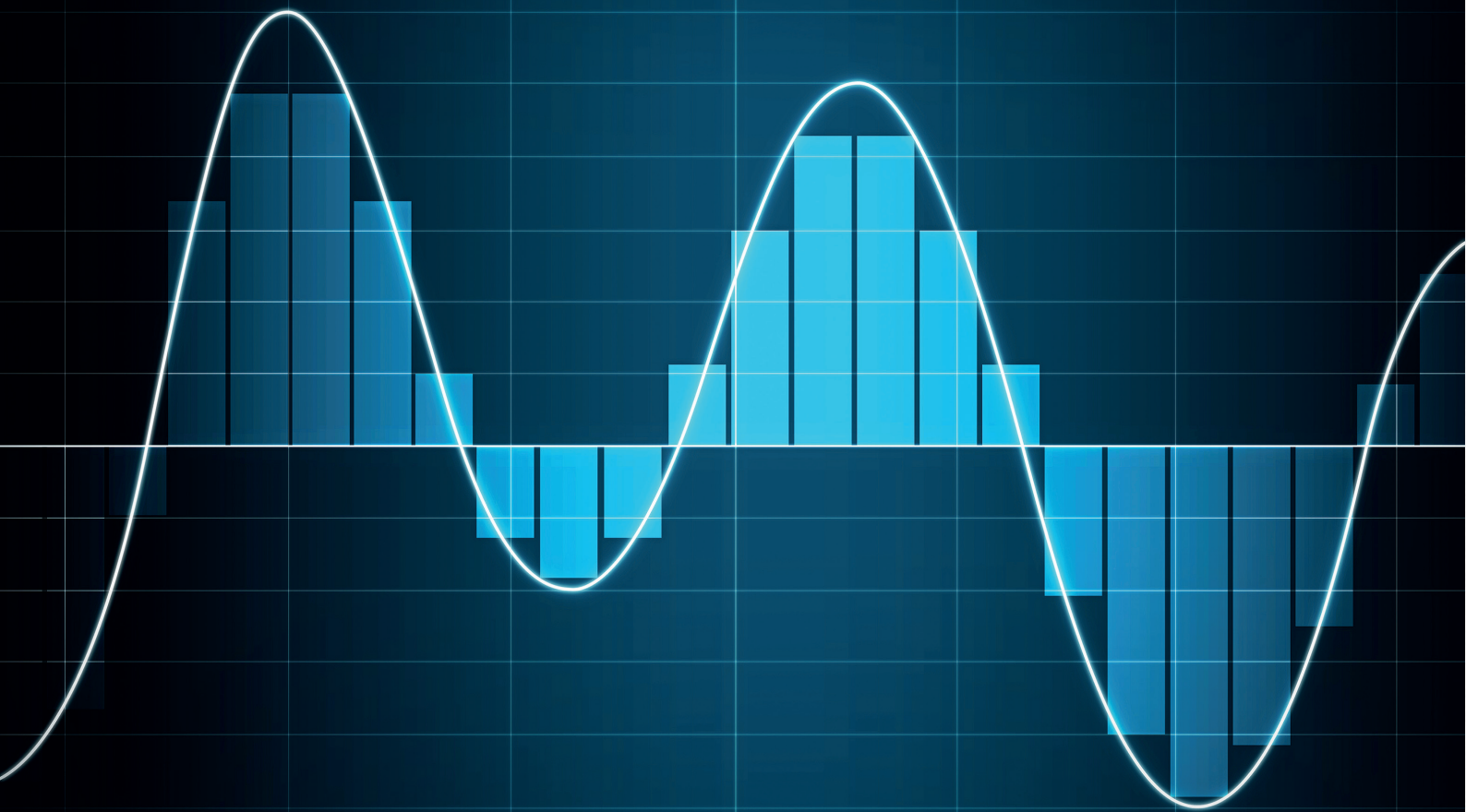
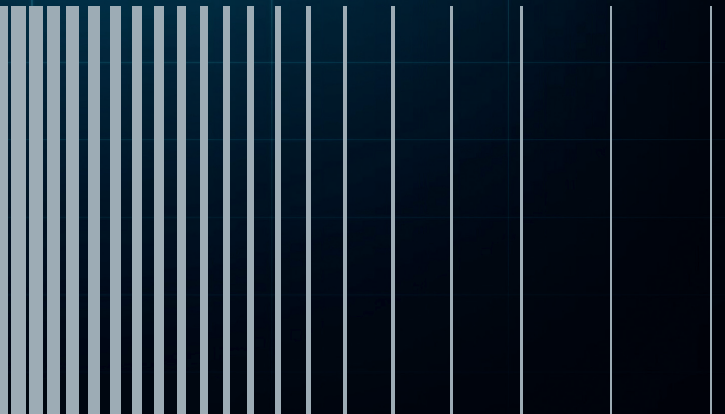


Unveil the maximum
performance of your
data converter design



ROHDE & SCHWARZ



Your challenge...

