

Efficient analysis of power and signal integrity and EMC

- | Electronic design
- | Test and measurement solutions

Your challenge...

Modern electronic designs increasingly integrate more functionality into less space. At the same time, processor speeds, clock and data rates are rising and signal levels are decreasing.

All these developments result in a growing need for testing at the component, board and system level.

This flyer offers a compact overview of Rohde & Schwarz solutions to address testing requirements when developing, verifying and optimizing electronic designs.

For more information on these solutions, visit our website:

www.rohde-schwarz.com/electronic-design

Power delivery

Everything starts with the right voltage source. The requirements on power supplies are low noise and ripple as well as accurate and stable output voltage in order to introduce as little disturbance as possible. You can count on R&S®HMP performance power supplies to deliver clean and stable power to your electronic design.

Power integrity

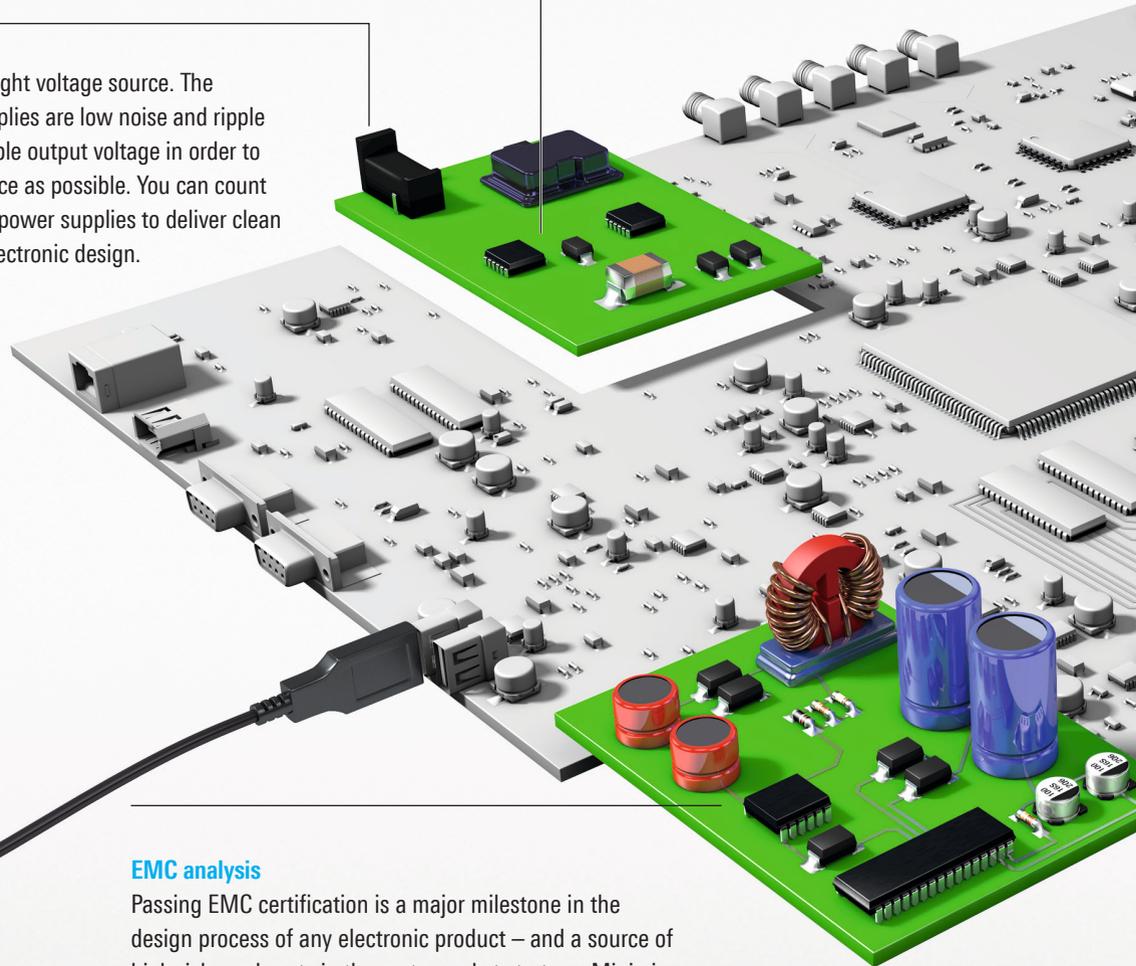
The constant trend towards lower voltage levels, higher data rates and smaller, more compact product dimensions challenges engineers to ensure extremely stable and clean supply voltages in their electronic designs. Designing for best power integrity requires extremely sensitive and accurate measurement. Rohde & Schwarz offers:

