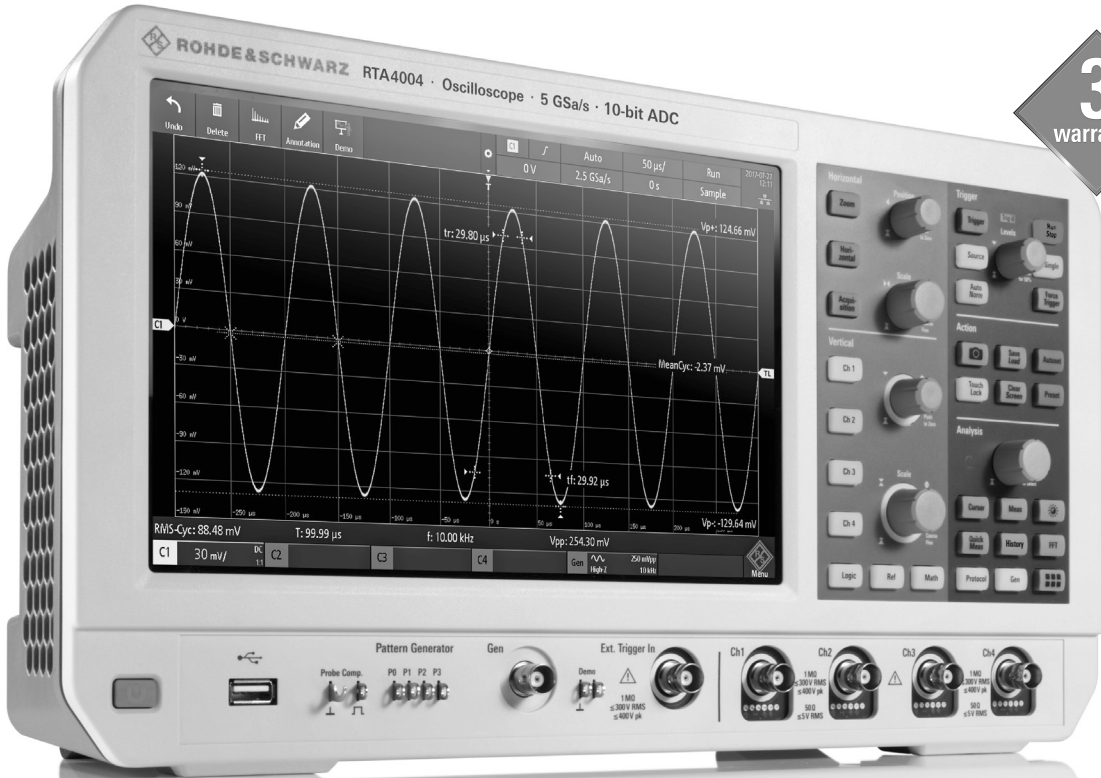


# R&S® RTA4000

## Oscilloscope

### Specifications

**3** year warranty



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# Definitions

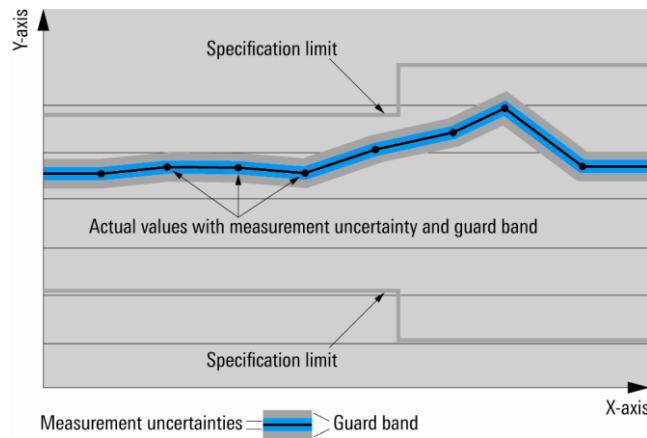
## General

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.

In line with the 3GPP/3GPP2 standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in Mbps (million bits per second), kbps (thousand bits per second), Msps (million symbols per second) or ksp/s (thousand symbols per second), and sample rates are specified in Msample/s (million samples per second). Mcps, Mbps, Msps, kbps, ksp/s and Msample/s are not SI units.

# Base unit

## Vertical system

|  |   |  |
|--|---|--|
| Input channels   | R&S®RTA4004   | 4 channels   |
| Input impedance  |   | 50 Ω ± 1.5 % (meas.)<br>1 MΩ ± 1 %    14 pF ± 1 pF (meas.)                                     |
| Analog bandwidth (–3 dB)   | at 50 Ω input impedance   |  |
|  | R&S®RTA4004   | > 200 MHz  |
|  | R&S®RTA4004 with -B243 option   | > 350 MHz  |
|  | R&S®RTA4004 with -B245 option   | > 500 MHz  |
|  | R&S®RTA4004 with -B2410 option  | > 1 GHz  |
|  | at 1 MΩ input impedance   |  |
|  | R&S®RTA4004 with  | > 200 MHz (meas.)  |
|  | R&S®RTA4004 with -B243 option   | > 350 MHz (meas.)  |
|  | R&S®RTA4004 with -B245 option   | > 500 MHz (meas.)  |
|  | R&S®RTA4004 with -B2410 option  | > 500 MHz (meas.)  |
| Lower frequency limit (–3 dB)  | at AC coupling  | < 5 Hz (meas.)   |
| Analog bandwidth limits  | at 50 Ω input impedance   |  |
|  | R&S®RTA4004   | 20 MHz, 100 MHz  |
|  | R&S®RTA4004 with -B243 option   | 20 MHz, 100 MHz, 200 MHz   |
|  | R&S®RTA4004 with -B245 option   | 20 MHz, 100 MHz, 200 MHz, 350 MHz  |
|  | R&S®RTA4004 with -B2410 option  | 20 MHz, 100 MHz, 200 MHz, 350 MHz,<br>500 MHz  |
|  | at 1 MΩ input impedance   |  |
|  | R&S®RTA4004   | 20 MHz, 100 MHz  |
|  | R&S®RTA4004 with -B243 option   | 20 MHz, 100 MHz, 200 MHz   |
|  | R&S®RTA4004 with -B245 option and<br>R&S®RTA4004 with -B2410 option   | 20 MHz, 100 MHz, 200 MHz, 350 MHz  |
|  | Rise time (calculated)  | R&S®RTA4004  |
| R&S®RTA4004 with -B243 option  |   | < 1 ns   |
| R&S®RTA4004 with -B245 option  |   | < 700 ps   |
| R&S®RTA4004 with -B2410 option   |   | < 350 ps   |
| Vertical resolution  |   | 10 bit, up to 16 bit with high resolution decimation   |
| DC gain accuracy   | offset and position = 0<br>maximum operating temperature change of ±5 °C after self-alignment   |  |
|  | input sensitivity > 5 mV/div  | ±1 %   |
|  | input sensitivity<br>≤ 5 mV/div to ≥ 1 mV/div   | ±1.5 %   |
|  | input sensitivity < 1 mV/div  | ±2.5 %   |
| Input coupling   |   | DC, AC, GND  |
| Input sensitivity  | at 50 Ω   | 0.5 mV/div to 1 V/div  |
|  | at 1 MΩ   | 0.5 mV/div to 10 V/div   |
| Maximum input voltage  | at 50 Ω   | 5 V (RMS), max. 30 V (V <sub>p</sub> )   |
|  | at 1 MΩ   | 300 V (RMS), 400 V (V <sub>p</sub> ), derates at<br>20 dB/decade to 5 V (RMS) above<br>250 kHz |
| Position range   |   | ±5 div   |
| Offset range at 50 Ω   | input sensitivity   |  |
|  | ≥ 112 mV/div to 1 V/div   | ±(30 V – 5 div × input sensitivity)  |
|  | ≥ 33.8 mV/div to 111 mV/div<br>0.5 mV/div to 33.6 mV/div  | ±(10 V – 5 div × input sensitivity)<br>±(2 V – 5 div × input sensitivity)                      |
| Offset range at 1 MΩ   | input sensitivity   |  |
|  | ≥ 515 mV/div to 10 V/div  | ±(250 V – 5 div × input sensitivity)   |
|  | ≥ 50.5 mV/div to 510 mV/div<br>0.5 mV/div to 50 mV/div  | ±(25 V – 5 div × input sensitivity)<br>±(2 V – 5 div × input sensitivity)                      |
| Offset accuracy  |   | ±(0.5 % ×  offset  +<br>0.1 div × input sensitivity + 0.5 mV)                                  |
| DC measurement accuracy  | after adequate suppression of<br>measurement noise by using either high-<br>resolution sampling mode or waveform<br>averaging, or a combination of both | ±(DC gain accuracy ×  reading – net<br>offset  + offset accuracy)                              |
| Channel-to-channel isolation<br>(each channel at same input sensitivity) | input frequency < analog bandwidth  | > 50 dB  |