With a wide range of applications in communications, automotive and many other industrial fields, data converters are an essential part of all cutting-edge electronic and RF designs. New generations of high-speed data converters address the need for growing bandwidths and data rates and put increasing demands on clock speed and digital processing power. Moreover, aspects such as low power consumption and heat dissipation present additional challenges during the development and verification of electronic and RF designs.

A stable clock signal, for instance, is a prerequisite for proper operation and performance of the data converter. Problems in jitter or spectral purity of the clock directly translate into a degradation of the data converter's performance. Power integrity is another key aspect in all data converters, since it has a direct impact on the performance of the clock and the converters themselves.

Power integrity

Power integrity issues such as noise, ripple and crosstalk have a strong impact on the performance of your data converters.

Rohde & Schwarz oscilloscopes and power rail probes efficiently detect and solve power integrity problems in your data converter designs:

- High sensitivity for measuring small signals and small interference
- Power rail probes with high offset range to increase resolution on ripples, noise and interference
- Powerful FFT and multidomain functionality to analyze signals

With data converters at the heart of almost every electronic design, this flyer focuses on the main measurement challenges in this field. It also provides an overview of the industry-leading test and measurement solutions from Rohde & Schwarz for development, characterization and production.

More information at

www.rohde-schwarz.com/data-converter

Clock substitution

Proper clock performance is essential in data converter designs. Rohde & Schwarz signal generators can be used as high-quality clock replacements:

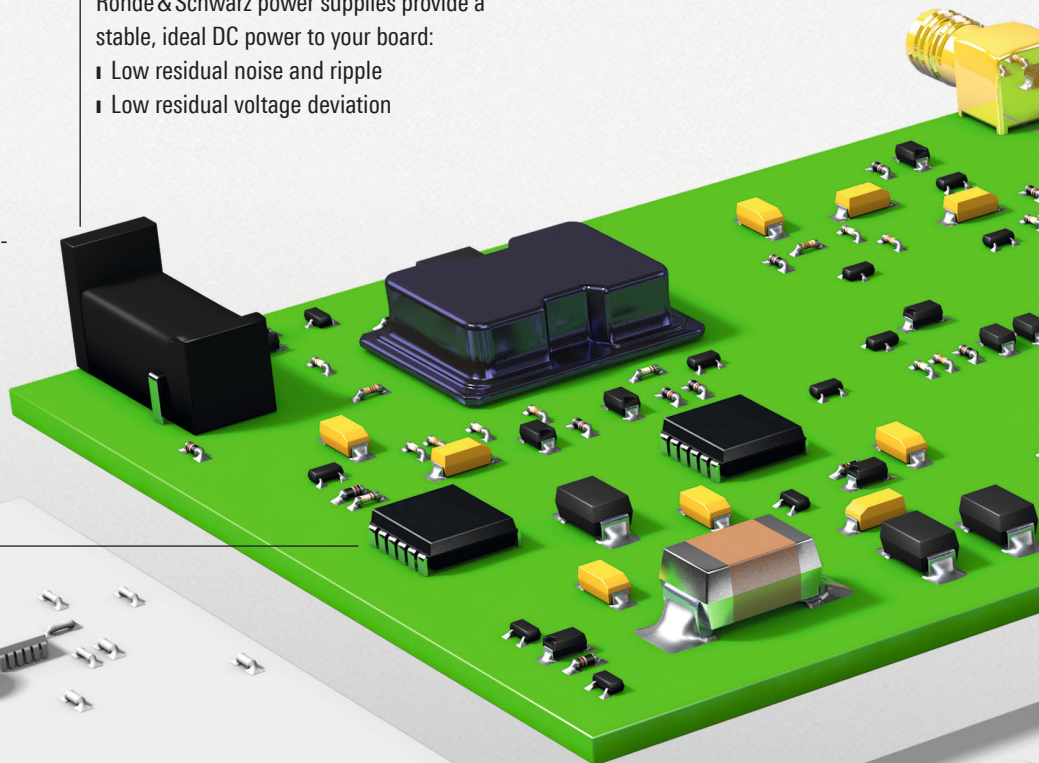
- Outstanding close-in and wideband phase noise performance to ensure superior low jitter
- High spectral purity to unveil the optimal performance of the DUT
- High output power to compensate cable losses

Power delivery

To ensure proper system performance, data converters and clocks need to be powered with clean supply voltages. Low-dropout (LDO) regulators are often used to improve supply voltage stability in today's data converter designs.