- Advanced oscilloscopes and probes to verify and analyze the remaining ripple and noise of your power rails.
- Vector network analyzers to analyze the power delivery network (PDN) to identify and remove critical frequency ranges that exceed the maximum allowed target impedance.

EMC analysis

Passing EMC certification is a major milestone in the design process of any electronic product – and a source of high risks and costs in the go-to-market strategy. Minimizing these risks and costs is crucial, making an early and consistent EMC test approach the key to success.

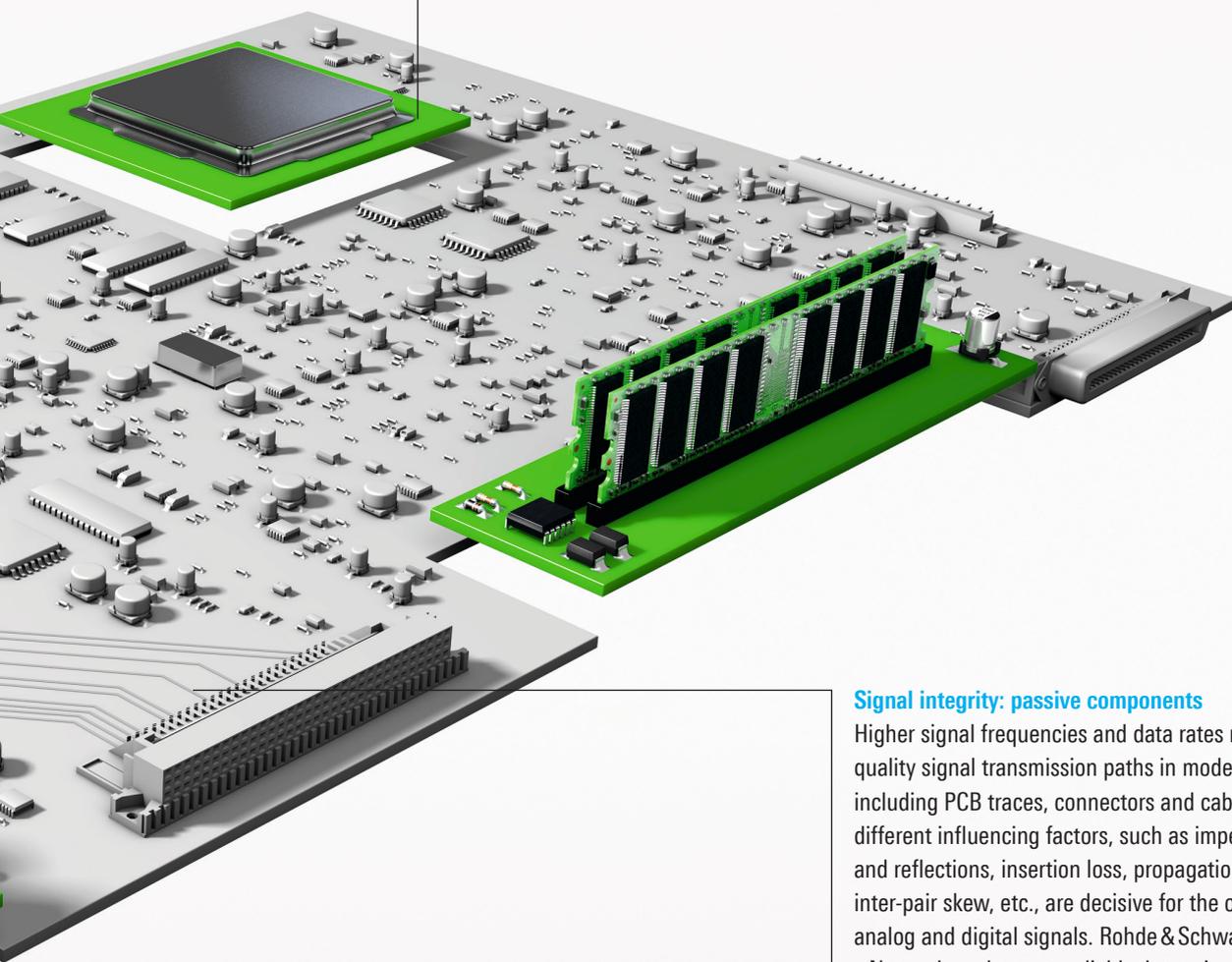
Whether you are looking into electromagnetic interference or electromagnetic susceptibility, Rohde & Schwarz can provide the test equipment and accessories to cover all necessary measurements.



