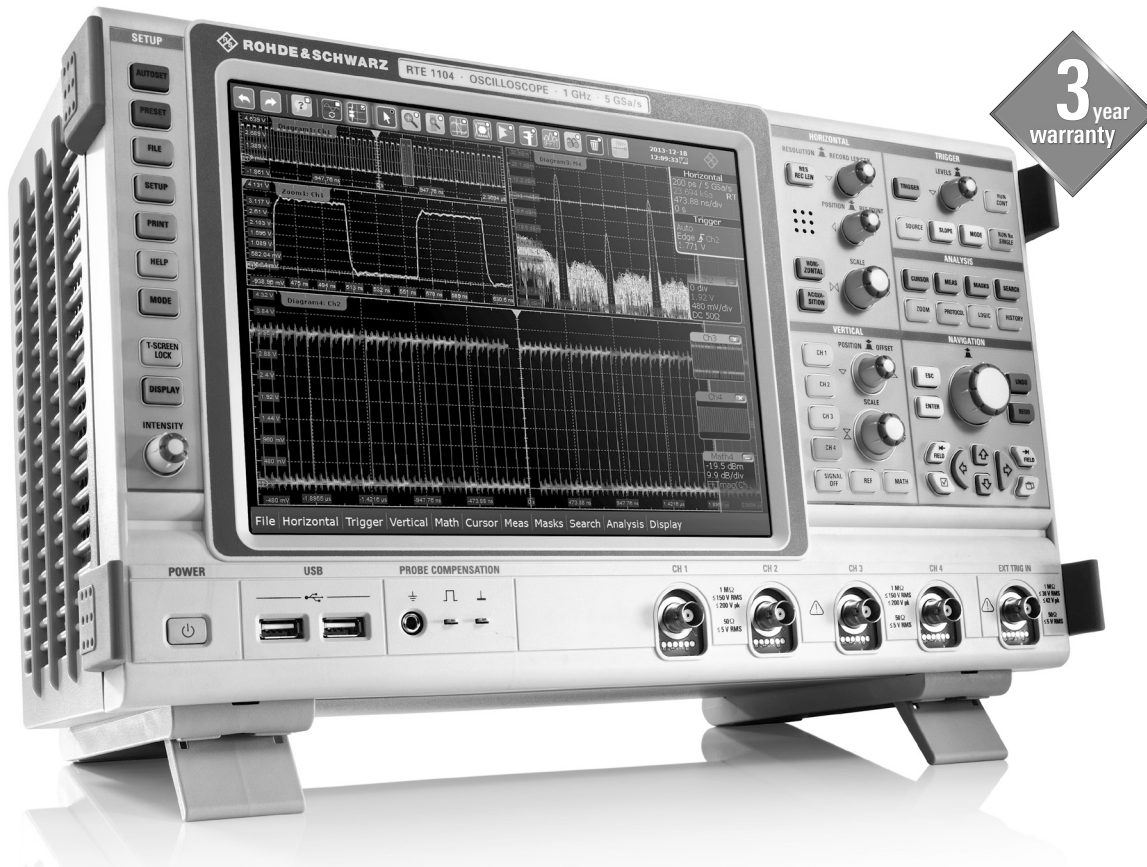


R&S® RTE

Digital Oscilloscope

Specifications



3 year warranty

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Definitions

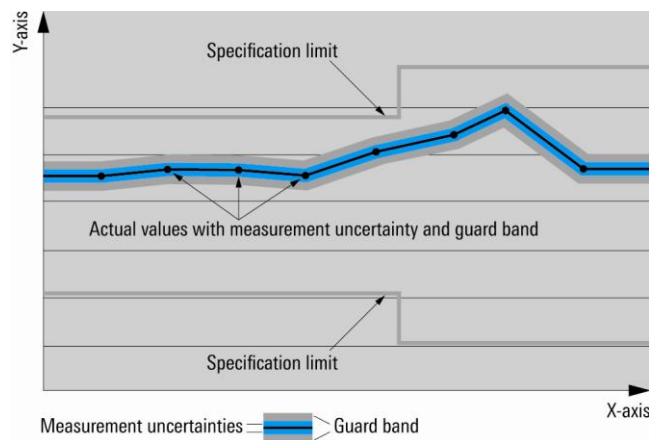
General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as $<$, \leq , $>$, \geq , \pm , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with $<$, $>$ or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: "parameter: value".

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

Base unit

Vertical system

| | | |
|---|---|--|
| Input channels | R&S®RTE1022 | 2 channels |
| | R&S®RTE1024 | 4 channels |
| | R&S®RTE1032 | 2 channels |
| | R&S®RTE1034 | 4 channels |
| | R&S®RTE1052 | 2 channels |
| | R&S®RTE1054 | 4 channels |
| | R&S®RTE1102 | 2 channels |
| | R&S®RTE1104 | 4 channels |
| | R&S®RTE1152 | 2 channels |
| | R&S®RTE1154 | 4 channels |
| | R&S®RTE1202 | 2 channels |
| | R&S®RTE1204 | 4 channels |
| Input impedance | | 50 Ω ± 1.5 % 1 MΩ ± 1 % 17 pF ± 1 pF (meas.) |
| Analog bandwidth (–3 dB) | at 50 Ω input impedance | |
| | R&S®RTE1022 and R&S®RTE1024 | ≥ 200 MHz |
| | R&S®RTE1032 and R&S®RTE1034 | ≥ 350 MHz |
| | R&S®RTE1052 and R&S®RTE1054 | ≥ 500 MHz |
| | R&S®RTE1102 and R&S®RTE1104 | ≥ 1 GHz |
| | R&S®RTE1152 and R&S®RTE1154 | ≥ 1.5 GHz |
| | R&S®RTE1202 and R&S®RTE1204 | ≥ 2 GHz |
| | at 1 MΩ input impedance | |
| | R&S®RTE1022 and R&S®RTE1024 | ≥ 200 MHz (meas.) |
| | R&S®RTE1032 and R&S®RTE1034 | ≥ 350 MHz (meas.) |
| R&S®RTE1052, R&S®RTE1054, R&S®RTE1102, R&S®RTE1104, R&S®RTE1152, R&S®RTE1154, R&S®RTE1202, and R&S®RTE1204 | ≥ 500 MHz (meas.) | |
| Analog bandwidth limits | max. –1.5 dB, min. –4 dB | 200 MHz, 20 MHz |
| Rise time/fall time | 10 % to 90 % at 50 Ω (calculated) | |
| | R&S®RTE1022 and R&S®RTE1024 | < 1.75 ns |
| | R&S®RTE1032 and R&S®RTE1034 | < 1 ns |
| | R&S®RTE1052 and R&S®RTE1054 | < 700 ps |
| | R&S®RTE1102 and R&S®RTE1104 | < 350 ps |
| | R&S®RTE1152 and R&S®RTE1154 | < 233 ps |
| | R&S®RTE1202 and R&S®RTE1204 | < 175 ps |
| Input VSWR | input frequency ≤ 500 MHz | 1.25 (meas.) |
| | input frequency > 500 MHz | 1.4 (meas.) |
| Vertical resolution | digitizer | 8 bit |
| | high definition mode | 16 bit (without reduction of the sampling rate ¹) |
| | high resolution decimation | 16 bit (with reduction of the sampling rate) |
| Effective number of bits of digitizer | for full-scale sine-wave signal with frequency equal to or lower than –3 dB bandwidth | > 7.0 bit (meas.) |
| DC gain accuracy | offset and position set to 0 V, after self-alignment | |
| | input sensitivity > 5 mV/div | ±1.5 % |
| | input sensitivity ≤ 5 mV/div | ±2 % |
| Input coupling | at 50 Ω | DC, GND |
| | at 1 MΩ | DC, AC (> 7 Hz), GND |
| Input sensitivity | at 50 Ω | 500 μV/div to 1 V/div, entire analog bandwidth supported for all input sensitivities |
| | at 1 MΩ | 500 μV/div to 10 V/div, entire analog bandwidth supported for all input sensitivities |

¹ The maximum realtime sampling rate of the high definition mode is 2.5 Gsample/s.

| | | | |
|--|---|--|---|
| Maximum input voltage | at 50 Ω | 5 V (RMS) | |
| | at 1 M Ω | 150 V (RMS), 200 V (V_p), derates at 20 dB/decade to 5 V (RMS) above 250 kHz | |
| Position range | | ± 5 div | |
| Offset range at 50 Ω | input sensitivity | | |
| | 200 mV/div to 1 V/div | ± 10 V | |
| | 50 mV/div to ≤ 200 mV/div | $\pm(4.9$ V – input sensitivity $\times 5$ div) | |
| | 500 μ V/div to ≤ 50 mV/div | $\pm(1.6$ V – input sensitivity $\times 5$ div) | |
| Offset range at 1 M Ω | input sensitivity | | |
| | 900 mV/div to 10 V/div | $\pm(129.5$ V – input sensitivity $\times 5$ div) | |
| | 80 mV/div to ≤ 900 mV/div | $\pm(12.4$ V – input sensitivity $\times 5$ div) | |
| | 500 μ V/div to ≤ 80 mV/div | $\pm(1.15$ V – input sensitivity $\times 5$ div) | |
| Offset accuracy | | $\pm(0.5\%$ \times net offset + 1 mV + 0.15 div \times input sensitivity) (net offset = offset – position \times input sensitivity) | |
| DC measurement accuracy | after adequate suppression of measurement noise using high-resolution sampling mode or waveform averaging or a combination of both | $\pm(\text{DC gain accuracy} \times$ reading – net offset + offset accuracy) | |
| Channel-to-channel isolation (each channel at same input sensitivity) | input frequency ≤ 1 GHz | > 50 dB | |
| | input frequency > 1 GHz | > 40 dB | |
| RMS noise floor at 50 Ω (typ.) | input sensitivity | R&S [®] RTE1022, R&S [®] RTE1024 | R&S [®] RTE1032, R&S [®] RTE1034 |
| | 500 μ V/div | 0.04 mV | 0.06 mV |
| | 1 mV/div | 0.04 mV | 0.06 mV |
| | 2 mV/div | 0.07 mV | 0.08 mV |
| | 5 mV/div | 0.13 mV | 0.15 mV |
| | 10 mV/div | 0.20 mV | 0.24 mV |
| | 20 mV/div | 0.30 mV | 0.40 mV |
| | 50 mV/div | 0.75 mV | 0.99 mV |
| | 100 mV/div | 1.46 mV | 1.97 mV |
| | 200 mV/div | 2.81 mV | 3.77 mV |
| | 500 mV/div | 7.84 mV | 10.4 mV |
| | 1 V/div | 13.4 mV | 17.9 mV |
| | input sensitivity | R&S [®] RTE1052, R&S [®] RTE1054 | R&S [®] RTE1102, R&S [®] RTE1104 |
| | 500 μ V/div | 0.08 mV | 0.10 mV |
| | 1 mV/div | 0.08 mV | 0.10 mV |
| | 2 mV/div | 0.10 mV | 0.13 mV |
| | 5 mV/div | 0.18 mV | 0.24 mV |
| | 10 mV/div | 0.27 mV | 0.34 mV |
| | 20 mV/div | 0.45 mV | 0.55 mV |
| | 50 mV/div | 1.13 mV | 1.39 mV |
| | 100 mV/div | 2.23 mV | 2.76 mV |
| | 200 mV/div | 4.31 mV | 5.34 mV |
| | 500 mV/div | 11.9 mV | 14.5 mV |
| | 1 V/div | 20.6 mV | 25.4 mV |
| | input sensitivity | R&S [®] RTE1152, R&S [®] RTE1154 | R&S [®] RTE1202, R&S [®] RTE1204 |
| | 500 μ V/div | 0.13 mV | 0.15 mV |
| | 1 mV/div | 0.13 mV | 0.15 mV |
| | 2 mV/div | 0.16 mV | 0.18 mV |
| | 5 mV/div | 0.27 mV | 0.30 mV |
| | 10 mV/div | 0.38 mV | 0.42 mV |
| | 20 mV/div | 0.60 mV | 0.66 mV |
| | 50 mV/div | 1.51 mV | 1.66 mV |
| | 100 mV/div | 3.01 mV | 3.25 mV |
| | 200 mV/div | 5.81 mV | 6.26 mV |
| 500 mV/div | 15.8 mV | 17.4 mV | |
| 1 V/div | 27.1 mV | 29.8 mV | |