|   |                   |         |                           |                           |                            |
|---|-------------------|---------|---------------------------|---------------------------|----------------------------|
| RMS noise floor at 1 M $\Omega$ (meas.) | Input sensitivity | R&S®    |                           |                           |                            |
|   |                   | RTA4004 | RTA4004 with -B243 option | RTA4004 with -B245 option | RTA4004 with -B2410 option |
|   | 10 V/div          | 226 mV  | 250 mV                    | 298 mV                    | 298 mV                     |
|   | 5 V/div           | 124 mV  | 132 mV                    | 182 mV                    | 182 mV                     |
|   | 2 V/div           | 53.1 mV | 58.7 mV                   | 81.5 mV                   | 81.5 mV                    |
|   | 1 V/div           | 29.1 mV | 32.9 mV                   | 45.6 mV                   | 45.6 mV                    |
|   | 500 mV/div        | 12.4 mV | 13.2 mV                   | 18.2 mV                   | 18.2 mV                    |
|   | 200 mV/div        | 5.3 mV  | 5.9 mV                    | 8.2 mV                    | 8.2 mV                     |
|   | 100 mV/div        | 3.0 mV  | 3.4 mV                    | 4.7 mV                    | 4.7 mV                     |
|   | 50 mV/div         | 1.2 mV  | 1.2 mV                    | 1.6 mV                    | 1.6 mV                     |
|   | 20 mV/div         | 0.54 mV | 0.59 mV                   | 0.83 mV                   | 0.83 mV                    |
|   | 10 mV/div         | 0.28 mV | 0.32 mV                   | 0.44 mV                   | 0.44 mV                    |
|   | 5 mV/div          | 0.16 mV | 0.19 mV                   | 0.25 mV                   | 0.25 mV                    |
|   | 2 mV/div          | 0.11 mV | 0.14 mV                   | 0.19 mV                   | 0.19 mV                    |
|   | 1 mV/div          | 0.09 mV | 0.10 mV                   | 0.13 mV                   | 0.13 mV                    |
|   | 0.5 mV/div        | 0.09 mV | 0.10 mV                   | 0.13 mV                   | 0.13 mV                    |
| RMS noise floor at 50 $\Omega$ (meas.)  | Input sensitivity | R&S®    |                           |                           |                            |
|   |                   | RTA4004 | RTA4004 with -B243 option | RTA4004 with -B245 option | RTA4004 with -B2410 option |
|   | 1 V/div           | 22.7 mV | 22.8 mV                   | 25.1 mV                   | 31.4 mV                    |
|   | 500 mV/div        | 12.6 mV | 13.7 mV                   | 15.4 mV                   | 19.8 mV                    |
|   | 200 mV/div        | 5.5 mV  | 6.2 mV                    | 7.0 mV                    | 9.1 mV                     |
|   | 100 mV/div        | 2.7 mV  | 3.0 mV                    | 3.4 mV                    | 4.6 mV                     |
|   | 50 mV/div         | 1.4 mV  | 1.6 mV                    | 1.8 mV                    | 2.4 mV                     |
|   | 20 mV/div         | 0.53 mV | 0.58 mV                   | 0.65 mV                   | 0.86 mV                    |
|   | 10 mV/div         | 0.26 mV | 0.28 mV                   | 0.32 mV                   | 0.41 mV                    |
|   | 5 mV/div          | 0.15 mV | 0.18 mV                   | 0.20 mV                   | 0.27 mV                    |
|   | 2 mV/div          | 0.07 mV | 0.09 mV                   | 0.10 mV                   | 0.13 mV                    |
|   | 1 mV/div          | 0.06 mV | 0.07 mV                   | 0.08 mV                   | 0.11 mV                    |
|   | 0.5 mV/div        | 0.05 mV | 0.07 mV                   | 0.08 mV                   | 0.11 mV                    |

## Horizontal system

|                         |                                       |   |
|-------------------------|---------------------------------------|---|
| Timebase range          |                                       | selectable between<br>0.5 ns/div and 500 s/div            |
| Channel deskew          |                                       | ±500 ns   |
| Trigger offset range    | minimum                               | $\frac{\text{memory depth}}{\text{actual sampling rate}}$ |
|                         | maximum                               | $\frac{2^{33}}{\text{actual sampling rate}}$              |
| Modes                   |                                       | normal, roll  |
| Channel-to-channel skew |                                       | < 200 ps (meas.)  |
| Timebase accuracy       | after delivery/calibration, at +23 °C | ±0.5 ppm  |
|                         | during calibration interval           | ±1 ppm  |

