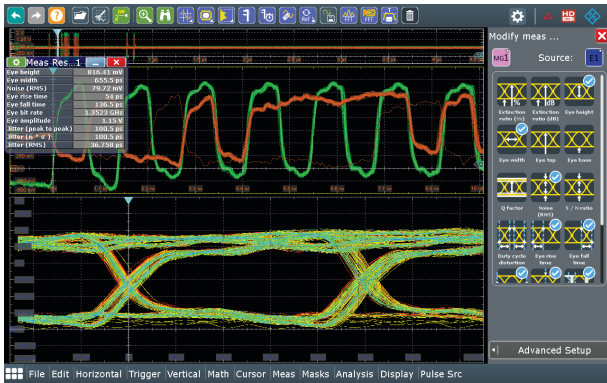# Applications

Signal integrity

The R&S®RTP oscilloscopes offer various analysis and measurement tools for analyzing the signal integrity of high-speed serial buses.

❚ Compliance test solutions for USB, Ethernet, PCIe, MIPI, DDR
❚ Trigger and decode solutions for various standards
❚ Extensive set of automated measurements including eye measurements

Signal Integrity debugging on DDR3 interface.

Wideband and multi-channel RF signal analysis

The R&S®RTP oscilloscopes enable users to perform precise wideband and multi-channel RF measurements. To analyze digitally modulated and pulsed radar signals, the oscilloscope's functionally can extended with the R&S®VSE software. To analyze proprietary signals with customized algorithm and maximum flexibility, the R&S®RTPs oscilloscopes can work with external analysis tools such as MATLAB®.


R&S®VSE vector signal explorer software.

High performance, benchtop versatility.

Power analysis

Analysis tools help developers verify and debug current and voltage supply circuits. The R&S®RTx-K31 power analysis option facilitates analysis of the turn on/off behavior, the circuit's internal transfer function, the safe operating area (SOA), the output signal quality and any loss. To measure voltage and current signals, users can choose from a wide selection of Rohde & Schwarz voltage probes ranging from µV to kV and current probes from mA to A.
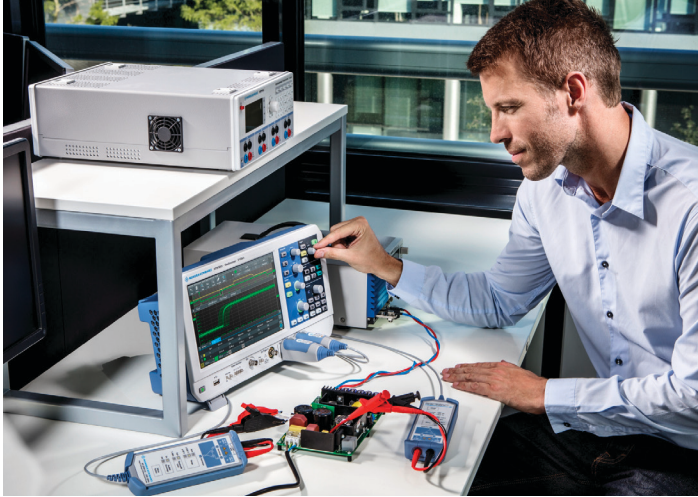
Measurement functions of the R&S®RTx-K31 option	
Measurement	**Measurement functions**
Current harmonics	▪ EN 61000-3-2 class A, B, C, D ▪ MIL-STD-1399 ▪ RTCA DO-160
Input	▪ inrush current ▪ power quality ▪ power consumption
Power converter control	▪ modulation analysis ▪ slew rate ▪ dynamic on-resistance
Power path	▪ safe operating area (SOA mask editor) ▪ turn on/off ▪ switching loss ▪ power efficiency
Output	▪ output ripple ▪ transient response ▪ output spectrum