Horizontal system

| | | |
|-------------------------|---|--|
| Timebase range | | selectable between 50 ps/div and 5000 s/div, time per div settable to any value within range |
| Channel deskew | | ±100 ns |
| Reference position | | 0 % to 100 % of measurement display area |
| Trigger offset range | max. | +(memory depth/current sampling rate) |
| | min. | -10 000 s |
| Modes | | normal, roll |
| Channel-to-channel skew | | < 100 ps (meas.) |
| Timebase accuracy | after delivery/calibration, at +23 °C | ±2 ppm |
| | during calibration interval | ±4 ppm |
| Delta time accuracy | corresponds to time error between two edges on same acquisition and channel; signal amplitude greater than 5 divisions, measurement threshold set to 50 %, vertical gain 10 mV/div or greater; rise time lower than four sample periods; waveform acquired in realtime mode | ±(K/realtime sampling rate + timebase accuracy × reading) (peak) (meas.) where K = 0.2 (R&S®RTE1022, R&S®RTE1024) K = 0.24 (R&S®RTE1032, R&S®RTE1034) K = 0.27 (R&S®RTE1052, R&S®RTE1054) K = 0.34 (R&S®RTE1102, R&S®RTE1104) K = 0.38 (R&S®RTE1152, R&S®RTE1154) K = 0.42 (R&S®RTE1202, R&S®RTE1204) |

Acquisition system

| | | |
|------------------------------------|--|---|
| Realtime sampling rate | | max. 5 Gsample/s on each channel |
| Realtime waveform acquisition rate | max. | > 1 000 000 waveforms/s |
| Memory depth ² | R&S®RTE1022, R&S®RTE1032, R&S®RTE1052, R&S®RTE1102, R&S®RTE1152, R&S®RTE1202 | 50 Msample on 2 channels, 100 Msample on 1 channel |
| | R&S®RTE1024, R&S®RTE1034, R&S®RTE1054, R&S®RTE1104, R&S®RTE1154, R&S®RTE1204 | 50 Msample on 4 channels, 100 Msample on 2 channels, 200 Msample on 1 channel |
| Decimation modes | | selection valid for all channels |
| | sample | first sample in decimation interval |
| | peak detect | largest and smallest sample in decimation interval |
| | high resolution | average value of samples in decimation interval |
| | root mean square | root of squared average of samples in decimation interval |
| Waveform arithmetic | | selection valid for all channels |
| | off | no arithmetic |
| | envelope | envelope of acquired waveforms |
| | average | average of acquired waveforms, max. average depth depends on decimation mode ³ |
| | sample | max. 16 777 215 |
| | high resolution | max. 65 535 |
| | root mean square | max. 255 |
| | reset condition | no reset (standard), manual reset |
| Sampling modes | realtime mode | max. sampling rate set by digitizer |
| | interpolated time | enhancement of sampling resolution by interpolation; max. equivalent sampling rate is 2 Tsample/s |
| Interpolation modes | | linear, sin(x)/x, sample&hold |

² The maximum available memory depth depends on the bit depth of the acquired data and, therefore, on the settings of the acquisition system, such as decimation mode, waveform arithmetic, number of waveform streams or high definition mode.

³ Waveform averaging is not compatible with peak detect decimation.

| | | |
|----------------------|---|-------------------------|
| Ultra segmented mode | continuous recording of waveforms in acquisition memory without interruption due to visualization | |
| | max. realtime waveform acquisition rate | > 1 600 000 waveforms/s |
| | min. blind time between consecutive acquisitions | < 400 ns |

High definition mode

| | | |
|------------------------|--|----------------|
| General description | The high definition mode increases the numeric resolution of the waveform signal by using digital filtering, leading to a reduced noise. Because of the R&S®RTE digital trigger concept, the signals with increased numeric resolution are used as input for triggering. | |
| Numeric resolution | bandwidth | bit resolution |
| | 10 kHz to 30 MHz | 16 bit |
| | 50 MHz | 14 bit |
| | 100 MHz | 13 bit |
| | 200 MHz | 12 bit |
| | 300 MHz | 11 bit |
| | 500 MHz | 10 bit |
| Realtime sampling rate | max. 2.5 Gsample/s on each channel | |

Trigger system

| | | |
|----------------|--|---|
| Sources | R&S®RTE1022, R&S®RTE1032, R&S®RTE1052, R&S®RTE1102, R&S®RTE1152, R&S®RTE1202 | channel 1, channel 2 |
| | R&S®RTE1024, R&S®RTE1034, R&S®RTE1054, R&S®RTE1104, R&S®RTE1154, R&S®RTE1204 | channel 1, channel 2, channel 3, channel 4 |
| Sensitivity | trigger hysteresis mode | auto (standard) or manual |
| | range | 0 V to 5 div × input sensitivity |
| Trigger jitter | full-scale sine wave of frequency set to -3 dB bandwidth | < 1 ps (RMS) (meas.) |
| Coupling mode | standard | same as selected channel |
| | lowpass filter | cutoff frequency selectable from 50 kHz to 50 % of analog bandwidth |
| Sweep mode | | auto, normal, single, n single |
| Event rate | max. | one event for every 800 ps time interval |
| Trigger level | range | ±5 div from center of screen |
| Holdoff range | time | 100 ns to 10 s, fixed and random |
| | events | 1 event to 2 000 000 000 events |

| | | |
|---------------------------|---|------------------|
| Main trigger modes | | |
| Edge | triggers on specified slope (positive, negative or either) and level | |
| Glitch | triggers on glitches of positive, negative or either polarity that are shorter or longer than specified width | |
| | glitch width | 200 ps to 1000 s |
| Width | triggers on positive or negative pulse of specified width; width can be shorter, longer, inside or outside the interval | |
| | pulse width | 200 ps to 1000 s |
| Runt | triggers on pulse of positive, negative or either polarity that crosses one threshold but fails to cross a second threshold before crossing the first one again; runt pulse width can be arbitrary, shorter, longer, inside or outside the interval | |
| | runt pulse width | 200 ps to 1000 s |
| Window | triggers when signal enters or exits a specified voltage range; triggers also when signal stays inside or outside the voltage range for a specified period of time | |
| Timeout | triggers when signal stays high, low or unchanged for a specified period of time | |
| | timeout | 200 ps to 1000 s |
| Interval | triggers when time between two consecutive edges of same slope (positive or negative) is shorter, longer, inside or outside a specified range | |
| | interval time | 200 ps to 1000 s |

| | | |
|----------------|---|---|
| Slew rate | triggers when the time required by a signal edge to toggle between user-defined upper and lower voltage levels is shorter, longer, inside or outside the interval; edge slope may be positive, negative or either | |
| | toggle time | 200 ps to 1000 s |
| Data2clock | triggers on setup time and hold time violations between clock and data present on any two input channels; monitored time interval may be specified by the user in the range from -100 ns to 100 ns around a clock edge and must be at least 200 ps wide | |
| Pattern | triggers when a logical combination (AND, NAND, OR, NOR) of the input channels stays true for a period of time shorter, longer, inside or outside a specified range | |
| State | triggers when a logical combination (AND, NAND, OR, NOR) of the input channels stays true at a slope (positive, negative or either) in one selected channel | |
| Serial pattern | triggers on serial data pattern up to 128 bit clocked by one input channel; pattern bits may be high (H), low (L) or don't care (X); clock edge slope may be positive, negative or either | |
| | max. data rate | < 1.25 Gbps |
| TV/video | triggers on baseband analog progressive and interlaced video signals including NTSC, PAL, PAL-M, SECAM, EDTV and HDTV broadcast standards as well as custom bi-level and tri-level sync video standards | |
| | trigger modes | all fields, odd fields, even fields, all lines, line number |
| Line | triggers with the frequency of the AC power line voltage | |

| Advanced trigger modes | | |
|--------------------------------|--|---|
| Sequence trigger (A/B trigger) | triggers on B event after occurrence of A event; delay condition after A event specified either as time interval or number of B events | |
| | A event | any trigger mode |
| | B event | edge, glitch, width, runt, window, timeout, interval, slew rate |
| Serial bus trigger | optional | I ² C, SPI, UART/RS-232, LIN, CAN, FlexRay™, I ² S, MIL-STD-1553, ARINC 429, CAN FD, SENT, Manchester, NRZ, MDIO and USB 1.0/1.1/2.0/HSIC with dedicated software options |
| External trigger input | input impedance | 50 Ω ± 1.5 % (meas.), 1 MΩ ± 1 % 14 pF (meas.) |
| | max. input voltage at 50 Ω | 5 V (RMS) |
| | max. input voltage at 1 MΩ | 30 V (RMS) derates at 20 dB/decade to 5 V (RMS) above 5 MHz |
| | trigger level range | ±5 V |
| | sensitivity, for input frequency ≤ 500 MHz | 300 mV (V _{pp}) |
| | input coupling | AC, DC (50 Ω and 1 MΩ), GND, HF reject (attenuates > 50 kHz), LF reject (attenuates < 50 kHz) |
| | trigger modes | edge (rise or fall) |
| | trigger out | functionality |
| Trigger out | output voltage | 0 V to 5 V at high impedance; 0 V to 2.5 V at 50 Ω |
| | pulse width | selectable between 50 ns and 60 ms |
| | pulse polarity | low active or high active |
| | output delay | depends on trigger settings |
| | jitter | ±600 ps (meas.) |

RF characteristics ⁴

| | | |
|-----------------------------|--|-------------------------|
| Sensitivity/noise density | at 1.001 GHz (measurement of the power spectral density at 1.001 GHz at input sensitivity 1 mV/div, corresponding to -36 dBm input range of the scope, using the FFT with center frequency 1.001 GHz, span 500 kHz, RBW 3 kHz) | -159 dBm (1 Hz) (meas.) |
| | at 100 kHz (measurement of the power spectral density at 100 kHz at input sensitivity 1 mV/div, corresponding to -36 dBm input range of the scope, using the FFT with center frequency 100 kHz, span 20 kHz, RBW 200 Hz) | -155 dBm (1 Hz) (meas.) |
| Noise figure | at 1.001 GHz (calculated based on the noise density above) | 15 dB (meas.) |
| | at 100 kHz (calculated based on the noise density above) | 19 dB (meas.) |
| Signal-to-noise ratio | measured for an input carrier with frequency 1 GHz and level 0 dBm at input sensitivity 70 mV/div, corresponding to 0 dBm input range of the scope, using the FFT with center frequency 1 GHz, span 100 MHz, RBW 400 Hz at +20 MHz from the center frequency | 107 dB (meas.) |
| Absolute amplitude accuracy | 0 to 1.5 GHz | ±1 dB (meas.) |
| Spurious-free dynamic range | measured for an input carrier with frequency 450 MHz and level 0 dBm at input sensitivity 70 mV/div, corresponding to 0 dBm input range of the scope, using the FFT with center frequency 1 GHz, span 1 GHz, RBW 100 kHz | 59 dBc (meas.) |
| Second-harmonic distortion | measured for an input carrier with frequency 450 MHz and level 0 dBm at input sensitivity 70 mV/div, corresponding to 0 dBm input range of the scope, using the FFT with center frequency 1 GHz, span 1 GHz, RBW 100 kHz | -52 dBc (meas.) |
| Third-harmonic distortion | measured for an input carrier with frequency 450 MHz and level 0 dBm at input sensitivity 70 mV/div, corresponding to 0 dBm input range of the scope, using the FFT with center frequency 1 GHz, span 1 GHz, RBW 100 kHz | -48 dBc (meas.) |

⁴ The RF characteristics are measured for an R&S®RTE1204 digital oscilloscope with 2 GHz bandwidth.