## Acquisition system

|                                |  |   |
|--------------------------------|--|---|
| Maximum realtime sampling rate | normal mode  | 2.5 Gsample/s   |
|                                | interleaved mode,<br>if following channels are not used<br>simultaneously:<br><ul style="list-style-type: none"> <li>• channel 1 and channel 2</li> <li>• channel 3 and channel 4</li> <li>• logic channels</li> </ul> | 5 Gsample/s   |
| Memory depth per channel       | normal mode  | 100 Msample per channel                                     |
|                                | interleaved mode,<br>if following channels are not used<br>simultaneously:<br><ul style="list-style-type: none"> <li>• channel 1 and channel 2</li> <li>• channel 3 and channel 4</li> <li>• logic channels</li> </ul> | 200 Msample per channel                                     |
| Acquisition modes              | sample   | first sample in decimation interval                         |
|                                | peak detect  | largest and smallest sample in decimation interval          |
|                                | high resolution  | average value of all samples in decimation interval         |
|                                | envelope   | envelope of acquired waveforms                              |
|                                | average  | average over a series of acquired waveforms                 |
|                                | envelope + peak detect   | envelope of acquired waveforms with active peak detect      |
|                                | envelope + high resolution   | envelope of acquired waveforms with active high resolution  |
|                                | average + high resolution  | average over a series of acquired high resolution waveforms |
| Number of averaged waveforms   |  | 2 to 100 000  |
| Waveform acquisition rate      | dot display, single channel, auto record length  | up to 64 000 waveforms/s                                    |

## Trigger system

|                |                               |  |
|----------------|-------------------------------|--|
| Trigger level  | range                         | $\pm 5$ div from center of screen  |
| Trigger modes  |                               | auto, normal, single, n single   |
| Hold-off range | time                          | inactive or 51.2 ns to 13.7 s  |
| Trigger types  |                               | edge, width, video, pattern, runt, rise time, fall time, serial bus, line, timeout   |
| Edge trigger A | trigger events<br>R&S®RTA4004 | rising edge, falling edge, both edges<br>channel 1, channel 2, channel 3,<br>channel 4, logic channels from D15 to D0<br>(with R&S®RTA-B1 option), external<br>trigger input |
|                | trigger coupling              | DC,<br>AC (attenuates < 10 Hz (meas.)),<br>LF reject (attenuates < 10 kHz (meas.))   |
|                | trigger filter                | HF reject (attenuates > 100 kHz (meas.)),<br>noise reject (attenuates > 100 MHz<br>(meas.))  |
|                | selectable trigger hysteresis | automatic, small, medium, large  |

|   |   |  |
|---|---|--|
| Trigger A sensitivity hysteresis mode automatic | with DC, AC, LF reject, noise reject<br>1 GHz, 500 MHz, 350 MHz | $> \frac{2.2 mV_{pp}}{\text{input sensitivity}} + 1 \text{ div (nom.)}$<br>(input sensitivity: [mV/div])   |
|   | 200 MHz, 100 MHz  | $> \frac{1.5 mV_{pp}}{\text{input sensitivity}} + 0.8 \text{ div (nom.)}$<br>(input sensitivity: [mV/div]) |
|   | 20 MHz  | $> \frac{0.6 mV_{pp}}{\text{input sensitivity}} + 0.4 \text{ div (nom.)}$<br>(input sensitivity: [mV/div]) |
|   | with HF reject  |  |
|   | all input sensitivities   | 1 div (meas.)  |
| Edge trigger A and B                            | trigger events  | rising edge, falling edge, both edges  |
|   | sources for A trigger   |  |
|   | R&S®RTA4004   | channel 1, channel 2, channel 3,<br>channel 4, logic channels from D15 to D0<br>(with R&S®RTA-B1 option)   |
|   | trigger coupling of A trigger                                   | DC   |
|   | sources for B trigger   |  |
|   | R&S®RTA4004   | channel 1, channel 2, channel 3,<br>channel 4, logic channels from D15 to D0<br>(with R&S®RTA-B1 option)   |
|   | trigger coupling of B trigger                                   | DC   |
|   | selectable trigger hysteresis for A and B trigger               | small, medium, large   |
|   | trigger B mode  | after time or after events   |
|   | trigger B minimum time  | 3.2 ns   |
|   | trigger B maximum time  | 100 s  |
| Width trigger                                   | trigger B events  | 1 to 65535   |
|   | trigger events  | pulse width is smaller, greater, equal,<br>unequal, inside interval, outside interval                      |
|   | minimum pulse width   | 3.2 ns   |
|   | maximum pulse width   | 6.8 s  |
|   | polarity  | positive, negative   |
|   | sources   |  |
|   | R&S®RTA4004   | channel 1, channel 2, channel 3,<br>channel 4, logic channels from D15 to D0<br>(with R&S®RTA-B1 option)   |
| selectable trigger hysteresis                   | small, medium, large  |  |
| Timeout trigger                                 | trigger events  | greater than timeout   |
|   | minimum timeout   | 3.2 ns   |
|   | maximum timeout   | 6.8 s  |
|   | polarity  | stays high, stays low, stays high or low   |
|   | sources   |  |
|   | R&S®RTA4004   | channel 1, channel 2, channel 3,<br>channel 4, logic channels from D15 to D0<br>(with R&S®RTA-B1 option)   |
| selectable trigger hysteresis                   | small, medium, large  |  |
| Video trigger                                   | trigger events  | selectable line, all lines, even frame,<br>odd frame, all frames   |
|   | supported standards   | PAL, NTSC, SECAM, PAL-M, SDTV 576i,<br>HDTV 720p, HDTV 1080i, HDTV 1080p                                   |
|   | sources   |  |
|   | R&S®RTA4004   | channel 1, channel 2, channel 3,<br>channel 4, ext. trigger input  |
|   | sync pulse polarity   | positive, negative   |