Get in touch with the power of ten.
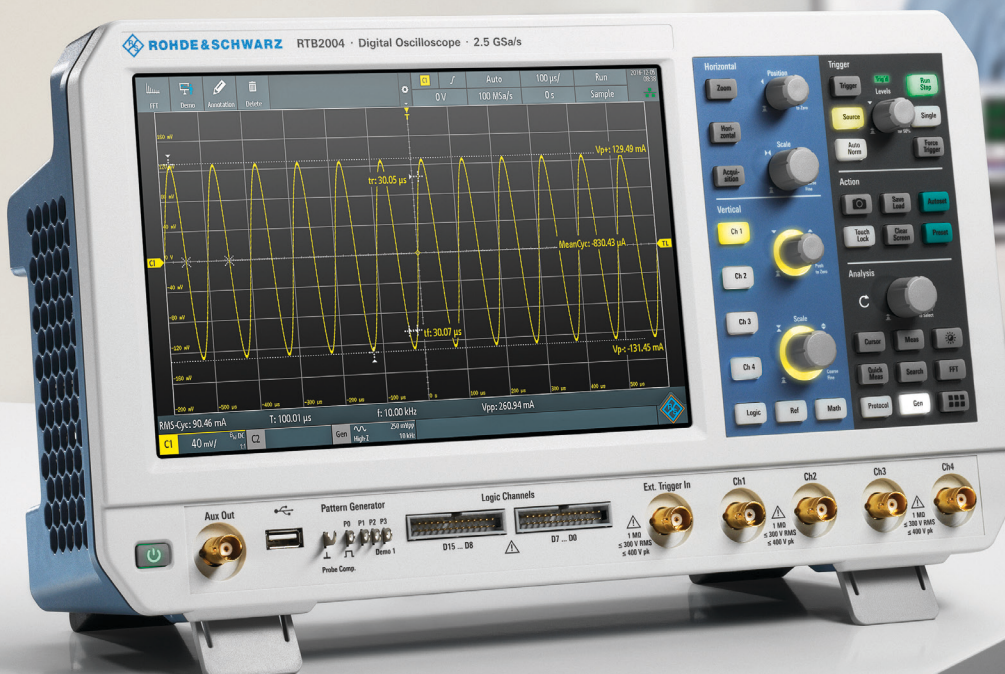
Analysis

We continually enhance our oscilloscope portfolio,
adding new models, applications and accessories to
ensure high-quality analysis.