Waveform measurements

| | | |
|----------------------|--------------------|--|
| General features | measurements | up to 8 measurements |
| | gate | delimits the display region evaluated for automatic measurements |
| | reference levels | user-configurable vertical levels define support structures for automatic measurements |
| | statistics | displays maximum, minimum, mean, standard deviation, RMS and measurement count for each automatic measurement |
| | track | measurement results displayed as continuous trace that is time-correlated to the measurement source; requires R&S®RTE-K31 option |
| | long-term analysis | history of selected measurements as trace against count index |
| | histogram | available for each measurement independently |
| Measurement category | amplitude and time | amplitude, high, low, maximum, minimum, peak-to-peak, mean, RMS, sigma, positive overshoot, negative overshoot, area, rise time, fall time, positive width, negative width, period, frequency, positive duty cycle, negative duty cycle, delay, phase, burst width, pulse count, edge count, positive switching, negative switching, cycle area, cycle mean, cycle RMS, cycle sigma, setup time, hold time, setup/hold ratio, pulse train, delay to trigger, slew rate rising, slew rate falling, DC voltmeter (requires Rohde & Schwarz active probe with R&S®ProbeMeter functionality) |
| | eye diagram | extinction ratio (% dB), eye height, eye width, eye top, eye base, Q factor, noise RMS, S/N ratio, duty cycle distortion, eye rise time, eye fall time, eye bit rate, eye amplitude, jitter (peak-to-peak, 6-sigma, RMS) |
| | spectrum | channel power, bandwidth, occupied bandwidth, harmonic search, total harmonic distortion THD in dB and % using power values, total harmonic distortion variants THD _a , THD _v and THD _r , using voltage, overall voltage and overall voltage root means square, peak list (THD _a , THD _v , THD _r and peak list require R&S®RTE-K18 option) |
| Cursors | setup | up to 2 cursor sets on screen, each set consisting of two horizontal and two vertical cursors |
| | target | acquired waveforms (input channels), math waveforms, reference waveforms, XY diagrams |
| | operating mode | vertical measurements, horizontal measurements or both; vertical cursors either set manually or locked to waveform |

| | | |
|--------------------|------------------------|---|
| Histogram | source | acquired waveform (input channels), math waveform, reference waveform |
| | mode | vertical (for timing statistics), horizontal (for amplitude statistics) |
| | automatic measurements | waveform count, waveform samples, histogram samples, histogram peak, peak value, upper peak, lower peak, maximum, minimum, median, range, mean, sigma, mean \pm 1, 2 and 3 sigma, marker \pm probability |
| Quick measurements | function | fast overview of user-configurable measurements from one channel |
| | number of measurements | up to 8 simultaneously |
| | measurements | amplitude, high, low, maximum, minimum, peak-to-peak, mean, RMS, sigma, overshoot, area, rise time, fall time, positive width, negative width, period, frequency, duty cycle, burst width, pulse count, edge count, positive switching, negative switching, cycle area, cycle mean, cycle RMS, cycle sigma, pulse train |

Mask testing

| | | |
|-------------------------------------|--------------------------------|---|
| Test definition | number of masks | up to 8 simultaneously |
| | source | acquired waveforms (input channels), math waveforms, reference waveforms, XY graphs |
| | fail condition | sample hit or waveform hit |
| | fail tolerance | minimum number of fail events for test fail in range from 0 to 4 000 000 000 |
| | action on error | acquisition stop, beep, print and save waveform, trigger out |
| | save/load to file | test and mask settings (.xml format) |
| Mask definition with segments | number of independent segments | up to 8 |
| | segment definition | array of points and connecting rule (upper, lower, inner) define segment region |
| | segment input | point and click on touchscreen, editable list |
| Mask definition with tolerance tube | input signal | acquired waveform |
| | definition of tolerance tube | horizontal width, vertical width, vertical stretch, vertical position |
| Result statistics | category | completed acquisitions, remaining acquisitions, state, sample hits, mask hits, fail rate, test result (pass or fail) |
| Visualization options | waveform style | vectors, dots |
| | violation highlighting | hits (on/off), highlight persistence (50 ms to 50 s or infinite), waveform color (default: red) |
| | mask colors | configurable colors for mask without violation (default: translucent gray), mask with violation (default: translucent red), mask with contact (default: translucent pale red) |

Waveform math

| | | |
|-----------------------|--|---|
| General features | number of math waveforms | up to 4 |
| | number of reference waveforms | up to 4 |
| | waveform arithmetic | user-selectable average or envelope of consecutive waveforms |
| Algebraic expressions | user may define complex mathematical expressions involving waveforms and measurement results | |
| | math functions | add, subtract, multiply, divide, absolute value, square, square root, integrate, differentiate, \log_{10} , \log_e , \log_2 , rescale, sin, cos, tan, arcsin, arccos, arctan, sinh, cosh, tanh, autocorrelation, crosscorrelation |
| | logical operators | not, and, nand, or, nor, xor, nxor |
| | relational operators | Boolean result of =, \neq , >, <, \leq , \geq |
| | frequency domain | spectral magnitude and phase, real and imaginary spectra, group delay |
| | digital filter | lowpass, highpass |
| Optimized math | operators | add, subtract, multiply, absolute value, differentiate, \log_{10} , \log_e , \log_2 , rescale, FIR, FFT magnitude |
| Spectrum analysis | FFT magnitude spectrum | |
| | setup parameters | center frequency, frequency span, frame overlap, frame window (rectangular, Hamming, Hann, Blackman, Gaussian, Flattop, Kaiser Bessel), user-selectable spectrum averaging, RMS, envelope, max. hold and min. hold (max. hold and min. hold require R&S®RTE-K18 option) |
| | max. realtime waveform acquisition rate | > 500 waveforms/s |

Search and mark function

| | | |
|----------------------|--|---|
| General description | scans acquired waveforms for occurrence of a user-defined set of events and highlights each occurrence | |
| Basic setup | source | acquired waveforms (input channels), math waveforms, reference waveforms |
| | search panels | up to 4, where each panel may manage multiple event searches |
| | search mode | manually triggered or continuous |
| | search conditions | |
| | supported events | edge, glitch, width, runt, window, timeout, interval, slew rate, data2clock, state, pattern |
| | event configuration | identical to corresponding trigger event |
| | event selection | single or multiple events on same source |
| Search scope | mode | current waveform, gated time interval |
| Result visualization | table | |
| | sort mode | horizontal position or vertical value |
| | max. result count | specifies max. table size |
| | zoom window | centered on highlighted event |

Display characteristics

| | |
|---------------------------------|--|
| Diagram types | Yt, XY, long-term measurement, spectrum, spectrogram (spectrogram requires R&S®RTE-K18 option) |
| Display interface configuration | display area can be split up into separate diagram areas by dragging and dropping signal icons; each diagram area can hold any number of signals; diagram areas may be stacked on top of each other and later accessed via the dynamic tab menu |
| Signal bar | accommodates timebase settings, trigger settings and signal icons; signal bar may be docked to left or right side of display area or hidden |
| Signal icon | each active waveform is represented by a separate signal icon on the signal bar; the signal icon displays the individual vertical and acquisition settings; a waveform can be minimized to its signal icon so that it appears as a realtime preview in miniature form; dialog boxes and measurement results may also be minimized to a signal icon |
| Axis label | X-axis ticks and Y-axis ticks labeled with tick value and physical unit |
| Diagram label | diagrams may be individually labeled with a descriptive user-defined name |
| Diagram layout | grid, crosshair, axis labels and diagram label may be switched on and off separately |
| Persistence | 50 ms to 50 s, or infinite |
| Zoom | user-defined zoom window provides vertical and horizontal zoom; each diagram area supports multiple zoom windows; touchscreen interface simplifies resize and drag operations on zoom window |
| Signal colors | predefined or user-defined color tables for persistence display |

Input and output

| Front | | |
|---------------------------|-----------------|---|
| Channel inputs | | BNC-compatible, for details see Vertical system |
| | probe interface | auto-detection of passive probes, Rohde & Schwarz active probe interface |
| External trigger input | | BNC-compatible, for details see Trigger system |
| Probe compensation output | signal shape | rectangle, $V_{low} = 0\text{ V}$, $V_{high} = 1\text{ V}$ amplitude $1\text{ V (}V_{pp}\text{)} \pm 5\%$ |
| | frequency | $1\text{ kHz} \pm 1\%$ |
| | impedance | $50\ \Omega$ (nom.) |
| Ground jack | | connected to ground |
| USB interface | | 2 ports, type A plug, version 2.0 |

| Rear | | |
|----------------------------|------------------|---|
| Trigger out | | SMA, for details see Trigger system |
| USB interface | | 2 ports, type A plug, version 3.0 |
| LAN interface | | RJ-45 connector, supports 10/100/1000BASE-T |
| External monitor interface | | DVI-D connector, output of scope display or extended desktop display |
| Reference input/output | connector | BNC female, software switch for selection of input/output |
| | input | |
| | impedance | $50\ \Omega$ (nom.) |
| | input frequency | 10 MHz |
| | required level | $\geq 0\text{ dBm}$ into $50\ \Omega$ |
| | output | |
| | impedance | $50\ \Omega$ (nom.) |
| | output frequency | 10 MHz (nom.) |
| | level | $> 7\text{ dBm}$ |
| GPIO interface | | see R&S®RTE-B10 option |
| Security slot | | for standard Kensington style lock |

General data

| | | |
|----------------|------------|---|
| Display | type | 10.4" LC TFT color display with touchscreen |
| | resolution | 1024 x 768 pixel (XGA) |

| | | |
|---------------------|-----------------------------|---|
| Temperature | | |
| Temperature loading | operating temperature range | 0 °C to +45 °C |
| | storage temperature range | -40 °C to +70 °C |
| Climatic loading | | +25° C/+40 °C at 85 % rel. humidity cyclic, in line with IEC 60068-2-30 |

| | | |
|-----------------|--|------------------------------|
| Altitude | | |
| Operating | | up to 3000 m above sea level |
| Nonoperating | | up to 4600 m above sea level |

| | | |
|------------------------------|------------|---|
| Mechanical resistance | | |
| Vibration | sinusoidal | 5 Hz to 150 Hz, 1.8 g at 55 Hz, 0.5 g from 55 Hz to 150 Hz, in line with EN 60068-2-6 |
| | | 5 Hz to 55 Hz, in line with MIL-PRF-28800F section 4.5.5.3.2 class 3 |
| | random | 10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64 |
| | | 5 Hz to 500 Hz, acceleration 2.058 g (RMS), in line with MIL-PRF-28800F section 4.5.5.3.1 class 3 |
| Shock | | 40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I |
| | | 30 g functional shock, halfsine, duration 11 ms, in line with MIL-PRF-28800F section 4.5.5.4.1 |

| | | |
|-------------|--|---|
| EMC | | |
| RF emission | | in line with CISPR 11/EN 55011 group 1 class A (for a shielded test setup); the instrument complies with the emission requirements stipulated by EN 55011, EN 61326-1 and EN 61326-2-1 class A, making the instrument suitable for use in industrial environments |
| Immunity | | in line with IEC/EN 61326-1 table 2, immunity test requirements for industrial environment ⁵ |

| | | |
|-----------------------|--|----------------------------|
| Certifications | | VDE-GS, cCSA _{US} |
|-----------------------|--|----------------------------|

| | | |
|-----------------------------|--|--------|
| Calibration interval | | 1 year |
|-----------------------------|--|--------|

⁵ Test criterion is displayed noise level within ± 1.5 div for input sensitivity of 5 mV/div.

| Power supply | | |
|---------------------|--|--|
| AC supply | | 100 V to 240 V at 50 Hz to 60 Hz and 400 Hz, max. 3.3 A to 1.5 A, in line with MIL-PRF-28800F section 3.5 |
| Power consumption | | max. 300 W |
| Safety | | in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1 |

| Mechanical data | | |
|------------------------|--------------------------|--|
| Dimensions | W x H x D | 427 mm x 249 mm x 204 mm (16.81 in x 9.80 in x 8.03 in) |
| Weight | without options, nominal | 8.6 kg (18.96 lb) |