|                        |                                       |   |
|------------------------|---------------------------------------|---|
| Pattern trigger        | trigger events                        | logic condition between active channels   |
|                        | sources                               |   |
|                        | R&S®RTA4004                           | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)  |
|                        | state of channels                     | high, low, don't care   |
|                        | logic between channels                | and/or  |
|                        | condition                             | true, false   |
|                        | duration condition                    | smaller, greater, equal, unequal, inside interval, outside interval, timeout  |
|                        | minimum duration time                 | 3.2 ns  |
| maximum duration time  | 6.8 s                                 |   |
| Runt trigger           |                                       | 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 |
| Rise time, fall time   | trigger events                        | time between the crossing of two selectable levels is smaller, greater, equal, unequal, inside interval, outside interval                                       |
|                        | minimum rise time                     | 3.2 ns  |
|                        | maximum rise time                     | 6.8 s   |
|                        | polarity                              | rising edge, falling edge, both edges   |
|                        | sources                               |   |
|                        | R&S®RTA4004                           | channel 1, channel 2, channel 3, channel 4  |
| Serial bus trigger     | supported standards                   |   |
|                        | R&S®RTA-K1 option                     | I <sup>2</sup> C, SSPI (two-wire, MOSI/MISO), SPI (three-wire, MOSI/MISO)   |
|                        | R&S®RTA-K2 option                     | UART/RS-232/RS-422/RS-485 (RX/TX)   |
|                        | R&S®RTA-K3 option                     | CAN/LIN   |
|                        | R&S®RTA-K5 option                     | audio (I <sup>2</sup> S, LJ, RJ, TDM)   |
|                        | R&S®RTA-K6 option                     | MIL-STD-1553  |
| R&S®RTA-K7 option      | ARINC 429                             |   |
| External trigger input | input impedance                       | 1 M $\Omega$ $\pm$ 1 % with 14 pF $\pm$ 2 pF (meas.)  |
|                        | maximum input voltage at 1 M $\Omega$ | 300 V (RMS), 400 V (V <sub>p</sub> ), derates at 20 dB/decade to 5 V (RMS) above 250 kHz  |
|                        | trigger level                         | $\pm$ 5 V   |
|                        | sensitivity                           | > 300 mV (V <sub>pp</sub> )   |
|                        | coupling                              | DC, AC, LF reject   |
| Trigger output         | functionality                         | A pulse is generated for every acquisition trigger event.   |
|                        | output voltage                        |   |
|                        | at high impedance                     | 0 V to 4.8 V  |
|                        | at 50 $\Omega$                        | 0 V to 2.4 V  |
| pulse polarity         | high active                           |   |



## Waveform measurements

|                        |   |   |
|------------------------|---|---|
| Automatic measurements | measurements on channels, math waveforms, reference waveforms | burst width, count positive pulses, count negative pulses, count falling edges, count rising edges, mean value, RMS cycle, RMS, mean cycle, peak+, peak-, frequency, period, amplitude, base level, positive overshoot, negative overshoot, pulse width, duty cycle+, duty cycle-, rise time, fall time, delay, phase, crest factor, slew rate+, slew rate- |
|                        | reference levels  | lower, middle and upper level in percentage   |
|                        | statistics  | maximum, minimum, mean, standard deviation and measurement count for each automatic measurement   |
|                        | number of active measurements                                 | 8   |
| Cursor measurements    | type  | vertical, horizontal, vertical and horizontal, V-marker   |
|                        | functions   | x and y tracking, coupling of cursors, set to trace, set to screen  |
| Quick measurements     | function  | fast overview of measurements from one channel, some measurements displayed with result lines in diagram  |
|                        | sources   |   |
|                        | R&S®RTA4004   | channel 1, channel 2, channel 3, channel 4  |
|                        | measurements displayed in diagram                             | mean, max. peak, min. peak, rise time, fall time  |
|                        | numerically displayed measurements                            | RMS cycle, peak-to-peak voltage, period, frequency  |

## Digital voltmeter

|                        |             |   |
|------------------------|-------------|---|
| Accuracy               |             | related to channel settings of voltmeter source |
| Measurements           |             | DC, AC+DC RMS, AC RMS                           |
|                        | R&S®RTA4004 | channel 1, channel 2, channel 3, channel 4      |
| Number of measurements |             | up to 4   |
| Resolution             |             | up to 3 digits                                  |
| Bandwidth              |             | 1 MHz   |

## Counter

|                        |             |   |
|------------------------|-------------|---|
| Measurements           |             | frequency, period   |
|                        | R&S®RTA4004 | channel 1, channel 2, channel 3, channel 4, trigger signal source             |
| Number of measurements |             | 2   |
| Resolution             |             | 7 digits  |
| Frequency range        |             | 0.05 Hz to bandwidth of oscilloscope (limited by bandwidth of trigger filter) |

## Mask testing

|                           |             |   |
|---------------------------|-------------|---|
|                           | R&S®RTA4004 | channel 1, channel 2, channel 3, channel 4  |
| Mask definition           |             | acquired waveform with user-defined tolerance, can be stored and restored                       |
| Result statistics         |             | completed acquisitions, passed and failed acquisitions (absolute and in percent), test duration |
| Actions on mask violation |             | sound, acquisition stop, screenshot, save waveform, pulse out (AUX OUT connector)               |
| Captured segments         |             | all segments, failed segments   |

## Waveform maths

|                          |             |  |
|--------------------------|-------------|--|
| Number of math equations |             | up to 5  |
| Functions                |             | addition, subtraction, multiplication, division, square, square root, absolute value, reciprocal, inverse, log10, ln, derivation, integration, low pass, high pass |
|                          | R&S®RTA4004 | channel 1, channel 2, channel 3, channel 4, math waveforms 1 to 4  |

## Fast Fourier transformation (FFT)

|                     |             |  |
|---------------------|-------------|--|
|                     | R&S®RTA4004 | channel 1, channel 2, channel 3, channel 4, math waveforms, references   |
| Setup parameters    |             | start frequency, stop frequency, center frequency, frequency span, vertical scale, vertical position, resolution bandwidth, gate (time range and position) |
| Windows             |             | Hanning, Hamming, Blackman, rectangular, flat top  |
| Waveform arithmetic |             | none, min. hold, max. hold, average (selectable 2 to 1024)   |

## Search function

|           |   |   |
|-----------|---|---|
| Functions | search types                            | edge, width, peak, rise/fall time, runt, data2clock, pattern, window, protocol (available with R&S®RTA-K3, R&S®RTA-K6 and R&S®RTA-K7 options) |
|           | configuration                           | manual level setting on screen, level with selectable hysteresis  |
|           | display of search events                | up to 10 000 events in diagram and in result table  |
|           | markers on search events                | up to 32 markers  |
|           | navigation in search events (stop mode) | knob (if result table is active)  |
|           | R&S®RTA4004                             | channel 1, channel 2, channel 3, channel 4, math waveforms from 1 to 5, D15 to D0 (with R&S®RTA-B1 option)                                    |

## Display characteristics

|                      |  |  |
|----------------------|--|--|
| Diagram types        | manually changeable vertical window size | Yt, XY, zoom, FFT, spectrogram (with R&S®RTA-K18 option)   |
| XY mode              |  | parallel display of XY diagram and Yt diagrams of input signals for X, Y                             |
| Zoom                 |  | horizontal and vertical zoom, split screen with overview signal and zoomed signal                    |
| Interpolation        |  | sin(x)/x, linear, sample & hold  |
| FFT mode             |  | split screen with Yt diagrams and dedicated frequency diagram, spectrogram (with R&S®RTA-K18 option) |
| Waveform display     |  | lines, dots only   |
| Persistence          |  | 50 ms to 12.8 s; infinite  |
| Special display mode |  | inverse brightness, waveform color modes for analog channels (temperature, fire, rainbow)            |
| Diagram grid         |  | lines, reticle, none, with annotation, track grid  |
| Reference signals    |  | up to 4 reference signals  |