Signal integrity: active components

Digital interfaces have become predominant in electronic designs. Increasing data rates and clock speeds and omnipresent wireless connectivity create a need for highly sophisticated testing and debugging solutions. Signal integrity measurements are the key in the field of high-speed digital designs. It also plays a pivotal role in RF and microwave designs. Rohde & Schwarz provides:

- Market-leading phase noise testers, spectrum analyzers and advanced oscilloscopes for precise jitter and phase noise characterization in the frequency and time domain.
- Signal and spectrum analyzers with excellent spectral purity, dynamic range and a wide analysis bandwidth for measuring spurious emissions, ACLR, EVM, etc.



Signal integrity: passive components

Higher signal frequencies and data rates require top-quality signal transmission paths in modern designs, including PCB traces, connectors and cables. Many different influencing factors, such as impedance mismatch and reflections, insertion loss, propagation delay, intra/inter-pair skew, etc., are decisive for the overall quality of analog and digital signals. Rohde & Schwarz provides:

- Network analyzers to reliably determine the signal integrity of passive components.

Introduction



“Measuring the standard means exceeding the standard”

Rohde&Schwarz is the global market leader for EMC compliance testing, with over 80 years of business experience in developing and producing cutting-edge test and measurement instruments and solutions.

When designing cutting-edge instruments and solutions for the latest EMC standards and customer requirements, we make sure that our instrument designs live up to these standards – and far exceed them.

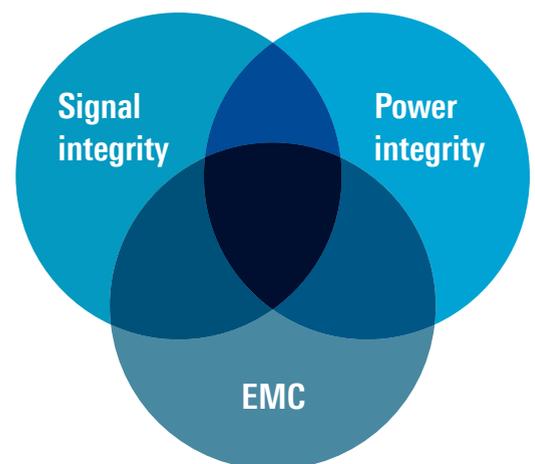
This is our inspiration and motivation for our state-of-the-art expertise in digital, analog and RF design and our deep understanding of design and manufacturing challenges.