Rohde & Schwarz power supplies provide a stable, ideal DC power to your board:

- Low residual noise and ripple
- Low residual voltage deviation



Clock verification

Clock jitter and spectral purity have a direct impact on the dynamic range of the converter. Rohde & Schwarz phase noise analyzers verify phase noise and spectrum performance of your clock:

- High-sensitivity phase noise measurements to determine the true clock characteristics in a short measurement time
- Internal source for measuring additive phase noise
- Built-in spectrum and signal analyzer

Performance characterization

Data converters are core components in many electronic and RF designs. Their performance parameters, such as effective number of bits (ENOB), signal-to-noise ratio (SNR), spurious-free dynamic range (SFDR), linearity and latency, have a direct impact on overall system performance.

Rohde & Schwarz spectrum and signal analyzers verify the signal quality at the output of the digital-to-analog converter:

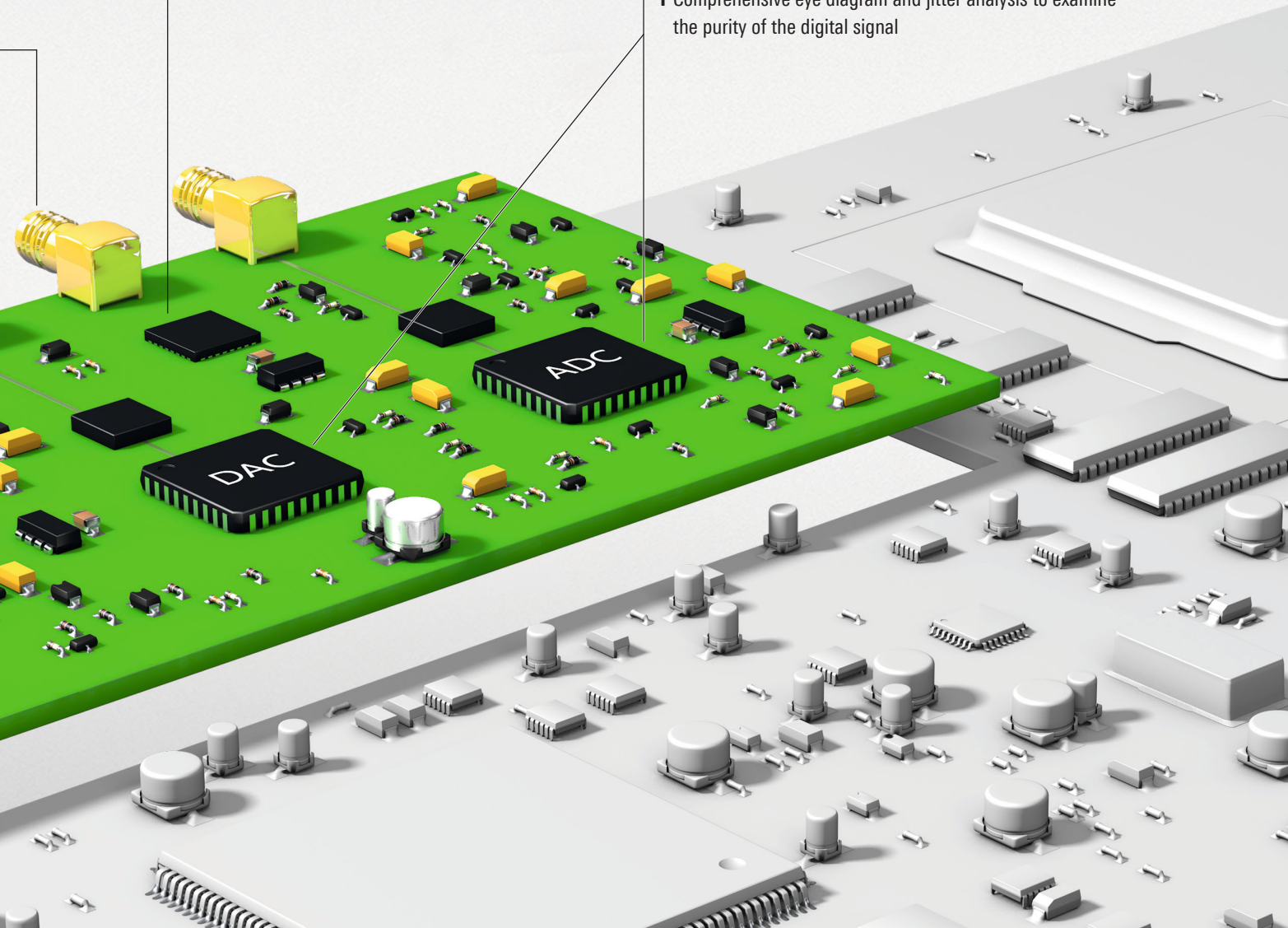
- Excellent spectral purity to catch even the slightest effects
- Outstanding bandwidth and error vector magnitude (EVM) performance for testing signals with digital modulation