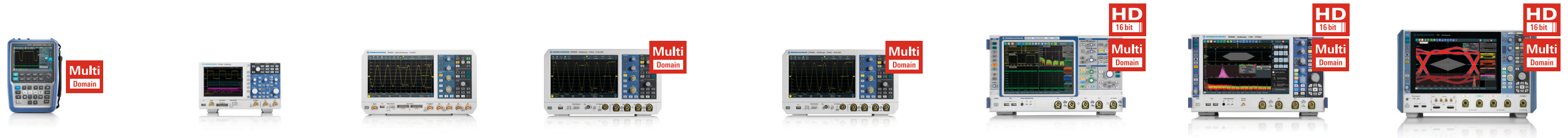| R&S® family	Measure	Math	Mask test	Serial protocol triggering and decoding[1]	Display functions	Applications[1]	Generator[1]	Compliance tests[1]
RTH1000	cursor, parameter	elementary	elementary (tolerance mask around signal)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, CAN-FD, SENT (6)	data logger	high-resolution frequency counter, advanced spectrum analysis, harmonics analysis		–
RTC1000	cursor, parameter	elementary	elementary (tolerance mask around signal)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN (4)	–	–	1-channel function, 4-bit pattern [1][2]	–
RTB2000	cursor, parameter incl. statistics	elementary	elementary (tolerance mask around signal)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN (4)	–	digital voltmeter (DVM)	1-channel function, 1-channel arbitrary, 4-bit pattern [1][2]	–
RTM3000	cursor, parameter incl. statistics	basic (math on math)	elementary (tolerance mask around signal)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429 (7)	–	power, digital voltmeter (DVM), spectrum analysis and spectrogram	1-channel function, 1-channel arbitrary, 4-bit pattern [1][2]	–
RTA4000	cursor, parameter incl. statistics	basic (math on math)	elementary (tolerance mask around signal)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429 (7)	–	power, digital voltmeter (DVM), spectrum analysis and spectrogram	1-channel function, 1-channel arbitrary, 4-bit pattern [1][2]	–
RTE1000	cursor, parameter incl. statistics	advanced (formula editor)	advanced (freely configurable, hardware-based)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, USB 2.0/HSIC, Ethernet, Manchester, NRZ, SENT, SpaceWire, CXPI, USB Power Delivery, automotive Ethernet 100BASE-T1 (18)	histogram, trend, track [2]	power, 16-bit high definition mode (standard), advanced spectrum analysis and spectrogram	2-channel function, 2-channel arbitrary, 8-bit pattern [1][2]	–
RTO2000	cursor, parameter incl. statistics	advanced (formula editor)	advanced (user-configurable, hardware-based)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b 10b, Ethernet, Manchester, NRZ, SENT, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, CXPI, USB 3.1 Gen1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, automotive Ethernet 100BASE-T1 (26)	histogram, trend, track [2]	power, 16-bit high definition mode, advanced spectrum analysis and spectrogram, jitter, clock data recovery, I/Q data, RF analysis	2-channel function, 2-channel arbitrary, 8-bit pattern [1][2]	various options available, for details see data sheet (PD 3607.2684.22)
RTP	cursor, parameter incl. statistics	advanced (formula editor)	advanced (user-configurable, hardware-based)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, CAN-FD, MIPI RFFE, USB 2.0/ HSIC, MDIO, 8b 10b, Ethernet, Manchester, NRZ, MIPI D-PHY, MIPI M-PHY/UniPro, USB 3.1 Gen1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery	histogram, trend, track [2]	16-bit high definition mode, advanced spectrum analysis and spectrogram, jitter, RF analysis, real-time deembedding		various options available, for details see data sheet (PD 5215.4152.22)

[1] Upgradeable.   [2] Requires an option

Oscilloscope portfolio

Excellent signal fidelity, high acquisition rates, an innovative trigger system and a smart user interface – that's what you get with a Rohde & Schwarz oscilloscope.

Choose from a wide range of oscilloscopes, from high-volume oscilloscopes for service, maintenance and education to top-class instruments for R&D and EMI debugging in the 600 MHz to 6 GHz range. Benefit from the high product quality and in-depth development and production expertise offered by Rohde & Schwarz.