## Protocol and logic

|                            |  |   |
|----------------------------|--|---|
| Bus decode                 | number of bus signals                  | 4 <sup>1</sup>  |
|                            | bus types                              | parallel, parallel clocked  |
|                            | R&S®RTA-K1 option                      | SSPI, SPI, I <sup>2</sup> C                                       |
|                            | R&S®RTA-K2 option                      | UART/RS-232/RS-422/RS-485   |
|                            | R&S®RTA-K3 option                      | CAN, LIN  |
|                            | R&S®RTA-K5 option                      | I <sup>2</sup> S, LJ, RJ, TDM                                     |
|                            | R&S®RTA-K6 option                      | MIL-STD-1553  |
|                            | R&S®RTA-K7 option                      | ARINC 429   |
|                            | display types                          | decoded bus, logical signal, frame table (depends on decoded bus) |
| position and size          | size and position on screen selectable |   |
| data format of decoded bus | hex, decimal, binary, octal, ASCII     |   |

## History and segmented memory

|                     |   |                                     |                  |                            |
|---------------------|---|-------------------------------------|------------------|----------------------------|
| Acquisition memory  |   | automatic, predefined, manual       |                  |                            |
|                     | automatic   | automatic segment size and numbers  |                  |                            |
|                     | predefined  | defined size and automatic numbers  |                  |                            |
|                     | manual  | user-defined size and numbers       |                  |                            |
| Memory segmentation | function  | memory segments for the acquisition |                  |                            |
|                     | number of segments <sup>2</sup>   | record length                       | segments (up to) | total memory (per channel) |
|                     |   | 5 ksample                           | 87 380           | 436.9 Msample              |
|                     |   | 10 ksample                          | 87 380           | 873.8 Msample              |
|                     |   | 20 ksample                          | 43 690           | 873.8 Msample              |
|                     |   | 50 ksample                          | 17 476           | 873.8 Msample              |
|                     |   | 100 ksample                         | 9 708            | 970.8 Msample              |
|                     |   | 200 ksample                         | 5 140            | 1028 Msample               |
|                     |   | 500 ksample                         | 2 131            | 1065.5 Msample             |
|                     |   | 1 Msample                           | 1 065            | 1065 Msample               |
|                     |   | 2 Msample                           | 536              | 1072 Msample               |
|                     |   | 5 Msample                           | 214              | 1070 Msample               |
|                     |   | 10 Msample                          | 107              | 1070 Msample               |
|                     |   | 20 Msample                          | 53               | 1060 Msample               |
|                     |   | 50 Msample                          | 21               | 1050 Msample               |
| 100 Msample         | 10  | 1000 Msample                        |                  |                            |
| 200 Msample         | 5   | 1000 Msample                        |                  |                            |
|                     | Segmentation is active on all analog and logic channels, protocol decoding and spectrum analysis.   |                                     |                  |                            |
| Fast-segmented mode | continuous recording of waveforms in acquisition memory without interruption due to visualization; blind time between consecutive acquisitions less than 1.5 µs (up to 700 000 waveforms/s) |                                     |                  |                            |

<sup>1</sup> If a bidirectional bus is used (e.g. UART RX/TX or SPI MOSI/MISO), two bus decoders are occupied.

<sup>2</sup> At interleaved mode.

|              |                      |   |
|--------------|----------------------|---|
| History mode | function             | The history mode always provides access to past acquisitions in the segmented memory.   |
|              | timestamp resolution | 3.2 ns  |
|              | history player       | replays the recorded waveforms; repetition possible; adjustable speed; manual next/previous segment; numerical segment number input |
|              | analyze options      | overlay all segments, average all segments, envelope all segments   |

## Miscellaneous

|                     |                     |  |
|---------------------|---------------------|--|
| Save/recall         | device settings     | save and recall on internal file system or USB memory stick or on a PC via web interface or USB-MTP  |
|                     | reference waveforms | save and recall on internal file system or USB memory stick or on a PC via web interface or USB-MTP  |
|                     | waveforms           | save on USB memory stick or download and save on a PC via web interface or USB-MTP, available file formats: BIN, CSV, TXT float (MSB/LSB first)  |
|                     | screenshots         | save on USB memory stick or download and save on a PC via web interface or USB-MTP, available file formats: BMP, PNG   |
|                     | device settings     | save and recall on internal file system or USB memory stick or on a PC via web interface or USB-MTP  |
| Camera key          |                     | configurable camera key, actions on press: <ul style="list-style-type: none"> <li>• save screenshot</li> <li>• one-touch</li> </ul>  |
|                     | save screenshot     | one-touch off  |
|                     | one-touch           | one or more from the list: <ul style="list-style-type: none"> <li>• setup</li> <li>• screenshots (PNG, color)</li> <li>• waveforms (BIN-MSB, CI, display data)</li> <li>• references</li> <li>• search event table</li> <li>• bus table</li> <li>• statistics</li> </ul>   |
| Instrument security |                     | secure erasure of internal file system and all settings  |
| Menu languages      |                     | available menu languages: <ul style="list-style-type: none"> <li>• English</li> <li>• German</li> <li>• French</li> <li>• Spanish</li> <li>• Italian</li> <li>• Portuguese</li> <li>• Czech</li> <li>• Polish</li> <li>• Russian</li> <li>• Simplified Chinese</li> <li>• Traditional Chinese</li> <li>• Korean</li> <li>• Japanese</li> </ul> |
| Help                |                     | online help, available languages: <ul style="list-style-type: none"> <li>• English</li> </ul>  |
| Undo/Redo           |                     | deep Undo/Redo function  |

## Input and outputs

| <b>Front</b>                                       |                     |  |
|--|---------------------|--|
| Channel inputs                                     |                     | BNC, for details see Vertical system                                       |
|  | probe interface     | auto detection of passive probes, Rohde & Schwarz active probe interface   |
| External trigger input                             |                     | BNC, for details see Trigger system  |
|  | probe interface     | auto detection of passive probes   |
| Waveform generator<br>(requires R&S®RTA-B6 option) |                     | BNC, for details see R&S®RTA-B6, waveform generator, demo lug and GND lug  |
| Probe compensation output                          | signal shape        | rectangle  |
|  | frequency           | 1 kHz  |
|  | voltage             | $V_{low} = 0\text{ V}$ , $V_{high} = 1.5\text{ V to }3.3\text{ V (meas.)}$ |
| Pattern source<br>(requires R&S®RTA-B6 option)     | P3 to P0            | 4 lugs, for details see R&S®RTA-B6, 4-bit pattern generator                |
|  | frequency           | 1 mHz to 25 MHz  |
|  | voltage             | $V_{low} = 0\text{ V}$ , $V_{high} = 1.5\text{ V to }3.3\text{ V (meas.)}$ |
| Ground lug   |                     | connected to ground  |
| USB host interface                                 |                     | 1 port, type A plug, version 2.0, flash drives only                        |
| <b>Rear</b>  |                     |  |
| Ethernet interface                                 |                     | 1 port, 1 Gbit   |
| AUX OUT (BNC)                                      | trigger out,        | for details see Trigger system   |
|  | reference frequency | 10 MHz $\pm$ 3.5 ppm (meas.)   |
|  | mask violation      | pulse  |
| USB host interface                                 |                     | 1 port, type A plug, version 2.0   |
| Fixation loop                                      |                     | for securing the instrument with a cable                                   |
| Security slot                                      |                     | for standard Kensington style lock   |
| <b>Right side</b>                                  |                     |  |
| Digital channel inputs                             | D15 to D8, D7 to D0 | requires R&S®RTA-B1 option   |