Options

R&S® RTE-B1

| |
|---|
| Mixed signal option, additional 16 logic channels |
|---|

Vertical system

| | | |
|-------------------------------|--|---|
| Input channels | | 16 logic channels (D0 to D15) |
| Arrangement of input channels | | arranged in two logic probes with 8 channels each, assignment of the logic probes to the channels (D0 to D7 or D8 to D15) is displayed on the probe |
| Input impedance | | 100 k Ω \pm 2 % ~4 pF (meas.) at probe tips |
| Maximum input frequency | signal with minimum input voltage swing and hysteresis setting: normal | 400 MHz (meas.) |
| Maximum input voltage | | \pm 40 V (V_p) |
| Minimum input voltage swing | | 500 mV (V_{pp}) (meas.) |
| Threshold groups | | D0 to D3, D4 to D7, D8 to D11 and D12 to D15 |
| Threshold level | range predefined | \pm 8 V in 25 mV steps CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, TTL, ECL, PECL, LVPECL |
| Threshold accuracy | | \pm (100 mV + 3 % of threshold setting) |
| Comparator hysteresis | | normal, robust, maximum |

Horizontal system

| | | |
|-------------------------|------------------------|------------------|
| Channel deskew | range for each channel | \pm 200 ns |
| Channel-to-channel skew | | < 500 ps (meas.) |

Acquisition system

| | | |
|------------------------------------|------|---|
| Sampling rate | max. | 5 Gsample/s on each channel |
| Realtime waveform acquisition rate | max. | > 200 000 waveforms/s |
| Memory depth | | 100 Msample for every channel |
| Decimation | | pulses lost due to decimation are displayed |

Trigger system

| | | |
|---------------|--------|----------------------------------|
| Holdoff range | time | 100 ns to 10 s, fixed and random |
| | events | 1 event to 2 000 000 000 events |

| Trigger modes | | |
|---------------|---|--|
| Edge | triggers on specified slope (positive, negative or either) in the source signal | |
| | sources | any channel from D0 to D15 or any logical combination of D0 to D15 |
| Width | triggers on positive or negative pulse of specified width in the source signal; width can be shorter, longer, equal, inside or outside the interval | |
| | sources | any channel from D0 to D15 or any logical combination of D0 to D15 |
| | pulse width | 200 ps to 10 s |
| Timeout | triggers when the source signal stays high, low or unchanged for a specified period of time | |
| | sources | any channel from D0 to D15 or any logical combination of D0 to D15 |
| | timeout | 200 ps to 10 s |
| Data2clock | triggers on setup time and hold time violations between a clock signal and a data signal; monitored time interval with a max. width of 200 ns and a position of max. \pm 1 μ s relative to the clock edge | |
| | data signal | any subset of channels from D0 to D15 or any user-defined bus signal |
| | clock signal | any channel from D0 to D15 |

| | | |
|----------------|--|---|
| Pattern | triggers when the source goes true or stays true for a period of time shorter, longer, equal, inside or outside a specified range | |
| | sources | any logical combination of D0 to D15 or any user-defined bus signal |
| | pulse width | 200 ps to 10 s |
| State | triggers on the slope (positive, negative or either) of the clock signal when data signal matches a user-defined logical state | |
| | data signal | any logical combination of D0 to D15 or any user-defined bus signal |
| | clock signal | any channel from D0 to D15 |
| Serial pattern | triggers on a serial data pattern of up to 32 bit; pattern bits may be high (H), low (L) or don't care (X); clock edge slope may be positive, negative or either | |
| | data signal | any channel from D0 to D15 or any logical combination of D0 to D15 |
| | clock signal | any channel from D0 to D15 or any analog channel |
| | max. data rate | 1.00 Gbps |
| | optional | I ² C, SPI, UART/RS-232, LIN, CAN, FlexRay™ and I ² S with dedicated software options |
| | sources | any channel from D0 to D15 |

Waveform measurements

| | | |
|----------------------------|--|---|
| General features | | measurement panels, gate, statistics, long-term analysis and limit check; see features of the base unit |
| Measurement sources | | all channels from D0 to D15 or any logical combination of D0 to D15 |
| Automatic measurements | | positive pulse width, negative pulse width, period, frequency, burst width, delay, phase, positive duty cycle, negative duty cycle, positive pulse count, negative pulse count, rising edge count, falling edge count |
| Additional cursor function | | display of decoded bus value at the cursor position |

Waveform math

| | | |
|----------|--|--------------------------------------|
| Function | | any logical combination of D0 to D15 |
|----------|--|--------------------------------------|

Search and mark functions

The search function will be available in a future software release.

Display characteristics

| | | |
|-----------------------------|---------------------------------|---|
| Display of logical channels | | selectable size and position on screen, diagram configuration by dragging and dropping signal icons |
| Bus decode | number of bus signals | 4 |
| | bus types | unclocked and clocked |
| | display types | decoded bus, logical signal, bus + logical signal, amplitude signal, amplitude + logical signal, tabulated list (decoded time interval selected with cursors) |
| | position and size | size and position on screen selectable |
| | data format of decoded bus | hex, unsigned integer, signed integer, fractional, binary |
| | data format of amplitude signal | unsigned integer, signed integer, fractional, binary offset |
| Channel activity display | | independent of the scope acquisition, the state (stays low, stays high or toggles) of the channels from D0 to D15 is displayed in the signal icon |

R&S® RTE-B6

Arbitrary function/waveform generator, 2 analog channels, 8-bit pattern generator

Analog channels

| General | | |
|---------------------|--|---|
| Output channel | | 2 channels |
| Vertical resolution | | 14 bit |
| Operating modes | | function generator, arbitrary waveform generator, modulation, frequency sweep |

| | | |
|-----------------------------|---|--|
| Function generator | output of predefined waveforms | |
| Sample rate | | 500 Msample/s |
| Waveforms | sine, square/pulse, ramp, DC, noise, sine cardinal (sinc), Gaussian pulse, Lorentz, exponential fall, exponential rise, cardiac | |
| Sine | frequency range | 1 mHz to 100 MHz |
| | amplitude flatness (relative to 1 kHz) | |
| | $f \leq 100$ kHz | $\leq \pm 0.1$ dB |
| | 100 kHz $< f \leq 60$ MHz | $\leq \pm 0.3$ dB |
| | 60 MHz $< f \leq 100$ MHz | $\leq \pm 0.5$ dB |
| | total harmonic distortion (1 V (V_{pp}) into 50 Ω) | |
| | $f \leq 100$ kHz | ≤ -70 dBc (=THD ≤ 0.032 %) |
| | 100 kHz $< f \leq 15$ MHz | ≤ -55 dBc |
| | 15 MHz $< f \leq 35$ MHz | ≤ -40 dBc |
| | 35 MHz $< f \leq 100$ MHz | ≤ -30 dBc |
| | nonharmonic spurious (1 V (V_{pp}) into 50 Ω) | -65 dBc (meas.) |
| | phase noise (meas.) | |
| $f \leq 25$ MHz | ≤ -105 dBc (1 Hz) at 1 kHz offset, ≤ -115 dBc (1 Hz) at 10 kHz offset, ≤ -125 dBc (1 Hz) at 100 kHz offset | |
| 25 MHz $< f \leq 100$ MHz | ≤ -105 dBc (1 Hz) at 1 kHz offset, ≤ -110 dBc (1 Hz) at 10 kHz offset, ≤ -115 dBc (1 Hz) at 100 kHz offset | |
| Square/pulse | frequency range | 1 mHz to 30 MHz |
| | duty cycle (if pulse width limit is not exceeded) | 0.01 % to 99.99 %, 0.01 % resolution |
| | pulse width | ≥ 16.5 ns, 0.1 ns resolution |
| | rise/fall time | |
| | $f \leq 10$ Hz | 90 μ s (meas.) |
| | 10 Hz $< f \leq 30$ MHz | 9 ns (meas.) |
| | overshoot | ≤ 2 % |
| | jitter (cycle-to-cycle) | ≤ 40 ps (RMS) (meas.) |
| Ramp (triangle, sawtooth) | frequency range | 1 mHz to 1 MHz |
| | linearity | ≤ 0.1 % (meas.) |
| | variable symmetry | 0 % to 100 %, 0.1 % resolution |
| DC | level range | |
| | into 50 Ω | $\pm [3 \text{ V} - (\text{noise amplitude } [V_{pp}] / 2)]$ |
| | into open circuit | $\pm [6 \text{ V} - (\text{noise amplitude } [V_{pp}] / 2)]$ |
| Noise | amplitude | |
| | DC | 0 V to 6 V (V_{pp}) (into 50 Ω) 0 V to 12 V (V_{pp}) (into open circuit) 4 digits resolution |
| | all other waveforms | 0 % to 100 % of AC signal amplitude, 1 % resolution |
| | bandwidth | ≥ 100 MHz |
| Sine cardinal (sinc) | frequency range | 1 mHz to 2 MHz |
| Gaussian pulse | frequency range | 1 mHz to 10 MHz |
| Lorentz | frequency range | 1 mHz to 5 MHz |
| Exponential rise/fall | frequency range | 1 mHz to 1 MHz |
| Cardiac | frequency range | 1 mHz to 1 MHz |

| | | |
|-------------------------------------|----------------------------------|--|
| Arbitrary waveform generator | output of user-defined waveforms | |
| Waveform length | | 1 sample to 40 Msample on each channel |
| Sample rate | | 1 sample/s to 250 Msample/s |
| Filter bandwidth | | 100 MHz |

| | | |
|-------------------|-----------------------------------|--|
| Modulation | | |
| Sample rate | | 500 Msample/s |
| Modulation types | | amplitude modulation (AM), frequency modulation (FM), frequency-shift key modulation (FSK), pulse width modulation (PWM) |
| Carrier waveform | AM, FM, FSK | sine |
| | PWM | square/pulse |
| AM | modulation signals | sine, square, ramp (triangle, sawtooth) |
| | modulation frequency | 1 mHz to 1 MHz |
| | depth | 0 % to 100 %, 0.1 % resolution |
| FM | modulation signals | sine, square, triangle, ramp, inverse ramp |
| | modulation frequency | 1 mHz to 1 MHz |
| | frequency deviation | 1 mHz to 10 MHz |
| FSK | modulation signal | 50 % duty cycle square wave |
| | range of frequency 1, frequency 2 | 1 mHz to 100 MHz |
| | hop rate | 1 mHz to 1 MHz |
| PWM | modulation signals | sine, square, ramp |
| | depth | 0 % to 99.99 % of the duty cycle, 0.01 % resolution |

| | | | |
|------------------------|---|---|--|
| Frequency sweep | output of a sinusoidal waveform with the frequency changing linearly between the start frequency and the stop frequency within the sweep time | | |
| | sample rate | 500 Msample/s | |
| | waveform | sine | |
| | frequency range | 1 mHz to 100 MHz | |
| | direction | up (start frequency < stop frequency) | |
| | | down (start frequency > stop frequency) | |
| sweep time | 1 ms to 500 s | | |

| | | |
|------------------------------|--|--|
| Two-channel operation | operating modes | independent channels, coupled parameters, differential |
| | parameter coupling | none, frequency and/or amplitude |
| | relative phase | -180° to 180°, 0.1° resolution |
| | channel-to-channel skew | ≤ 200 ps (meas.) |
| | channel-to-channel isolation (each channel with same output amplitude) | |
| | f ≤ 10 MHz | ≥ 60 dB (meas.) |
| 10 MHz < f ≤ 100 MHz | ≥ 40 dB (meas.) | |

| | | |
|---------------------|--|---|
| Outputs | | |
| Connectors | | BNC female on the rear panel |
| Function | | on, off, inverted |
| Output impedance | | 50 Ω (nom.) |
| Overload protection | | a short-circuit to ground is tolerated indefinitely, automatic shutoff in case of voltages ≥ +7 V or ≤ -7 V (meas.), automatic shutoff in case of overcurrent, max. -20 V to +20 V without damage (meas.), ESD protection |