R&S® family	RTH1000	RTC1000	RTB2000	RTM3000	RTA4000	RTE1000	RTO2000	RTP
Vertical								
Bandwidth	60/100/200/350/500 MHz [1]	50/70/100/200/300 MHz [1]	70/100//200/300 MHz [1]	100/200/350/500 MHz/1 GHz [1]	200/350/500 MHz/1 GHz [1]	200/350/500 MHz/1/1.5/2 GHz [1]	600 MHz/1/2/3/4/6 GHz [1]	4/6/8 GHz
Number of channels	2 plus DMM/4	2	2/4	2/4	4	2/4	2/4 (only 4 channels in 4 GHz and 6 GHz model)	4
V/div 1 MΩ	2 mV to 100 V	1 mV to 10 V	1 mV to 5 V	500 µV to 10 V	500 µV to 10 V	500 µV to 10 V	1 mV to 10 V (500 µV to 10 V) [2]	
V/div 50 Ω	–			500 µV to 1 V	500 µV to 1 V	500 µV to 5 V	1 mV to 1 V (500 µV to 1 V) [2]	1 mV to 1 V
Horizontal								
Sampling rate per channel (in Gsample/s)	1.25 (4-channel model); 2.5 (2-channel model); 5 (all channels interleaved)	1; 2 (2 channels interleaved)	1.25; 2.5 (2 channels interleaved)	2.5; 5 (2 channels interleaved)	2.5; 5 (2 channels interleaved)	5	10; 20 (2 channels interleaved in 4 GHz and 6 GHz model)	20
Max. memory (per channel/1 channel active)	125 ksample (4-channel model); 250 ksample (2-channel model); 500 ksample (50 Msample in segmented memory mode [2])	1 Msample; 2 Msample	10 Msample; 20 Msample (160 Msample in segmented memory mode [2])	40 Msample; 80 Msample (400 Msample in segmented memory mode [2])	100 Msample; 200 Msample (1 Gsample in segmented memory mode)	50 Msample/200 Msample	standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample	standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample
Segmented memory	option	–	option	option	standard	standard	standard	standard
Acquisition rate (in waveforms/s)	50 000	10 000	50 000 (300 000 in fast segmented memory mode [2])	64 000 (700 000 in fast segmented memory mode [2])	64 000 (700 000 in fast segmented memory mode)	1 000 000 (2 000 000 in ultra-segmented memory mode)	1 000 000 (3 000 000 in ultra-segmented memory mode)	950 000 (3 000 000 in ultra-segmented memory mode)
Trigger								
Options	advanced, digital trigger (14 trigger types) [2],	elementary (5 trigger types)	basic (6 trigger types)	basic (7 trigger types)	basic (7 trigger types)	advanced, digital trigger (13 trigger types)	advanced (includes zone trigger), digital trigger (14 trigger types) [2]	advanced, digital trigger (14 trigger types) with realtime deembedding [2], zone trigger [2]
Mixed signal option								
No. of digital channels [1]	8	8	16	16	16	16	16	16
Sampling rate of digital channels (in Gsample/s)	1.25	1	1.25	two logic probes: 2.5 on each channel; one logic probe: 5 on each channel	two logic probes: 2.5 on each channel; one logic probe: 5 on each channel	5	5	5
Memory of digital channels	125 ksample	1 Msample	10 Msample	40 Msample	100 Msample	100 Msample	200 Msample	200 Msample
Display and operation								
Size and resolution	7", color, 800 × 480 pixel	6.5", color, 640 × 480 pixel	10.1", color, 1280 × 800 pixel	10.1", color, 1280 × 800 pixel	10.1", color, 1280 × 800 pixel	10.4", color, 1024 × 768 pixel	12.1", color, 1280 × 800 pixel	12.1", color, 1280 × 800 pixel
Operation	optimized for touchscreen operation, parallel button operation	optimized for fast button operation	optimized for touchscreen operation, parallel button operation		optimized for touchscreen operation, parallel button operation			
General data								
Size in mm (W × H × D)	201 × 293 × 74	285 × 175 × 140	390 × 220 × 152	390 × 220 × 152	390 × 220 × 152	427 × 249 × 204	427 × 249 × 204	440 × 270 × 310
Weight in kg	2.4	1.7	2.5	3.3	3.3	8.6	9.6	18
Battery	lithium-ion, > 4 h	–	–	–	–	–	–	–

[1] Upgradeable.   [2] Requires an option.