## General data

|                              |   |   |
|------------------------------|---|---|
| <b>Display</b>               |   |   |
| Type                         |   | 10.1" WXGA display with capacitive touch  |
| Resolution                   |   | 1280 × 800 pixel (WXGA)   |
| <b>Temperature</b>           |   |   |
| Temperature loading          | operating temperature range                         | 0 °C to +50 °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   |
| <b>Altitude</b>              |   |   |
| Operating                    |   | up to 3000 m above sea level  |
| Nonoperating                 |   | up to 4600 m above sea level  |
| <b>Mechanical resistance</b> |   |   |
| Vibration                    | sinusoidal  | 5 Hz to 150 Hz, max. 1.8 g at 55 Hz; 0.5 g from 55 Hz to 150 Hz, in line with EN 60068-2-6 MIL-PRF-28800F, 4.5.5.3.2 sinusoidal vibration, class 3 and 4  |
|                              | random  | 10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64, MIL-PRF-28800F, 4.5.5.3.1 random vibration, class 3 and 4  |
| Shock                        |   | 40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I, MIL-PRF-28800F, 4.5.5.4.1 functional shock, 30 g, 11 ms, halfsine  |
| <b>EMC</b>                   |   |   |
| 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 environments <sup>3</sup>  |
| Certifications               |   | VDE, cCSA <sub>US</sub> , KC  |
| Calibration interval         |   | 1 year  |
| <b>Power supply</b>          |   |   |
| AC supply                    |   | 100 V to 240 V at 50 Hz to 60 Hz, 1.6 A to 0.7 A  |
| Power consumption            |   | max. 160 W  |
| Safety                       |   | in line with <ul style="list-style-type: none"> <li>• IEC 61010-1, IEC 61010-2-030</li> <li>• EN 61010-1, EN 61010-2-030</li> <li>• CAN/CSA-C22.2 No. 61010-1</li> <li>• CAN/CSA-C22.2 No. 61010-2-030</li> <li>• UL 61010-1, UL 61010-2-030</li> </ul>           |
| <b>Mechanical data</b>       |   |   |
| Dimensions                   | W × H × D   | 390 mm × 220 mm × 152 mm (15.35 in × 8.66 in × 5.98 in)   |
| Weight                       | without options (nom.)                              | 3.3 kg (7.275 lb)   |
| Audible noise                | maximum sound pressure level at a distance of 1.0 m | 28.3 dB(A)  |

<sup>3</sup> Test criterion is displayed noise level within ±1 div for input sensitivity of 5 mV/div.

# Options

## R&S®RTA-B1

|   |  |   |
|---|--|---|
| <b>Mixed signal option</b> , additional 16 logic channels |  |   |
| Vertical system   |  |   |
| Input channels  |  | 16 logic channels (from D15 to D0)  |
| Arrangement of input channels                             |  | arranged in two logic probes with 8 channels each, assignment of the logic probes to the channels D15 to D8 and D7 to D0  |
| Input impedance   |  | 100 k $\Omega$ $\pm$ 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  |  | from D15 to D12, D11 to D8, D7 to D4 and D3 to D0   |
| Threshold level   | user range<br>predefined   | $\pm$ 8 V in 25 mV steps<br>CMOS 2.5 V, TTL 1.4 V, ECL -1.3 V   |
| Threshold accuracy  |  | $\pm$ (100 mV + 3 % of threshold setting)   |
| Comparator hysteresis                                     |  | small, medium, large  |
| Horizontal system   |  |   |
| Channel deskew  | range for each channel   | $\pm$ 500 ns  |
| Channel-to-channel skew                                   |  | < 200 ps (meas.) for same vertical settings on the channels   |
| Acquisition system  |  |   |
| Sampling rate   | two logic probes<br>one logic probe                                    | 2.5 Gsample/s on each channel<br>5 Gsample/s on each channel  |
| Memory depth  | two logic probes<br>one logic probe                                    | 100 Msample for every channel<br>200 Msample for every channel  |
| Trigger system  |  | see chapter Trigger system of the base unit   |
| Waveform measurements                                     |  |   |
| Measurement sources                                       |  | all channels from D15 to D0   |
| 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 hex. value at the cursor position  |
| Display characteristics                                   |  |   |
| Channel activity display                                  |  | independent of the oscilloscope acquisition, the state (stays low, stays high or toggles) of the channels from D15 to D0 is displayed   |

## R&amp;S®RTA-B6

| <b>Waveform generator and 4-bit pattern generator</b> |                               |   |
|---|-------------------------------|---|
| <b>Waveform generator</b>                             |                               |   |
| Resolution  |                               | 14 bit  |
| Sample rate   |                               | 250 Msample/s   |
| Output impedance                                      |                               | 50 $\Omega$ $\pm$ 1 % (meas.)   |
| Amplitude   | level                         |   |
|   | in to high Z                  | 20 mV to 10 V ( $V_{pp}$ )  |
|   | in to 50 $\Omega$             | 10 mV to 5 V ( $V_{pp}$ )   |
|   | accuracy                      | 1.5 %   |
| DC offset   | level                         |   |
|   | in to high Z                  | $\pm$ 5 V   |
|   | in to 50 $\Omega$             | $\pm$ 2.5 V   |
|   | accuracy                      | 1.5 % or $\pm$ 3 mV whatever is greater   |
| DC  |                               |   |
| Sine  | frequency                     | 0.1 Hz to 25 MHz  |
|   | SFDR                          | > 40 dBc (meas.)  |
|   | THD                           | > 40 dBc (meas.)  |
| Pulse, rectangle                                      | frequency                     | 0.1 Hz to 10 MHz  |
| Ramp, triangle, sinc, exponential                     | frequency                     | 0.1 Hz to 1 MHz   |
| Arbitrary   | sample rate                   | max. 10 Msample/s   |
|   | memory depth                  | 32k point   |
| Noise   | bandwidth                     | max. 25 MHz   |
|   | level                         | 0 to 100 % of signal amplitude  |
|   |                               |   |
| Modulation  | AM                            |   |
|   | function                      | sine, rectangle, triangle, ramp   |
|   | frequency                     | 0.1 Hz to 1 MHz   |
|   | depth                         | 0 to 100 %  |
|   | FM                            |   |
|   | function                      | sine, rectangle, triangle, ramp   |
|   | frequency                     | 0.1 Hz to 1 MHz   |
|   | deviation                     | depends on modulation frequency   |
|   | ASK                           |   |
|   | function                      | sine, rectangle, triangle, ramp   |
|   | frequency                     | 0.1 Hz to 1 MHz   |
|   | ASK depth                     | 0 to 100 %  |
|   | FSK                           |   |
|   | function                      | sine, rectangle, triangle, ramp   |
|   | frequency                     | 0.1 Hz to 1 MHz   |
| FSK rate  | 0.1 Hz to carrier frequency/2 |   |
| Sweep   | start frequency               | 1 Hz to 25 MHz  |
|   | stop frequency                | 1 Hz to 25 MHz  |
|   | sweep time                    | 1 ms to 10 s  |
|   | sweep type                    | linear, logarithmic   |
| <b>4-bit pattern generator</b>                        |                               |   |
| Functions   |                               | probe adjust/square wave, bus signal source 4-bit counter, programmable 4-bit pattern |
| Bus signal source                                     |                               | SPI, I <sup>2</sup> C, UART, CAN, LIN   |
|   | bandwidth                     | 9600 bit/s to 1 Mbit/s  |
| 4-bit counter   | frequency                     | 25 mHz to 50 MHz  |
| Programmable pattern                                  | sample rate                   | 20 ns to 1 s, up/down   |
|   | square wave frequency         | 1 mHz to 500 kHz  |
|   | memory depth                  | 8096 bit per channel  |
|   | pattern idle time             | 50 ns to 1 s  |
|   | amplitude                     | $V_{low} = 0$ V, $V_{high} = 1.5$ V to 3.3 V (meas.)                                  |