| | | |
|------------------------------|--|--|
| Amplitude range ⁶ | sine, square/pulse, ramp, pulse, exponential rise, exponential fall | |
| | into 50 Ω | 10 mV to 6 V (V_{pp}) (frequency ≤ 50 MHz), 10 mV to 4 V (V_{pp}) (frequency > 50 MHz) |
| | into open circuit | 20 mV to 12 V (V_{pp}) (frequency ≤ 50 MHz), 20 mV to 8 V (V_{pp}) (frequency > 50 MHz) |
| | sine cardinal (sinc) | |
| | into 50 Ω | 10 mV to 3 V (V_{pp}) |
| | into open circuit | 20 mV to 6 V (V_{pp}) |
| | Gauss, Lorentz | |
| | into 50 Ω | 10 mV to 2.5 V (V_{pp}) |
| | into open circuit | 20 mV to 5 V (V_{pp}) |
| | arbitrary waveforms | |
| | into 50 Ω | 10 mV to 6 V (V_{pp}) (sample rate ≤ 125 Msample/s), 10 mV to 4 V (V_{pp}) (sample rate > 125 Msample/s) |
| | into open circuit | 20 mV to 12 V (V_{pp}) (sample rate ≤ 125 Msample/s), 20 mV to 8 V (V_{pp}) (sample rate > 125 Msample/s) |
| | resolution | 1 mV |
| accuracy | ± [1% of control + 1 mV (V_{pp})] at 1 kHz | |
| DC offset range | sine, square/pulse, ramp, pulse, exponential rise, exponential fall | |
| | into 50 Ω | ± [3 V – (amplitude [V (V_{pp})] / 2)] |
| | into open circuit | ± [6 V – (amplitude [V (V_{pp})] / 2)] |
| | sine cardinal (sinc), Gauss, Lorentz | |
| | into 50 Ω | ±0.5 V |
| | into open circuit | ±1 V |
| | resolution | 1 mV |
| accuracy | ± (2 % of control + 2 mV) | |
| Frequency accuracy | Δf ≤ [(timebase accuracy) × (nominal frequency) + 1 μHz] (timebase accuracy: see Horizontal system) | |

8-bit pattern generator

| | | |
|-----------------|--|--|
| Function | | output of user-defined patterns |
| Output channels | | 8 channels, coupled w.r.t. pattern length and data output rate |
| Pattern length | | 1 bit to 40 Mbit on each channel |
| Bit rate | | 1 bit/s to 40 Mbit/s |

| | | |
|---------------------|---------------------------------------|--|
| Outputs | | |
| Connector | | 16-pin double row connector, 2.54 mm pitch, located on an adapter board, which is connected via a removable ribbon cable to the R&S®RTO-B6 |
| Output impedance | | 330 Ω (nom.) |
| Overload protection | reverse input voltage without damage | -0.5 V to +6.5 V (meas.), ESD protection |
| Amplitude | low level output voltage (I = 100 μA) | |
| | output voltage | 0 V +0,15 V / -0.02 V |
| | accuracy | ≤ 0.15 V (meas.) |
| | high level output voltage | |
| | setting range | 1.2 V to 5.0 V |
| | resolution | 0.1 V |
| | accuracy | ≤ 0.05 V |
| Rise/fall time | | 8 ns (meas.) |
| Overshoot | | ≤ 5 % (meas.) |

⁶ Amplitude is the sum of the AC amplitude and the noise amplitude.

R&S® RTE-B10

| Additional GPIB interface | | |
|----------------------------------|--|---|
| Function | | interface in line with IEC 625-2 (IEEE 488.2) |
| Command set | | SCPI 1999.0 |
| Connector | | 24-pin Amphenol female |
| Interface functions | | SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0 |

R&S® RTE-B18

| Additional removable solid state disk | | |
|--|--|-------------------------|
| Disk type | | solid state disk |
| Disk size | | ≥ 240 Gbyte (nom.) |
| Firmware | | installed upon delivery |

R&S® RTE-K1

| I²C serial triggering and decoding | | |
|--|-------------------------|--|
| Protocol configuration | bit rate | up to 3.4 Mbps (auto-detected) |
| | auto threshold setup | assisted threshold configuration for I ² C triggering and decoding |
| | device list | associate frame address with symbolic ID |
| Trigger | source (clock and data) | any input channel or logical channel |
| | trigger event setup | start, stop, restart, missing ACK, address, data, address + data |
| | address setup | 7 bit or 10 bit address (value in hex, decimal, octal or binary); ACK, NACK or either; read, write or either; R/W bit included in address value or apart; condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 8 byte (hex, decimal, octal or binary); condition =, ≠, ≥, ≤, in range, out of range; offset within frame in range from 0 byte to 4095 byte |
| Decode | source (clock and data) | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame, start/restart, address, R/W bit, data, ACK/NACK, stop, error |
| | address and data format | hex, decimal, octal, binary, ASCII; symbolic names for user-defined subset of addresses |
| Search | search event setup | combination of start, stop, restart, missing ACK, address, data, address + data |
| | event settings | same as trigger event settings |

| SPI serial triggering and decoding | | |
|---|--------------------------------|--|
| Protocol configuration | type | 2-wire, 3-wire and 4-wire SPI |
| | bit rate | up to 50 Mbps (auto-detected) |
| | bit order | LSB first, MSB first |
| | word size | 4 bit to 32 bit |
| | frame condition | SS, timeout |
| | polarity (MOSI, MISO, SS, CLK) | active high, active low |
| | phase (CLK) | first edge, second edge |
| | auto threshold setup | assisted threshold configuration for SPI triggering and decoding |
| Trigger | source (MOSI, MISO, SS, CLK) | any input channel or logical channel |
| | trigger event setup | start of frame, MOSI, MISO, MOSI + MISO |
| | data setup | data pattern up to 256 bit (hex or binary); condition =, ≠; offset within frame in range from 0 bit to 32767 bit |
| Decode | source (MOSI, MISO, SS, CLK) | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame, word, error |
| | data format | hex, decimal, octal, binary, ASCII |
| Search | search event setup | start of frame, MOSI, MISO, MOSI + MISO |
| | event settings | same as trigger event settings |

R&S® RTE-K2

| UART/RS-232/RS-422/RS-485 serial triggering and decoding | | |
|---|----------------------|---|
| Protocol configuration | bit rate | 300 bps to 20 Mbps |
| | signal polarity | idle low, idle high |
| | number of bits | 5 bit to 9 bit |
| | bit order | LSB first, MSB first |
| | parity | odd, even, mark, space, none |
| | stop bit | 1, 1.5 or 2 bit periods |
| | end of packet | word, timeout, none |
| | auto threshold setup | assisted threshold configuration for UART triggering and decoding |
| Trigger | source (TX and RX) | any input channel or logical channel |
| | trigger event setup | start bit, packet start, data, parity error, break condition |
| | data setup | data pattern up to 256 bit (hex, decimal, octal, binary or ASCII); condition =, ≠; offset within packet in range 0 bit to 32767 bit |
| Decode | source (TX and RX) | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | packet, data payload, start error, parity error, stop error |
| | data format | hex, decimal, octal, binary, ASCII |

R&S®RTE-K3

| CAN serial triggering and decoding | | |
|------------------------------------|----------------------|---|
| Protocol configuration | signal type | CAN_H, CAN_L |
| | bit rate | 100 bps to 1 Mbps |
| | sampling point | 5 % to 95 % within bit period |
| | device list | associate frame identifier with symbolic ID, load DBC file content |
| | auto threshold setup | assisted threshold configuration for CAN triggering and decoding |
| Trigger | source | any input channel or logical channel |
| | trigger event setup | start of frame, frame type, identifier, identifier + data, symbolic, error condition (any combination of CRC error, bit stuffing error, form error and ACK error) |
| | identifier setup | frame type (data, remote or both), identifier type (standard or extended); condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 8 byte (hex, decimal, octal or binary); big-endian or little-endian; condition =, ≠, ≥, ≤, in range, out of range |
| | symbolic setup | message name, signal name; numeric signal condition =, ≠, ≥, ≤, in range, out of range; enumerated signal condition =, ≠, ≥, ≤ |
| Decode | source | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | start of frame, identifier, DLC, data payload, CRC, end of frame, error frame, overload frame, CRC error, bit stuffing error |
| | data format | hex, decimal, octal, binary, ASCII, symbolic |
| Search | source | any input channel or logical channel |
| | search event setup | combination of start of frame, frame type, identifier, identifier + data, error condition (any combination of CRC error, bit stuffing error, form error and ACK error) or only symbolic |
| | event settings | same as trigger event settings |

| LIN serial triggering and decoding | | |
|---|----------------------|---|
| Protocol configuration | version | 1.3, 2.x or SAE J602; mixed traffic is supported |
| | bit rate | standard bit rate (1.2/2.4/4.8/9.6/10.417/19.2 kbps) or user-defined bit rate in range from 1 kbps to 20 kbps |
| | device list | associate frame identifier with symbolic ID, data length and protocol version |
| | auto threshold setup | assisted threshold configuration for LIN triggering and decoding |
| Trigger | source | any input channel |
| | trigger event setup | start of frame (sync break), identifier, identifier + data, wakeup frame, error condition (any combination of checksum error, parity error and sync field error) |
| | identifier setup | range from 0d to 63d; select condition =, ≠, ≥, ≤, in range, out of range for trigger "identifier"; select single identifier and condition = for trigger "identifier + data" |
| | data setup | data pattern up to 8 byte (hex, decimal, octal or binary); condition =, ≠, ≥, ≤, in range, out of range |
| Decode | source (TX and RX) | any input channel, math waveform, reference waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame, frame identifier, data payload, checksum, error condition |
| | data format | hex, decimal, octal, binary, ASCII |
| Search | search event setup | combination of start of frame (sync break), identifier, identifier + data, wakeup frame, error condition (any combination of checksum error, parity error and sync field error) |
| | event settings | same as trigger event settings |

R&S®RTE-K4

| FlexRay™ serial triggering and decoding | | |
|---|----------------------|--|
| Protocol configuration | signal type | single-ended, differential, logic |
| | channel type | channel A, channel B |
| | bit rate | standard bit rates (2.5/5.0/10.0 Mbps) |
| | device list | associate frame identifier with symbolic ID |
| | auto threshold setup | assisted threshold configuration for FlexRay™ triggering and decoding |
| | source | any input channel or logical channel |
| Trigger | trigger event setup | start of frame, header + data, symbol, wakeup, error condition (any combination of FSS error, BSS error, FES error, header CRC error and frame CRC error) |
| | header setup | indicator bits, identifier, payload length, cycle count |
| | indicator bits setup | payload preamble bit, null frame bit, sync frame bit and startup frame bit separately configurable (1, 0 or don't care) |
| | identifier setup | condition =, ≠, ≥, ≤, in range, out of range |
| | payload length setup | condition =, ≠, ≥, ≤, in range, out of range |
| | cycle count | condition =, ≠, ≥, ≤, in range, out of range; step parameter for selection of non-contiguous values within provided range |
| | data setup | data pattern up to 8 byte (hex, decimal, octal or binary); condition =, ≠, ≥, ≤, in range, out of range; offset within frame in range from 0 byte to 253 byte |
| Decode | source | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame, frame header, identifier, payload length, header CRC, cycle count, data payload, frame CRC, error condition |
| | data format | hex, decimal, octal, binary, ASCII |
| Search | search event setup | combination of start of frame, header + data, symbol, wakeup, error condition (any combination of FSS error, BSS error, FES error, header CRC error and frame CRC error) |
| | event settings | same as trigger event settings |

R&S® RTE-K5

| I²S serial triggering and decoding | | |
|--|-----------------------|--|
| Protocol configuration | signal type | I ² S standard, left justified, right justified, TDM |
| | auto threshold setup | assisted threshold configuration for I ² S triggering and decoding |
| Trigger | source | any input channel or logical channel |
| | trigger event setup | data, window, frame condition, word select, error condition |
| | data setup | data pattern of an audio channel up to 4 byte (hex, signed decimal, unsigned decimal, octal or binary); condition =, ≠, ≥, ≤, <, >, in range, out of range |
| | window setup | word count of data pattern of an audio channel up to 4 byte (hex, signed decimal, unsigned decimal, octal or binary); condition =, ≠, ≥, ≤, <, >, in range, out of range |
| | frame condition setup | combination of audio channels in a frame, up to 4 byte (hex, signed decimal, unsigned decimal, octal or binary); condition =, ≠, ≥, ≤, <, >, in range, out of range |
| | word select setup | rising or falling edge of word select input channel |
| | error condition setup | source of word select |
| Decode | source | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus and logical signal, tabulated list |
| | color coding | audio frame, frame error, incomplete frame |
| | data format | hex, unsigned decimal, signed decimal (two's complement), octal, binary, ASCII |
| Protocol measurements | audio display | display of audio waveform for specified audio channels |
| | long-term display | history of selected audio data as trace against measurements, waveforms and time index |