From market-leading expertise to cutting-edge instruments, from full-scale solutions to reliable support and service – with Rohde&Schwarz, you have a long-term partner at your side to tackle all aspects of:

- Power integrity
- Signal integrity
- EMC analysis

Now and in the future

Electronic design – power and signal integrity and EMI debugging



Power integrity

Clean and stable power rail voltages are the basis for proper performance of any electronic design. The continuing demand for higher performance, higher level of integration and lower power consumption drives supply voltages down, making voltage tolerances tighter and power rail qualification a challenging task.

Ripple, noise and load-step response measurements on integrated circuits such as CPUs, DDR memories and FPGAs require very low noise and broadband probing solutions that can measure in the single-digit millivolt range. Qualifying the power supply for sensitive analog receiver circuits means measuring very small disturbances at relatively high DC offset levels.

The R&S®RTO and R&S®RTE oscilloscopes in combination with the R&S®RT-ZPR20 power rail probe offer:

- > 2 GHz bandwidth to capture fast transients
- Superior low-noise measurements
- Powerful spectrum analysis of noise components
- High waveform update rate for fast worst-case analysis
- Highest offset up to +/-60 V
- Built-in 16-bit DC voltmeter with 0.05 % accuracy

Relatively new effects such as crosstalk between power rails and high-speed data lines and significant RF signal coupling easily exceed 2 GHz and put the entire system performance at risk – to the point of complete device failure.

With the clear need to further reduce development risks and costs, an engineer's wish list is simple but demanding:

- Superior FFT capabilities for precise spectrum analysis
 - Sufficient bandwidth to cover all Wi-Fi frequency bands
 - Fast and easy multi-domain analysis on power rails
- All these aspects are addressed by a single instrument – the R&S®RTO2000 oscilloscope.

For deeper analysis and further optimization of the supply voltage network, electronic engineers have to look at worst-case scenarios. An impedance plot of the entire power delivery network (PDN) helps them determine critical constellations.

The R&S®ZNX series of vector network analyzers offers:

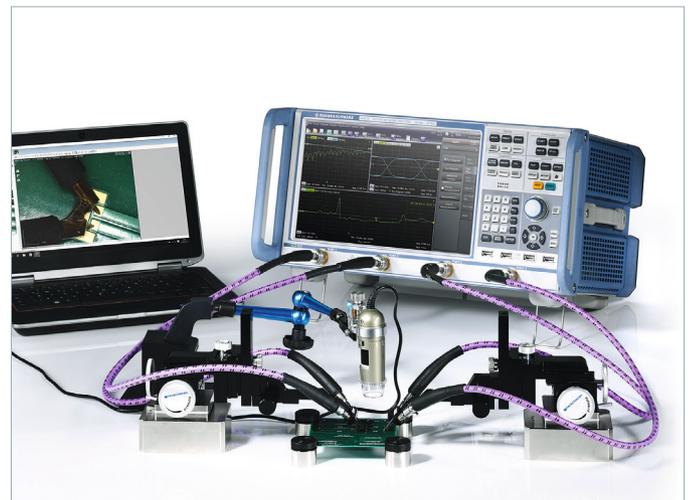
- Accurate and fast measurements
- Easy-to-use user interface and calibration routines

With state-of-the-art Rohde&Schwarz VNAs, engineers have a powerful tool to quickly and easily create impedance plots of their PDN and optimize their design to meet the given target impedance.

Power integrity measurement.



PDN impedance measurement.



Signal integrity

Signal integrity (SI) is becoming increasingly important due to higher data rates and space-optimized embedded designs. The transition from parallel to serial bus interfaces has increased data rates, with 5 Gbps to 10 Gbps being common in many designs. Such complex designs are a challenge for today's electronic engineers – and may require a significant amount of time for debugging.