Probe portfolio

Model	Type	Bandwidth	Dynamic range
R&S®RT-ZP10	passive, single-ended, 10:1	500 MHz	400 V (RMS)
R&S®RT-ZH10	passive, single-ended, 100:1	400 MHz	1 kV (RMS)
R&S®RT-ZH11	passive, single-ended, 1000:1	400 MHz	1 kV (RMS)
R&S®RT-ZI10	passive, single-ended, 10:1, isolated	500 MHz	600 V CAT IV / 1000 V CAT III
R&S®RZ-ZI10C	passive, single-ended, 10:1, isolated, compact	500 MHz	300 V CAT III
R&S®RT-ZI11	passive, single-ended, 100:1, isolated	500 MHz	600 V CAT IV / 1000 V CAT III / 3540 V CAT 0
R&S®RT-ZZ80	passive, single-ended, 10:1, broadband	8 GHz	20 V (RMS)
R&S®RT-ZP1X	passive, single-ended, 1:1	38 MHz	55 V (RMS)
R&S®RT-ZPR20/40	active, single-ended, 1:1 [1]	2/4 GHz	±850 mV
R&S®RT-ZS10L	active, single-ended, 10:1	1 GHz	±8 V
R&S®RT-ZS10E	active, single-ended, 10:1 [1]	1 GHz	±8 V
R&S®RT-ZS10/20/30/60	active, single-ended, 10:1 [1,2]	1/1.5/3/6 GHz	±8 V
R&S®RT-ZD01	active, differential, 100:1/1000:1	100 MHz	±140 V (100:1), ±1400 V (1000:1)
R&S®RT-ZD002	active, differential, 10:1/100:1	25 MHz	±700 V
R&S®RT-ZD003	active, differential, 20:1/200:1	25 MHz	±1400 V
R&S®RT-ZD02	active, differential, 10:1	200 MHz	±20 V
R&S®RT-ZD08	active, differential, 10:1	800 MHz	±15 V
R&S®RT-ZD10/20/30	active, differential, 10:1 [1,2]	1/1.5/3 GHz	±5 V, with R&S®RT-ZA15: ±70 V DC / ±46 V AC (peak)
R&S®RT-ZD40	active, differential, 10:1 [1,2]	4.5 GHz	±5 V
R&S®RT-ZM15/30/60/90	active, multimode amplifier module, 10:1 / 2:1 [1,2]	1.5/3/6/9 GHz	depends on tip module used
R&S®RT-ZMA10	solder-in [3]	[4]	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZMA12	square-pin [3]	[4], max. 6 GHz	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZMA15	quick-connect [3]	[4]	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZMA30	browser [3]	[4]	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZMA40	SMA [3]	[4], max. 6 GHz	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZMA50	extreme temperature solder-in [3]	[4], max. 2.5 GHz	±2.5 V (10:1), ±0.5 V (1:1)
R&S®RT-ZHD07	active, differential, 25:1/250:1 [1,2]	200 MHz	±750 V (peak)
R&S®RT-ZHD15/16	active, differential, 50:1/500:1 [1,2]	100/200 MHz	±1500 V (peak)
R&S®RT-ZHD60	active, differential, 100:1/1000:1 [1,2]	100 MHz	±6000 V (peak)
R&S®RT-ZC02	AC/DC current probe	20 kHz	100 A (RMS) / 1000 A (RMS), 0.01 V/A / 0.001 V/A switchable
R&S®RT-ZC03	AC/DC current probe	100 kHz	20 A (RMS) / ±30 A (peak), 0.1 V/A
R&S®RT-ZC05B	AC/DC current probe [1]	2 MHz	500 A (RMS) / ±700 A (peak), 0.01 V/A
R&S®RT-ZC10/B	AC/DC current probe [1]	10 MHz	150 A (RMS) / ±300 A (peak), 0.01 V/A
R&S®RT-ZC15B	AC/DC current probe [1]	50 MHz	30 A (RMS) / ±50 A (peak), 0.1 V/A
R&S®RT-ZC20/B	AC/DC current probe [1]	100 MHz	30 A (RMS) / ±50 A (peak), 0.1 V/A
R&S®RT-ZC30	AC/DC high-sensitivity current probe	120 MHz	5 A (RMS) / ±7.5 A (peak), 1 V/A
R&S®HZ-14	active E and H near-field probe set [5]	9 kHz to 1 GHz	N/A
R&S®HZ-15	passive E and H near-field probe set	30 MHz to 3 GHz	N/A
R&S®HZ-17	compact H near-field probe set	30 MHz to 3 GHz	N/A

[1] Includes Rohde&Schwarz probe interface.

[2] Includes R&S®ProbeMeter and micro button for instrument control.

[3] Tip module for R&S®RT-ZMxx probes.

[4] Depends on amplifier module.

[5] Requires R&S®HZ-9 external power supply.

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