R&S®RTE-K6

| MIL-STD-1553 serial triggering and decoding | | |
|--|---------------------------|--|
| Protocol configuration | signal type | single-ended |
| | bit rate | standard bit rate (1 Mbit/s) |
| | polarity | normal, inverted |
| | device list | associate frame identifier with symbolic ID |
| | auto threshold setup | assisted threshold configuration |
| | timing | min. gap (2 μ s to 262 μ s) or off; max. response (2 μ s to 262 μ s) or off |
| Trigger | trigger event setup | sync, word, data word, command/status word, command word, status word, error condition |
| | sync and word setup | all words, command/status word, data word |
| | data word setup | RTA (condition =, \neq , \geq , \leq , in range, out of range); data pattern (condition =, \neq , \geq , \leq , in range, out of range); payload data index (=, <, >, \geq , \leq , range); max length of data pattern is 4 byte |
| | command/status word setup | RTA (condition =, \neq , \geq , \leq , in range, out of range); 11 bit pattern (condition =, \neq , \geq , \leq , in range, out of range) |
| | command word setup | RTA (condition =, \neq , \geq , \leq , in range, out of range); subaddress/mode (condition =, \neq , \geq , \leq , in range, out of range); data word count/mode count (condition =, \neq , \geq , \leq , in range, out of range); direction (T/R) |
| | status word | RTA (condition =, \neq , \geq , \leq , in range, out of range); status flags (message error, instrumentation, service request, broadcast command, busy, subsystem flag, dynamic bus control, terminal flag) |
| | error condition | any combination of sync error, Manchester error, parity error, timing error (see protocol configuration) |
| Decode | source | any analog input channel, math waveform, reference waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame (word), sync, RTA, status bit field, parity, data field, error condition |
| | data format | hex, octal, binary, ASCII, signed, unsigned |
| Search | search event setup | sync, word, data word, command/status word, command word, status word, error condition |
| | event settings | same as trigger event settings |

R&S® RTE-K7

| ARINC 429 triggering and decoding | | |
|--|----------------------|--|
| Protocol configuration | signal type | single-ended |
| | bit rate | high (100 kbit/s) low (12 kbit/s to 14.5 kbit/s) |
| | polarity | A leg, B leg |
| | device list | associate frame identifier with symbolic ID |
| | auto threshold setup | assisted threshold configuration |
| | timing | min. gap (0 bit to 100 bit) or off; max. gap (0 bit to 1000 bit) or off |
| Trigger | trigger event setup | word start, word stop, label + data, error condition |
| | label + data setup | label (condition =, ≠, ≥, ≤, in range, out of range); data (condition =, ≠, ≥, ≤, in range, out of range); SDI/SSM |
| | error condition | any combination of coding error, parity error, timing error (see protocol configuration) |
| Decode | source | any analog input channel, math waveform, reference waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame (word), label, SDI, data, SSM, parity, error condition |
| | data format | hex, octal, binary, ASCII, signed, unsigned |
| Search | search event setup | word start, word stop, label + data, error condition |
| | event settings | same as trigger event settings |

R&S® RTE-K8

| Ethernet serial decoding | | |
|---------------------------------|----------------------|--|
| Protocol configuration | signal type | one channel, differential |
| | bit rate | selectable/adjustable |
| | auto threshold setup | assisted threshold configuration |
| | source (SDATA) | analog and math channels |
| | variants | 10BASE-T, 100BASE-TX |
| Decode | display type | decoded bus, logical signal, bus + logical signal, tabulated list, details |
| | color coding | preamble, frame, destination address, source address, data |
| | data format | hex |
| Search | search event setup | frame, error |
| | frame | 48 bit destination address, 48 bit source address, 16 bit length/type, 32 bit frame check; conditions =, ≠, <, >, ≥, ≤, in range, out of range |
| | error | preamble, length error |

R&S®RTE-K9

| CAN-FD serial triggering and decoding | | |
|---------------------------------------|----------------------|---|
| Protocol configuration | signal type | CAN_H, CAN_L |
| | standard | ISO, non-ISO (Bosch) |
| | bit rate | |
| | arbitration rate | 10 kbps to 1 Mbps |
| | data rate | 10 kbps to 15 Mbps |
| | sampling point | 5 % to 95 % within bit period; independent settings for arbitration phase and data phase |
| | device list | associate frame identifier with symbolic ID, load DBC file content |
| | auto threshold setup | assisted threshold configuration |
| Trigger | source | any input channel or logical channel |
| | trigger event setup | start of frame, frame type, identifier, identifier + data, symbolic, error condition (any combination of CRC error, bit stuffing error, form error and ACK error) |
| | identifier setup | frame type (data, remote or both), identifier type (standard or extended); condition =, ≠, ≥, ≤, in range, out of range |
| | FD bits | FDF, BRS and ESI (0, 1, X) |
| | data setup | data pattern up to 8 bytes in the complete data range (hex, decimal, octal or binary); condition =, ≠, ≥, ≤, in range, out of range |
| | symbolic setup | message name, signal name; numeric signal condition =, ≠, ≥, ≤, in range, out of range; enumerated signal condition =, ≠, ≥, ≤ |
| Decode | source | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | start of frame, identifier, FD bits, DLC, data payload, CRC, end of frame, error frame, overload frame, CRC error, bit stuffing error |
| | data format | hex, decimal, octal, binary, ASCII, symbolic |
| Search | source | any input channel or logical channel |
| | search event setup | combination of start of frame, frame type, identifier, identifier + data, error condition (any combination of CRC error, bit stuffing error, form error and ACK error) or only symbolic |
| | event settings | same as trigger event settings |

R&S® RTE-K10

| SENT serial triggering and decoding | | |
|--|---|---|
| Protocol configuration | signal type | data signal |
| | clock period (clock tick) | 1 µs to 100 µs |
| | clock tolerance | 0 % to 25 % |
| | data nibbles | 1 to 6 |
| | serial message type | none, Short Serial Message and Enhanced Serial Message |
| | CRC version | Legacy (Feb 2008) and v2010 (latest) |
| | CRC calculation | SAE J2716 standard and TLE 4998X |
| | pause pulse | no, yes, for constant frame length |
| frame length in clock ticks (applicable only when pause pulse = constant frame length) | 104 to 922 | |
| Trigger | source | any analog input channel |
| | trigger event setup | calibration or sync, transmission sequence, serial message and error condition |
| | transmission sequence status nibble setup | from 0 to F, condition =, ≠, ≥, ≤, in range, out of range |
| | transmission sequence data nibbles setup | each nibble value from 0 to F, condition =, ≠, ≥, ≤, in range, out of range |
| | serial message identifier setup | from 00 to FF, condition =, ≠, ≥, ≤, in range, out of range |
| | serial message identifier type setup (applicable only when the serial protocol = Enhanced Serial Message in protocol configuration) | 4 bit and 8 bit |
| | serial message data setup | 00 to FF (Short Serial Message), 000 to FFF (Enhanced Serial Message with 8 bit ID), 0000 to FFFF (Enhanced Serial Message with 4 bit ID) |
| | error condition setup | form error, calibration pulse error, pulse period error, CRC error and irregular frame length error |
| Decode | source | any analog input channel, |
| | display type | decoded bus, tabulated list |
| | color coding | transmission sequence: sync/calibration, status, data bits, CRC, pause pulse (optional), calibration pulse error, pulse period error, irregular frame length error and CRC error. serial message: identifier, data, CRC, form error, CRC error |
| | data format | hex, decimal, octal, binary, ASCII |
| Search | source | any analog input channel |
| | search event setup | calibration or sync, transmission sequence, serial message and error condition |
| | event settings | same as trigger event settings |

R&S®RTE-K18

| Spectrum analysis | | |
|------------------------------|--|--|
| General description | The R&S®RTE-K18 spectrum analysis allows advanced signal analysis in the frequency domain. | |
| Spectrogram | display characteristics | spectrogram display; a separate spectrogram can be created for each FFT display; each FFT segment of a captured acquisition is displayed in a separate spectrogram line support of logarithmic frequency x-axis |
| | number of spectrograms | up to 4 |
| | signal colors | predefined or user-defined color tables for persistence display with the spectrogram |
| | time lines | in stop mode two separate time lines can be used to navigate through a spectrogram in time; for each time line the relevant FFT segment is displayed in a diagram; the difference in acquisition time between the timelines is displayed |
| Logarithmic frequency x-axis | display characteristics | logarithmic frequency x-axis for the FFT display with support of analysis tools like cursors and masks |
| | | logarithmic frequency x-axis for the spectrogram display |
| Waveform measurements | measurement functions | total harmonic distortion variants THD _a , THD _v and THD _r using voltage, overall voltage and overall voltage root means square |
| | peak list | peak list; diagram labels for easy identification of the peak list entries in the diagram |
| Waveform math | | user-selectable max. hold and min. hold in addition to spectrum averaging, RMS and envelope |

R&S®RTE-K31

| Power analysis | | |
|------------------------|---|---|
| General description | The R&S®RTE-K31 power analysis option extends the R&S®RTE firmware with measurement functionality focused on switched mode power supplies (SMPS) and DC/DC converters. | |
| Input | quality | evaluation of power quality at an AC input; measures real power, apparent power, reactive power, power factor and phase angle of power, frequency, crest factor, RMS of voltage and current |
| | harmonics | measures up to the 40 th harmonic of the incoming line frequency; precompliance checking for IEC 61000-3-2 (A, B, C, D), RTCA DO-160, MIL-STD-1399, max. limit checks |
| | inrush current | measures peak inrush current; multiple measurement zones configurable with analysis of the post-inrush behavior |
| Switching/control loop | slew rate | The slope of current or voltage is measured at start and end of the switching cycle. |
| | modulation | measures modulation of switching frequency and duty cycle under steady state and start-up conditions |
| | dynamic on-resistance | measures resistance of the switching transistor(s) in active state |
| Power path | efficiency (only for 4 channel devices) | measures input and output power to calculate the efficiency of an SMPS |
| | loss | measures switching loss and conduction loss of a power device |
| | safe operating area (SOA) | checks violation of voltage and current limits in which a power device can operate without damage; current versus voltage view (linear or log); violation mask is user-defined and editable in linear and log-log views |
| | turn on/off | measures relationship between AC and DC current, when turning the SMPS off and on |
| Output | ripple | measures AC components of output voltage and current, AC RMS, frequency, duty cycles, min./max./peak-to-peak amplitude |
| | spectrum | FFT analysis of output, measurement of frequency peaks |
| | transient response | This measurement captures the device behavior between the event of load changes and stabilization. includes peak (voltage, time), settling time, rise time, overshoot and delay |
| Deskew | automated | By using the R&S®RT-ZF20 probe deskew and calibration test fixture and Rohde & Schwarz voltage and current probes, the skew between the voltage and current signal is compensated automatically. |
| Reporting | easy reporting: Click to save a measurement. Report generation using user-selected test results from historical and currently-active tests. Put repeated and/or different measurements in one report. | |

R&S®RTE-K50

| Manchester and NRZ serial triggering and decoding | | |
|--|------------------------------|---|
| Protocol configuration | signal type | selectable, one channel, differential or single-ended, two channel, differential or single-ended |
| | bit rate | auto detected, selectable/adjustable |
| | auto threshold setup | assisted threshold configuration |
| | source (SDATA) | analog, math. channels, logical (only NRZ) |
| | bit encoding variants | Manchester, Manchester II, NRZ clocked, NRZ unclocked |
| | properties | active state, idle state, clock edge |
| | frame separation | gap, enable signal (only NRZ) |
| Frame format | frame | multiple frame management, frame identification and sync, variable length frames, variable number of cells |
| | cells | name, size (bits), numeric format, bit order, color |
| | file storage of frame format | save/load as xml files |
| Trigger | variants | all |
| | trigger event setup | frame start, pattern |
| | frame start | gap, start bit |
| | pattern | up to 256 bit pattern within 65 535 bit frame ⁷ |
| Decode | display type | decoded bus, logical signal, bus signal, tabulated list, result details |
| | color coding | according to cell configuration table |
| | data format | according to cell configuration table |
| Search | search event setup | frames and frame fields, errors |

⁷ The pattern trigger will not be effective after Manchester violations.