Rohde & Schwarz signal generators stimulate the input of the analog-to-digital converter with ideal signals:

- Excellent phase noise and spectral purity to see the DUT in its best light
- Outstanding bandwidth and EVM performance to provide any signal with digital modulation

Rohde & Schwarz oscilloscopes analyze the LVDS, JESD204 input/output of the data converter:

- Digital trigger for maximum trigger accuracy
- Fast trigger and decode functionality for accurate timing measurements
- Comprehensive eye diagram and jitter analysis to examine the purity of the digital signal



Introduction

With over 80 years of experience in the field of test and measurement, Rohde&Schwarz offers a large portfolio of solutions for electronic and RF design. The company has more than 70 subsidiaries and representatives around the world, providing local support and service worldwide.

Our wide range of test instruments and solutions such as oscilloscopes, spectrum analyzers, signal generators, vector network analyzers and power supplies are the result of our technological passion and high-quality engineering in development and production. Along with strong customer commitment, this is our inspiration and motivation for industry-leading solutions and expertise in digital, analog and RF design.

Market leader expertise, cutting-edge instruments, full-scale solutions, reliable support and service: with Rohde&Schwarz you have a long-term partner at your side to help you tackle all aspects of electronic design challenges, from development to production. This brochure provides an overview of our test and measurement solutions for:

- Power delivery and power integrity
- Clock substitution and clock verification
- Data converter performance tests



Power delivery and power integrity

Power delivery

The R&S®HMP series of high-performance power supplies delivers clean, stable and precise DC power to your data converters:

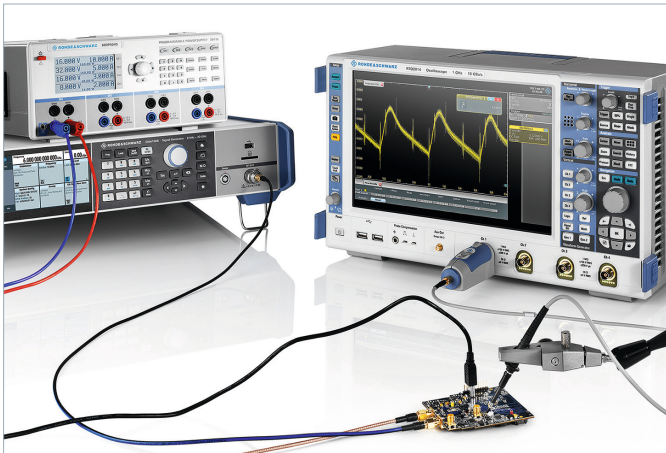
- Available with two, three or four galvanically isolated channels
- High setting and measurement accuracy
- Low residual deviation after load and voltage change
- Low residual noise and ripple
- EasyArb function for programmable voltage/current/time profiles
- Remote control available via USB, Ethernet, IEEE-488 (GPIB) and RS-232

Power integrity

The R&S®RTO and R&S®RTE oscilloscope families from Rohde&Schwarz are the ideal tools for measuring the power integrity of your data converters. The dedicated R&S®RT-ZPR20 power rail probe offers 2 GHz of bandwidth and an excellent sensitivity with a 1:1 attenuation ratio. It includes a highly accurate, integrated DC voltmeter to accurately measure DC voltage. With a wide offset range, the probe removes this DC voltage and supports high-sensitivity measurements of noise, ripple, load step response and crosstalk on the power rails:

- Dedicated 1:1 power rail probes with 2.0 GHz of bandwidth, integrated voltmeter and ± 60 V offset range
- High scalability in channel count and bandwidth
 - R&S®RTO: up to 6 GHz, four channels
 - R&S®RTE: up to 2 GHz, four channels
- High frontend sensitivity for measuring small signals
- Powerful FFT and multidomain functionality to analyze signals in time and frequency domain
- High acquisition rate of up to 1,000,000 waveforms/s for quick worst-case analysis and detection of sporadic signals
- HD mode to further increase the resolution up to 16 bit

Power integrity measurement setup with power rail probe and oscilloscope.