## R&S®RTA-K1

| <b>I<sup>2</sup>C triggering and decoding</b> |                                    |  |
|---|------------------------------------|--|
| Bus configuration                             | sources for SCL and SDA            |  |
|   | R&S®RTA4004                        | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option) |
|   | bit rate                           | up to 10 Mbps  |
|   | size of address                    | 7 bit or 10 bit  |
|   | size of data                       | 8 bit  |
|   | label list                         | associate frame identifier with symbolic ID  |
| Trigger                                       | trigger events                     | start, stop, restart, missing acknowledge, address (7 bit or 10 bit), data, address and data       |
|   | offset for trigger on data         | 0 data byte to 4095 data byte  |
|   | data pattern width                 | up to 3 sequential data byte   |
| Decode  | displayed signals                  | bus signal, logic signal or both   |
|   | color coding of bus signal         | address, data, start, stop, ACK, NACK, error   |
|   | displayed format of address        | hex, symbolic ID (label list)  |
|   | displayed format of data           | ASCII, binary, decimal or hex  |
| <b>SPI triggering and decoding</b>            |                                    |  |
| Bus configuration                             | sources for CS, CLK, MOSI and MISO |  |
|   | R&S®RTA4004                        | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option) |
|   | bit rate                           | up to 25 Mbps  |
|   | chip select (CS)                   | active low, active high or missing (SSPI)  |
|   | clock (CLK) slope                  | rise or fall   |
|   | data symbol size                   | 1 bit to 32 bit  |
|   | idle time for SSPI                 | 12.8 ns to 26.8 ms   |
| Trigger                                       | trigger events                     | start of frame, end of frame, bit number, data pattern   |
|   | selectable bit number              | 0 to 4095  |
|   | offset for trigger on data pattern | 0 to 4095 bit  |
|   | data pattern size                  | 1 bit to 32 bit  |
| Decode  | displayed signals                  | bus signal, logic signal or both   |
|   | color coding of bus signal         | data, start, stop, error   |
|   | displayed format of data           | ASCII, binary, decimal or hex  |
|   | data decoding                      | MSB or LSB first   |

## R&S®RTA-K2

| <b>UART/RS-232/RS-422/RS-485 triggering and decoding</b> |                                   |   |
|--|-----------------------------------|---|
| Bus configuration  | source for RX and TX              |   |
|  | R&S®RTA4004                       | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)            |
|  | bit rate                          | 300 bps to 1 Mbps or user-selectable up to 6 Mbps   |
|  | end of frame                      | timeout   |
|  | signal polarity                   | idle low, idle high   |
|  | data symbol size                  | 5 bit to 9 bit  |
|  | parity                            | none, even or odd   |
|  | stop bits                         | 1, 1.5 or 2   |
|  | Idle time                         | up to 26.8 ms   |
| Trigger  | trigger events                    | start bit, start of frame, symbol number, any symbol, pattern of symbols, parity error, stop bit error, break |
|  | offset for trigger on data symbol | 0 to 4095 symbols   |
|  | data symbol pattern width         | 1 to floor (32/symbol size) symbols   |
| Decode   | displayed signals                 | bus signal, logic signal or both  |
|  | color coding of bus signal        | data, start, stop, error, parity  |
|  | displayed format of data          | ASCII, binary, decimal or hex   |

## R&amp;S®RTA-K3

| <b>CAN triggering and decoding</b> |                            |  |
|------------------------------------|----------------------------|--|
| Bus configuration                  | signal type                | CAN_H, CAN_L   |
|                                    | bit rate                   | 10/20/33.3/50/83.3/100/125/250/500/1000 kbps or user-selectable in range from 100 bps to 5 Mbps  |
|                                    | sampling point             | 10 % to 90 % within bit period   |
|                                    | label list                 | associate frame identifier with symbolic ID  |
| Trigger                            | trigger events             | start of frame, frame type, identifier, identifier + data, 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 (11 bit or 29 bit); condition =, ≠, >, <; identifier selectable from label list                               |
|                                    | data setup                 | data pattern up to 8 byte (hex or binary); condition =, ≠, >, <  |
| Decode                             | displayed signals          | bus signal, logic signal or both   |
|                                    | color coding of bus signal | start of frame, identifier, DLC, data payload, CRC, ACK, end of frame, error frame, overload frame, CRC error, bit stuffing error, ACK error                     |
|                                    | displayed format of data   | hex, decimal, binary, ASCII  |
|                                    | frame table                | decode results displayed as tabulated list, errors highlighted in red; frame navigation; data export as CSV file   |
| Search                             | search events              | frame, error, identifier, identifier + data, identifier + error  |
|                                    | frame event setup          | start of frame, end of frame, overload frame, error frame, data ID 11 bit, data ID 29 bit, remote ID 11 bit, remote ID 29 bit                                    |
|                                    | error event setup          | any combination of CRC error, bit stuffing error, form error and ACK error   |
|                                    | identifier setup           | frame type (data, remote or both), identifier type (11 bit or 29 bit); condition =, ≠, >, <; identifier selectable from label list                               |
|                                    | data setup                 | data pattern up to 8 byte (hex or binary); condition =, ≠, >, <  |
|                                    | event table                | search results displayed as tabulated list; event navigation   |
| <b>LIN triggering and decoding</b> |                            |  |
| Bus configuration                  | version                    | 1.3, 2.x or SAE J602; mixed traffic is supported   |
|                                    | bit rate                   | 1.2/2.4/4.8/9.6/10.417/19.2 kbps or user-selectable in range from 100 bps to 5 Mbps  |
|                                    | polarity                   | active high or active low  |
|                                    | label list                 | associate frame identifier with symbolic ID  |
| Trigger                            | source                     |  |
|                                    | R&S®RTA4004                | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)   |
|                                    | trigger events             | start of frame (sync break), identifier, identifier + data, wakeup frame, error condition (any combination of checksum error, parity error and sync field error) |
|                                    | data setup                 | range from 0d to 63d; condition =, ≠, >, <; identifier selectable from label list  |
|                                    | data setup                 | data pattern up to 8 byte (hex or binary); condition =, ≠, >, <  |