R&S® RTE-K55

| MDIO serial triggering and decoding | | |
|--|--|---|
| Protocol configuration | bit rate | up to 5 Mbps (auto-detected) |
| | auto threshold setup | assisted threshold configuration for MDIO triggering and decoding |
| | device list | associate frame address with symbolic ID |
| Trigger | source (clock and data) | any input channel or logical channel |
| | trigger event setup | start, stop, ST, OP, PHY address, register address, data |
| | ST setup | 01 (clause 22), 00 clause 45, any |
| | OP setup | address, write, post read, read, any |
| | PHY address setup | 5 bit address (hex, decimal, octal or binary); equal |
| | PHY register (clause 22)/device type (clause 45) setup | 5 bit value (hex, decimal, octal or binary); equal |
| | data (clause 22)/data/address (clause 45) | 16 bit value (hex, decimal, octal or binary); equal |
| Decode | source (clock and data) | any input channel, math waveform, reference waveform, logical channel |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame, PHY address, PHY register, address, data, turnaround |
| | PHYAD/PRTAD | symbolic names for user defined addresses |
| | address/data field format | hex, decimal, octal, binary, ASCII |
| Search | source (clock and data) | any input channel, math waveform, reference waveform, logical channel |
| | search event setup | start, stop, ST, OP, PHY address, register address, data |
| | event settings | same as trigger event settings |

R&S®RTE-K57

| IEEE 100BASE-T1 serial triggering and decoding | | |
|---|-----------------------|---|
| Protocol configuration | signal type | one channel differential, two channels single-ended, optional additional use of reverse channels for signal improvement: one channel differential, two channels single-ended |
| | symbol rate | 66.667 Msymbol/s, adjustable for testing |
| | thresholds | upper/lower, assisted threshold configuration |
| | source | any analog input channels, math waveforms, reference waveforms |
| | polarity | normal, inverted |
| | mode | slave, master |
| Trigger | trigger event setup | frame start MAC frame idle frame error conditions |
| | MAC frame setup | destination address (condition =, ≠, <, >, ≥, ≤, in range, out of range), source address (condition =, ≠, <, >, ≥, ≤, in range, out of range), length/type (condition =, ≠, <, >, ≥, ≤, in range, out of range), frame check (condition =, ≠, <, >, ≥, ≤, in range, out of range), data (condition =, ≠, <, >, ≥, ≤, in range, out of range), data index (condition =, <, >, ≥, ≤, range) |
| | error condition setup | preamble error, CRC error, SFD error |
| Decode | display type | decoded bus, tabulated list, details, decode layers |
| | color coding | for different cells types |
| | data format | hex, octal, binary, signed, unsigned |
| | decode layer | reversed bits, descrambled bits, scrambled bits, ternary symbols |
| Search | search event setup | frame start MAC frame idle frame error conditions |
| | event settings | same as trigger event settings |

R&S® RTE-K60

| USB 1.0/1.1/2.0/HSIC serial triggering and decoding | | |
|---|---|---|
| Protocol configuration | signal type | single-ended, differential |
| | protocol type | low, full, high speed and HSIC |
| | bit rate | standard bit rates (1.5/12/480 Mbit/s) |
| | source | any input channel |
| | probe type | |
| | for low and full speed | single-ended probe |
| | for high speed | differential probe (R&S®RT-ZDxx) |
| | for HSIC | single-ended probe(R&S®RT-ZSxx) |
| auto threshold setup | assisted threshold configuration for USB triggering and decoding | |
| Trigger | trigger event setup | start of packet, end of packet, PID token (IN, OUT, SETUP, SOF), PID data (Data0, Data1, Data2 ⁸ , MData ⁸), PID handshake (ACK, NAK, STALL, NYET ⁸), PID special (PRE ⁹ , ERR ⁸ , SPLIT ⁸ , PING ⁸); bus state (reset ⁹ , resume ⁹ , suspend ⁹); error condition |
| | address, endpoint and frame setup SC, port, SEU, ET check (SPLIT) ⁸ | condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 4 byte (hex, decimal, octal, binary or ASCII), bit separately configurable (1, 0 or don't care); condition =, ≠; position based or window based triggering (first occurrence in packet payload) |
| | error condition | any error, PID error, CRC5 error, CRC16 error, bit stuffing error, unexpected PID, SE1 error ⁹ and glitching error |
| Decode | source | any input channel, math waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | packet identifier, payload length, frame, address, endpoint, data payload, CRC5, CRC16, error condition |
| | data format | hexadecimal, decimal, octal, binary, ASCII, unsigned |
| Search | search event setup | combination of start of packet, PID token (IN, OUT, SETUP, SOF), PID data (Data0, Data1, Data2 ⁸ , MData ⁸), PID handshake (ACK, NAK, STALL, NYET ⁸), PID special (PRE ⁹ , ERR ⁸ , SPLIT ⁸ , PING ⁸); error condition (any error, PID error, CRC5 error, CRC16 error, bit stuffing error, unexpected PID, SE1 error ⁹ and glitching error) |
| | address, endpoint and frame setup SC, port, SEU, ET check (SPLIT) | condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 4 byte (hex, decimal, octal, binary or ASCII), bit separately configurable (1, 0 or don't care); condition =, ≠; position based or window based triggering (first occurrence in packet payload) |
| | error condition | any error, PID error, CRC5 error, CRC16 error, bit stuffing error, unexpected PID, SE1 error ⁹ and glitching error |

⁸ Only available in high speed and HSIC.⁹ Only available in low and full speed.

R&S®RTE-K63

| USB power delivery serial triggering and decoding | | |
|--|---|--|
| Protocol configuration | signal type | one channel |
| | bit rate | auto detected |
| | source | any analog input channel, logical channels, math channels, reference channels |
| | thresholds | data, advertisements |
| | data details | detailed breakdown selectable |
| Trigger | trigger event setup | frame start |
| | | frame content |
| | | errors |
| | frame content | extended, NumDataObjs, MsgID, PwrRole/Plug, Rev, DataRole, MsgType, voltage advertisements (content conditions =, ≠, <, >, ≥, ≤, in range, out of range) |
| errors | 4b/5b, preamble, CRC, length, SOP warning | |
| Decode | display type | decoded bus, logical signal, bus + logical signal, tabulated list, details, decode layers |
| | color coding | cell and frame types |
| | data format | hexadecimal, octal, binary, signed, unsigned |
| | decode layer | final, edges, bits, 4b5b symbols |
| Search | search event setup | frame start |
| | | frame content |
| | | errors |
| | event settings | same as trigger event settings |

R&S® RTE-K65

| SpaceWire serial triggering and decoding | | |
|--|------------------------|---|
| Protocol configuration | signal type | two channels: strobe and data (differential or single-ended) |
| | bit rate | auto adjust (strobe + data) |
| | source | any analog input channels, logical channels ¹⁰ , math channels, reference channels |
| Trigger | trigger event setup | control frame, data pattern, null frame, time code, error condition |
| | control frame setup | any, FCT, EOP, EEP |
| | data pattern setup | 8 bit (condition =, ≠, <, >, ≥, ≤, in range, out of range) |
| | time code setup | 8 bit (condition =, ≠, <, >, ≥, ≤, in range, out of range) |
| | errors condition setup | parity, ESC |
| Decode | display type | decoded bus, logical signal, bus + logical signal, tabulated list, decode layers |
| | color coding | control frame, data frame, null frame, time code |
| | data format | hex |
| Search | search event setup | control frame, data pattern, null frame, time code, error |
| | event settings | same as trigger event settings |

R&S® RTE-K76

| CXPI serial triggering and decoding | | |
|-------------------------------------|---|--|
| Protocol configuration | signal type | one channel |
| | bit rate | auto-detected/adjustable |
| | auto threshold setup | assisted threshold configuration |
| | source (SDATA) | any input channels, math waveforms, reference waveforms or logical channels |
| Trigger | trigger event setup | frame start, frame types with frame content, error condition |
| | frame types | normal, normal poll, sleep, long, long poll, PID, PTYPE, PTYPE+PID |
| | frame content (depending on frame type) | frame ID, NW, CT, DLC, data pattern |
| | data pattern setup | up to 8 byte (condition =, ≠, <, >, ≥, ≤, in range, out of range), payload data index (=, <, >, ≥, ≤, range) |
| | error condition setup | IFS, IBS, CRC, length, parity, UART, DLC |
| Decode | display type | decoded bus, logical signal, bus + logical signal, tabulated list, details, decode layers |
| | color coding | for different cell types |
| | data format | hex, octal, binary, signed, unsigned |
| Search | search event setup | frame start, frame types with data, error types |
| | event settings | same as trigger event settings |

¹⁰ SpaceWire protocol trigger on logical channels is not available.

