary steps towards mass production. Rohde&Schwarz provides both multipurpose as well as specialized test equipment for these applications.

Power converter verification and production testing

Verification and production testing of AC/DC or DC/DC power converters requires high vertical resolution, deep memory and dedicated analysis capabilities. The R&S®RTB2000 and R&S®RTM3000 oscilloscopes are ideally suited for this task.

Key benefits:

- ▶ Native 10 bit ADC resolution
- ▶ Deep memory of up to 80 Msample
- ▶ Up to 0.5 mV/Div HW input sensitivity
- ▶ Advanced analysis capabilities

Major home appliance efficiency and conformance testing

Energy efficiency, current harmonics and verifying inrush currents are all standard tests to which electronic consumer durables must comply.

The R&S®HMC8015 power analyzer is a single-box solution for automated compliance tests to standards such as IEC 62301, EN50564 or IEC / EN 61000 3.

Key benefits:

- ▶ Measurement range: 50 uW to 12 kW with 0.05 % basic accuracy
- ▶ 100 kHz bandwidth
- ▶ Pass/fail production testing and automated policy testing in line with EN and IEC standards
- ▶ Data logging, waveform view and energy meter functionality



R&S®HMC 8015 Power Analyzer

R&S®HZC 815 Power Analyzer

Solutions for SERVICE AND FIELD TESTING

Troubleshooting power converter or electric drive installations often requires measurements at the customer's premises without a mains supply. Typical laboratory oscilloscopes have limitations, as they require an external power source.

The R&S®Scope Rider handheld oscilloscope is a powerful all-in-one solution for:

- ▶ Power converter and inverter debugging
- ▶ Motor drive analysis
- ▶ Load current measurements
- ▶ Railway electricity troubleshooting
- ▶ Power quality monitoring

Key benefits:

- ▶ Galvanically isolated input channels for safe and accurate measurements
- ▶ Lab performance oscilloscope in rugged, portable design
- ▶ 4 hours battery life
- ▶ 8-in-1 functionality: oscilloscope, logic analyzer, protocol analyzer, data logger, digital multimeter, spectrum analyzer, harmonics analyzer, frequency counter
- ▶ User-programmable applications for automated touch-of-a-button measurement routines
- ▶ Remote operation via web browser



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

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

Rohde & Schwarz customer support

www.rohde-schwarz.com/support