The race towards higher bit rates and shorter bit periods continues, resulting in the following challenges when designing PCB signal paths, including vias and connectors:

- ▮ Reflections at impedance changes
- ▮ Noise from crosstalk
- ▮ Skin effects

At frequencies above 1 Gbps, PCB traces act as transmission lines. This calls for sophisticated measurements and verification methods. One common measurement instrument for signal path evaluation is the vector network analyzer. The R&S®ZNB delivers market-leading performance and also features advanced SI capabilities such as:

- ▮ Advanced time domain analysis and eye diagram analysis
- ▮ Fast embedding/deembedding for impedance matching
- ▮ Fast and easy calibration

Higher bit rates and processing speeds create further challenges for reference oscillator and clock signals. To test and verify these signals, particular measurements are becoming increasingly important, for instance:

- ▮ Precise phase noise measurements for VCOs and crystal oscillators
- ▮ Accurate jitter analysis on clock signals and PLLs

When it comes to highly sensitive measurements in the femto second range, the R&S®FSWP phase noise analyzer is the perfect choice for these test and verification requirements.

The R&S®FSWP provides:

- ▮ Market-leading phase noise and jitter performance sensitivity with cross-correlation
- ▮ Special feature for characterizing random and periodic jitter
- ▮ Extremely low-noise internal DC sources to supply and control VCOs and other components
- ▮ Simple and fast measurement

Modern oscilloscopes offer the most generic approach for SI measurements. They are easy to use and commonly known by electronic designers. The R&S®RTO oscilloscope series from Rohde&Schwarz offers a unique set of benefits:

- ▮ Excellent signal fidelity with up to 16-bit vertical resolution
- ▮ Powerful jitter analysis including simple setup via a jitter wizard
- ▮ Precise trigger functions and fastest acquisition rate of 1 million waveforms/s
- ▮ Superior spectrum analysis (FTT) for in-depth debugging

Verification of high-speed differential signal lines.



Phase noise measurement.



Electromagnetic compatibility analysis

Meeting EMC requirements is critical for bringing electronic products to market. Failures found late in the cycle impact project costs and the launch schedule.

It is therefore crucial to think about EMC as early as possible. This means that EMC analysis has to be done at the PCB or IC level.

Most electronic design engineers are aware of this and look for instrumentation that helps them quickly and reliably verify EMC behavior during all design stages.

Rohde&Schwarz addresses this need and offers specialized products and accessories for all levels of electromagnetic interference (EMI) analysis during the design cycle. Solutions for EMI debugging include:

- Market-leading spectrum analyzers in the mid-range and low-end, such as the R&S®FSL, R&S®FPH and R&S®FPC1000
- Advanced oscilloscopes with superior FFT implementation, such as the R&S®RTO and R&S®RTE

EMI precompliance solutions include:

- EMI test receivers designed for precompliance testing, such as the R&S®ESL and R&S®ESRP
- Market-leading spectrum analyzers in the high-end and mid-range, such as the R&S®FSW and R&S®FSV

In addition, Rohde&Schwarz offers complete, turnkey compliance solutions for EMI testing.

EMI debugging using oscilloscope.



The second important part of EMC testing is susceptibility. There are many different electromagnetic phenomena that a product could be exposed to, e.g. continuous RF signals such as transmissions from a nearby transmitter, transitory disturbances such as the noise introduced onto the mains due device switching, or pulse-shaped disturbance resulting from an electrostatic discharge.

The different, possible disturbance signals and propagation paths mean different testing requirements and procedures. Testing radiated and conducted EMS, ESD and direct power injection are the most common.

Our reliable and powerful solutions enable everyone to generate the required signals to prove the immunity of their electronic design under defined circumstances.

Solutions for EMS debugging include:

- R&S®SMx low phase noise signal sources
- Reliable and highly efficient R&S®BBA150 broadband amplifier
- Fast and accurate R&S®NRPxx power meters

Rohde&Schwarz also offers complete, turnkey compliance solutions for EMS testing.

EMI debugging using testreceiver.



Service that adds value

- | Worldwide
- | Local und personalized
- | Customized and flexibel
- | 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.

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

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