Ordering information

| Designation | Type | Order No. |
|--|--------------|--------------|
| Base unit (including standard accessories: R&S®RTE-ZP10 500 MHz passive probe per channel, accessories bag, quick start guide, CD with manual, power cord) | | |
| Digital Oscilloscope | | |
| 200 MHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1022 | 1326.2000.22 |
| 200 MHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1024 | 1326.2000.24 |
| 350 MHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1032 | 1326.2000.32 |
| 350 MHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1034 | 1326.2000.34 |
| 500 MHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1052 | 1326.2000.52 |
| 500 MHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1054 | 1326.2000.54 |
| 1 GHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1102 | 1326.2000.62 |
| 1 GHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1104 | 1326.2000.64 |
| 1.5 GHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1152 | 1326.2000.72 |
| 1.5 GHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1154 | 1326.2000.74 |
| 2 GHz, 5 Gsample/s, 10/20 Msample, 2 channels | R&S®RTE1202 | 1326.2000.82 |
| 2 GHz, 5 Gsample/s, 10/40 Msample, 4 channels | R&S®RTE1204 | 1326.2000.84 |
| Hardware options (plug-in) | | |
| Mixed Signal Option, 400 MHz, 5 Gsample/s, 16 channels, 100 Msample/channel | R&S®RTE-B1 | 1326.3570.02 |
| Digital Extension Port for R&S®RT-ZVCxx usage with R&S®RTE oscilloscope, included in R&S®RTE-B1 | R&S®RTE-B1E | 1333.0750.02 |
| Arbitrary Waveform Generator, 100 MHz, 2 analog channels, 8-bit pattern generator | R&S®RTE-B6 | 1326.3012.02 |
| GPIB Interface | R&S®RTE-B10 | 1317.4978.02 |
| Replacement SSD Hard Disk, incl. firmware | R&S®RTE-B18 | 1317.7002.02 |
| Bandwidth upgrade ¹¹ | | |
| Upgrade of R&S®RTE1022/1024 to 350 MHz bandwidth | R&S®RTE-B200 | 1326.1384.02 |
| Upgrade of R&S®RTE1022/1024 to 500 MHz bandwidth | R&S®RTE-B201 | 1326.1390.02 |
| Upgrade of R&S®RTE1022/1024 to 1 GHz bandwidth | R&S®RTE-B202 | 1326.1403.02 |
| Upgrade of R&S®RTE1022/1024 to 1.5 GHz bandwidth | R&S®RTE-B203 | 1326.1410.02 |
| Upgrade of R&S®RTE1022/1024 to 2 GHz bandwidth | R&S®RTE-B204 | 1326.1426.02 |
| Upgrade of R&S®RTE1032/1034 to 500 MHz bandwidth | R&S®RTE-B205 | 1326.1432.02 |
| Upgrade of R&S®RTE1032/1034 to 1 GHz bandwidth | R&S®RTE-B206 | 1326.1449.02 |
| Upgrade of R&S®RTE1032/1034 to 1.5 GHz bandwidth | R&S®RTE-B207 | 1326.1455.02 |
| Upgrade of R&S®RTE1032/1034 to 2 GHz bandwidth | R&S®RTE-B208 | 1326.1461.02 |
| Upgrade of R&S®RTE1052/1054 to 1 GHz bandwidth | R&S®RTE-B209 | 1326.1478.02 |
| Upgrade of R&S®RTE1052/1054 to 1.5 GHz bandwidth | R&S®RTE-B210 | 1326.1484.02 |
| Upgrade of R&S®RTE1052/1054 to 2 GHz bandwidth | R&S®RTE-B211 | 1326.1490.02 |
| Upgrade of R&S®RTE1102/1104 to 1.5 GHz bandwidth | R&S®RTE-B212 | 1326.1503.02 |
| Upgrade of R&S®RTE1102/1104 to 2 GHz bandwidth | R&S®RTE-B213 | 1326.1510.02 |
| Upgrade of R&S®RTE1152/1154 to 2 GHz bandwidth | R&S®RTE-B214 | 1326.1526.02 |
| Software options | | |
| Serial triggering and decoding | | |
| I ² C/SPI Serial Triggering and Decoding | R&S®RTE-K1 | 1326.1178.02 |
| UART/RS-232/RS-422/RS-485 Serial Triggering and Decoding | R&S®RTE-K2 | 1326.1184.02 |
| CAN/LIN Serial Triggering and Decoding | R&S®RTE-K3 | 1326.1190.02 |
| FlexRay™ Serial Triggering and Decoding | R&S®RTE-K4 | 1326.1203.02 |
| I ² S Serial Triggering and Decoding | R&S®RTE-K5 | 1326.1210.02 |
| MIL-STD-1553 Serial Triggering and Decoding | R&S®RTE-K6 | 1326.1226.02 |
| ARINC 429 Triggering and Decoding | R&S®RTE-K7 | 1326.1232.02 |
| Ethernet Serial Decoding | R&S®RTE-K8 | 1326.1332.02 |
| CAN-FD Serial Triggering and Decoding | R&S®RTE-K9 | 1326.1249.02 |
| SENT Serial Triggering and Decoding | R&S®RTE-K10 | 1326.1603.02 |
| Manchester and NRZ Serial Triggering and Decoding | R&S®RTE-K50 | 1326.1326.02 |
| MDIO Serial Triggering and Decoding | R&S®RTE-K55 | 1326.1255.02 |
| IEEE 100BASE-T1 Serial Triggering and Decoding | R&S®RTE-K57 | 1333.0609.02 |
| USB 1.0/1.1/2.0/HSIC Serial Triggering and Decoding | R&S®RTE-K60 | 1326.1610.02 |
| USB Power Delivery Serial Triggering and Decoding | R&S®RTE-K63 | 1326.3158.02 |
| SpaceWire Serial Triggering and Decoding | R&S®RTE-K65 | 1326.2845.02 |
| CXPI Serial Triggering and Decoding | R&S®RTE-K76 | 1326.3193.02 |

¹¹ The bandwidth upgrade is performed at a Rohde & Schwarz service center, where the oscilloscope will also be calibrated.

| Designation | Type | Order No. |
|---|--------------|--------------|
| Analysis | | |
| Spectrum Analysis | R&S®RTE-K18 | 1326.3006.02 |
| Power Analysis | R&S®RTE-K31 | 1326.1278.02 |
| Probes | | |
| 500 MHz, passive, 10:1, 1 MΩ 9.5 pF, max. 400 V | R&S®RT-ZP10 | 1409.7550.00 |
| 400 MHz, passive, high-voltage, 100:1, 50 MΩ 7.5 pF, 1 kV (RMS) | R&S®RT-ZH10 | 1409.7720.02 |
| 400 MHz, passive, high-voltage, 1000:1, 50 MΩ 7.5 pF, 1 kV (RMS) | R&S®RT-ZH11 | 1409.7737.02 |
| 1.0 GHz, active, 1 MΩ 0.8 pF | R&S®RT-ZS10E | 1418.7007.02 |
| 1.0 GHz, active, 1 MΩ 0.8 pF, R&S®ProbeMeter, micro button | R&S®RT-ZS10 | 1410.4080.02 |
| 1.5 GHz, active, 1 MΩ 0.8 pF, R&S®ProbeMeter, micro button | R&S®RT-ZS20 | 1410.3502.02 |
| 3.0 GHz, active, 1 MΩ 0.8 pF, R&S®ProbeMeter, micro button | R&S®RT-ZS30 | 1410.4309.02 |
| 100 MHz, high-voltage, active, differential, 8 MΩ 3.5 pF, 1 kV (RMS) (CAT III) | R&S®RT-ZD01 | 1422.0703.02 |
| 1.0 GHz, active, differential, 1 MΩ 0.6 pF, R&S®ProbeMeter, micro button | R&S®RT-ZD10 | 1410.4715.02 |
| 1.5 GHz, active, differential, 1 MΩ 0.6 pF, R&S®ProbeMeter, micro button | R&S®RT-ZD20 | 1410.4409.02 |
| 3.0 GHz, active, differential, 1 MΩ 0.6 pF, R&S®ProbeMeter, micro button | R&S®RT-ZD30 | 1410.4609.02 |
| 10 MHz, current, AC/DC, 0.01 V/A, 150 A (RMS) | R&S®RT-ZC10 | 1409.7750K02 |
| 100 MHz, current, AC/DC, 0.1 V/A, 30 A (RMS) | R&S®RT-ZC20 | 1409.7766K02 |
| 120 MHz, AC/DC, 1 V/A, 5 A (RMS) | R&S®RT-ZC30 | 1409.7772K02 |
| 2 MHz, current, AC/DC, 0.01 V/A, 500 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC05B | 1409.8204.02 |
| 10 MHz, current, AC/DC, 0.01 V/A, 150 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC10B | 1409.8210.02 |
| 50 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC15B | 1409.8227.02 |
| 100 MHz, current, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC20B | 1409.8233.02 |
| Multi-Channel Power Probe, 2 x 2 voltage/current channels, for R&S®RTO2000/R&S®RTE | R&S®RT-ZVC02 | 1326.0259.02 |
| Multi-Channel Power Probe, 2 x 4 voltage/current channels, for R&S®RTO2000/R&S®RTE | R&S®RT-ZVC04 | 1326.0259.04 |
| Probe accessories | | |
| Accessory Set for R&S®RTE-ZP10 passive probe (2.5 mm probe tip) | R&S®RT-ZA1 | 1409.7566.02 |
| Spare Accessory Set for R&S®RT-ZS10/10E/20/30 | R&S®RT-ZA2 | 1416.0405.02 |
| Pin Set for R&S®RT-ZS10/10E/20/30 | R&S®RT-ZA3 | 1416.0411.02 |
| Mini Clips | R&S®RT-ZA4 | 1416.0428.02 |
| Micro Clips | R&S®RT-ZA5 | 1416.0434.02 |
| Lead Set | R&S®RT-ZA6 | 1416.0440.02 |
| Pin Set for R&S®RT-ZD10/20/30 | R&S®RT-ZA7 | 1417.0609.02 |
| Pin Set for R&S®RT-ZD40 | R&S®RT-ZA8 | 1417.0867.02 |
| Adapter SMA(f) to BNC(m) | R&S®RT-ZA10 | 1416.0457.02 |
| Probe Power Supply | R&S®RT-ZA13 | 1409.7789.02 |
| External Attenuator, incl. adjustment tool | R&S®RT-ZA15 | 1410.4744.02 |
| Extended Cable Set for R&S®RT-ZVC, PCB probing, 1 current and voltage lead, length: 32 cm | R&S®RT-ZA30 | 1333.1686.02 |
| Extended Cable Set for R&S®RT-ZVC, 4 mm probing, 1 current and voltage lead, length: 32 cm | R&S®RT-ZA31 | 1333.1692.02 |
| Oscilloscope Interface Cable for R&S®RT-ZVC (included in R&S®RT-ZVC02/-ZVC04, 1326.0259.02/.04) | R&S®RT-ZA33 | 1333.1770.02 |
| Extended Cable Set for R&S®RT-ZVC, 4 mm probing, 1 current and voltage lead, length: 1 m | R&S®RT-ZA34 | 1333.1892.02 |
| Extended Cable Set for R&S®RT-ZVC, PCB probing, 1 current and voltage lead, length: 1 m | R&S®RT-ZA35 | 1333.1905.02 |
| Solder-in Cable Set for R&S®RT-ZVC, 4 current and voltage solder-in cables, solder-in pins | R&S®RT-ZA36 | 1333.1911.02 |
| Extended Cable Set for R&S®RT-ZVC, BNC connector, 1 current and voltage lead, length: 16 cm | R&S®RT-ZA37 | 1337.9130.02 |
| Accessories | | |
| Front Cover, for R&S®RTO/RTE digital oscilloscopes | R&S®RTO-Z1 | 1317.6970.02 |
| Soft Case, for R&S®RTO/RTE digital oscilloscopes and accessories | R&S®RTO-Z3 | 1304.9118.02 |
| Transit Case, for R&S®RTO/RTE digital oscilloscopes and accessories | R&S®RTO-Z4 | 1317.7025.02 |
| Probe Pouch, for R&S®RTO/RTE digital oscilloscopes | R&S®RTO-Z5 | 1317.7031.02 |
| Probe Deskew and Calibration Test Fixture | R&S®RT-ZF20 | 1800.0004.02 |
| Compact Probe Set for E and H Near-Field Measurements, 30 MHz to 3 GHz | R&S®HZ-15 | 1147.2736.02 |
| 3 GHz, 20 dB Preamplifier, 100 V to 230 V Power Adapter, for R&S®HZ-15 | R&S®HZ-16 | 1147.2720.02 |
| 19" Rackmount Kit, for R&S®RTO/RTE digital oscilloscopes with 6 HU | R&S®ZZA-RTO | 1304.8286.02 |

| Warranty | | |
|---|---------|---|
| Base unit | | 3 years |
| All other items ¹² | | 1 year |
| Options | | |
| Extended Warranty, one year | R&S®WE1 | Please contact your local Rohde & Schwarz sales office. |
| Extended Warranty, two years | R&S®WE2 | |
| Extended Warranty with Calibration Coverage, one year | R&S®CW1 | |
| Extended Warranty with Calibration Coverage, two years | R&S®CW2 | |
| Extended Warranty with Accredited Calibration Coverage, one year | R&S®AW1 | |
| Extended Warranty with Accredited Calibration Coverage, two years | R&S®AW2 | |

Extended warranty with a term of one and two years (WE1 and WE2)

Repairs carried out during the contract term are free of charge ¹³. Necessary calibration and adjustments carried out during repairs are also covered.

Extended warranty with calibration coverage (CW1 and CW2)

Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs ¹³ and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

Extended warranty with accredited calibration (AW1 and AW2)

Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs ¹³ and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

¹² For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

¹³ Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

Service that adds value

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
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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.

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Certified Environmental Management

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Thurlby Thandar Instrument Distribution
Glebe Road, Huntingdon, PE29 7DR, UK
+44 (0)1480 412 451
sales@ttid.co.uk
www.ttid.co.uk



Rohde & Schwarz GmbH & Co. KG

www.rohde-schwarz.com

Rohde & Schwarz training

www.training.rohde-schwarz.com

Regional contact

- | Europe, Africa, Middle East | +49 89 4129 12345
customersupport@rohde-schwarz.com
- | North America | 1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
- | Latin America | +1 410 910 79 88
customersupport.la@rohde-schwarz.com
- | Asia Pacific | +65 65 13 04 88
customersupport.asia@rohde-schwarz.com
- | China | +86 800 810 82 28 | +86 400 650 58 96
customersupport.china@rohde-schwarz.com

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R&S® RTE Digital Oscilloscope

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