Comprehensive screen on the oscilloscope zooming into a longer period of recording.



Clock substitution and clock verification

Clock substitution

Testing state-of-the-art data converters is a challenging task. With increasing bandwidths, clock rates go up to 10 GHz and beyond, while high resolution and wide spurious-free dynamic range must not be compromised. Since clock jitter and spectral purity have a direct impact on data converter performance, clock sources play a pivotal role in these designs. With frequency models going up to 20 GHz, the new R&S®SMA100B sets new standards in jitter and phase noise performance, spectral purity and output power. The R&S®SMA100B ensures that you get the best performance from the data converters you design today and in the future.

With the R&S®SMA100B and R&S®SMB100A, Rohde&Schwarz offers clock substitution in different performance ranges:

- R&S®SMA100B: best jitter / phase noise performance up to 20 GHz for high-end converters, multiple options for different performance levels
- Optional secondary output available as clock source in the R&S®SMA100B (R&S®SMAB-B29)
- R&S®SMB100A: optimized price/performance ratio up to 40 GHz
- Excellent performance down to very low clock frequencies
- High output power to compensate losses in the setup
- Wear-free all-electronic attenuator up to 20 GHz in the R&S®SMA100B

Clock verification

Particularly in high-end data converters, high-quality clock sources are required to ensure optimum converter performance. Thanks to the superior sensitivity, clock phase noise and clock jitter are typically measured in the frequency domain. In addition, measurement in the frequency domain makes it easy to separate random jitter from periodic jitter, which can be easily determined by the spur level. Convenient adaptation of integration ranges and weighting filters makes the R&S®FSWP phase noise analyzer and VCO tester from Rohde&Schwarz an even more powerful tool for characterizing jitter with the highest possible sensitivity. It is the industry-leading solution for phase noise and jitter measurements on high-quality clock signals.

Together with the R&S®FSW, R&S®FSVA, R&S®FSV and R&S®FPS spectrum analyzers and their available phase noise measurement capabilities, Rohde&Schwarz offers a large solution portfolio for clock verification in all performance ranges:

- Market-leading phase noise and jitter performance sensitivity with cross-correlation
- Very fast phase noise measurements
- Special feature for characterizing random and periodic jitter
- Simultaneous measurement of amplitude noise and phase noise

Clock replacement with external signal generator and clock verification on onboard signal with phase noise analyzer.



Performance characterization

Analyzing the output of a digital-to-analog converter (DAC)

Rohde & Schwarz offers a wide range of signal and spectrum analyzers for testing DACs. All analyzers, from basic value and handheld models to benchtop instruments up to 85 GHz, set standards in accuracy, RF performance and usability. Performance-oriented, cost-conscious users will find the optimum solution during development, production, installation and servicing of RF systems. All analyzers are equipped as standard with internal functions to measure typical parameters such as ACLR, IP3 and spurious emissions. Depending on the performance needed, the different models (e.g. R&S®FPS, R&S®FSV, R&S®FSVA, R&S®FSW) offer different dynamic ranges up to 200 dB for these measurements from a displayed average noise level of around -170 dBm/Hz to the maximum input level of 30 dBm.

Today's high-speed DACs are used more and more as a synthesizer replacement to directly generate the target RF frequency or an IF signal. To ensure best phase noise performance, it can be characterized using the spectrum analyzer's integrated application or, for more demanding performance ranges, the R&S®FSWP dedicated phase noise tester:

- Wide range of spectrum and signal analyzers to meet the exact need in every application
- Best performance in each class in accuracy, RF performance and usability

Testing the signal quality of a direct RF signal generated by the DAC.



Feeding the input of an analog-to-digital converter (ADC)

Testing ADCs requires two RF sources, one for the clock and one for the analog input signal. While the clock driver should be an ideal low-jitter analog source, the input for the ADC may become more complex. Common test signals are single continuous wave tones and two continuous wave tones for intermodulation tests on the RF input circuitry. For high-end converters, the R&S®SMA100B is the right solution for clock and analog RF signals. The R&S®SMB100A family complements the portfolio for more cost-sensitive applications.

To make sure the ADC works for the target application, real-world signals such as wideband 5G signals also need to be applied. The R&S SMW200A provides clean modulated signals with low error vector magnitude to show the true performance of the ADC:

- R&S®SMA100B for super-clean analog input signal into the ADC to determine true performance
- General-purpose R&S®SMBV100A, or high-end R&S®SMW200A for modulated inputs with up to 2 GHz bandwidth

Feeding a digital signal into the analog input of an ADC beside the clock signal to test its analog input.



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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Maximize the performance of your data converters

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