|        |                            |  |
|--------|----------------------------|--|
| Decode | displayed signals          | bus signal, logic signal or both   |
|        | color coding of bus signal | frame, frame identifier, parity, data payload, checksum, error condition   |
|        | displayed format of data   | hex, decimal, binary, ASCII  |
|        | frame table                | decode results displayed as tabulated list, errors highlighted in red; frame navigation; data export as CSV file |
| Search | search events              | frame, error, identifier, identifier + data, identifier + error  |
|        | frame event setup          | start of frame, wake up  |
|        | error event setup          | any combination of checksum error, parity error and sync field error   |
|        | identifier setup           | range from 0d to 63d; condition =, ≠, >, <; identifier selectable from label list                                |
|        | data setup                 | data pattern up to 8 byte (hex or binary); condition =, ≠, >, <  |
|        | event table                | search results displayed as tabulated list; event navigation   |

## R&amp;S®RTA-K5

| Audio (I <sup>2</sup> S, LJ, RJ, TDM) triggering and decoding |                                 |   |   |
|---|---------------------------------|---|---|
| Bus configuration   | source (data, clock, word/sync) |   |   |
|   | R&S®RTA4004                     | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)  |   |
|   | thresholds                      | per-channel threshold (analog channels), per-group threshold (logic channels), assisted threshold configuration (find level)                                      |   |
|   | bit rate                        | up to 30 Mbps   |   |
|   | signal type                     | I <sup>2</sup> S standard, left justified, right justified, TDM   |   |
|   | polarity                        | data: active high, active low; clock: rising edge, falling edge; word/sync: normal, inverted  |   |
|   | word length                     | 2 bit to 32 bit   |   |
|   | bit order                       | most significant bit first (MSBF), least significant bit first (LSBF)   |   |
|   | I <sup>2</sup> S-specific setup |   |   |
|   | first channel                   | left, right   |   |
|   | LJ/RJ-specific setup            |   |   |
|   | first channel                   | left, right   |   |
|   | channel offset                  | 0 to 31 bit   |   |
|   | TDM-specific setup              |   |   |
|   | number of channels              | 1 to 8  |   |
|   | channel length                  | 2 bit to 32 bit   |   |
|   | channel offset                  | 0 to (channel length – word length) bits  |   |
|   | channel delay                   | 0 to 31 bit   |   |
|   | Trigger                         | trigger events  | data, window, word/sync, error condition  |
|   |                                 | data setup  | define individual value and condition for each audio channel; condition =, ≠, >, <, inside range, outside range, don't care; trigger when "all" or "any" audio channel conditions are met in single audio frame |
| window setup  |                                 | audio channel setup same as data setup; user-defined window length up to 4 000 000 000 frames   |   |
| word/sync setup   |                                 | rising edge, falling edge   |   |
| Decode  | displayed signals               | bus signal, stacked bus signal, logic signal  |   |
|   | color coding of bus signal      | color-coded audio channels  |   |
|   | displayed format of data        | hex, signed decimal, binary, ASCII  |   |
|   | frame table                     | decode results displayed as tabulated list with timestamp; frame navigation; data export as CSV file  |   |
|   | track of audio waveform         | displays audio channel content as a waveform that is time-correlated to the source signals; user can activate, scale and position each audio channel individually |   |

## R&amp;S®RTA-K6

| MIL-STD-1553 triggering and decoding |  |  |
|--------------------------------------|--|--|
| Protocol configuration               | source   | R&S®RTA4004  |
|                                      | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)       |  |
|                                      | bit rate   | standard bit rate (1 Mbit/s)   |
|                                      | polarity   | normal, inverted   |
|                                      | label list   | associate frame identifier with symbolic ID  |
|                                      | auto threshold setup   | assisted threshold configuration   |
|                                      | timing   | max response (4 µs to 200 µs)  |
| Trigger                              | trigger event setup  | sync, word, command word, status word, command and data word, error condition  |
|                                      | sync setup   | all words, command/status word, data word  |
|                                      | word setup   | all words, command word, status word, data word  |
|                                      | command word setup (type: address/word)  | RT address (condition =, ≠, ≥, ≤, in range, out of range); direction (T/R); subaddress (condition =, ≠, ≥, ≤, in range, out of range); data word count (condition =, ≠, ≥, ≤, in range, out of range)  |
|                                      | command word setup (type: mode code)   | RT address (condition =, ≠, ≥, ≤, in range, out of range); subaddress (0, 31 or either); mode code from labeled dropdown list  |
|                                      | status word setup  | RT address; status flags (message error, instrumentation, service request, broadcast command, busy, subsystem flag, dynamic bus control, terminal flag) individually configurable (1, 0, don't care)   |
|                                      | command and data word setup  | transmission type (BC-RT, RT-BC, BC-BC, mode code); RT address (condition =, ≠, ≥, ≤, in range, out of range); subaddress (condition =, ≠, ≥, ≤, in range, out of range); data word count (condition =, ≠, ≥, ≤, in range, out of range); data pattern up to 4 words long (condition =, ≠, ≥, ≤, in range, out of range); payload data index (condition =) |
| error condition setup                | any combination of sync error, Manchester error, parity error, timing error (see protocol configuration) |  |
| Decode                               | display signals  | bus signal; symbolic ID in bus signal when label list in use   |
|                                      | color coding   | sync, RT address, subaddress, mode code, status bit field, data, error condition   |
|                                      | displayed format of data   | hex, decimal, binary, ASCII  |
|                                      | frame table  | decode results displayed as tabulated list, errors highlighted in red; frame navigation; data export as CSV file; column with symbolic ID when label list in use   |
| Search                               | search events  | word, command word, mode code, status word, command and data word, error   |
|                                      | word setup   | command, status, data  |
|                                      | command word setup   | see trigger settings for "command word setup (type: address/word)"   |
|                                      | mode code setup  | see trigger settings for "command word setup (type: mode code)"  |
|                                      | status word setup  | see trigger settings for "status word setup"   |
|                                      | command and data word setup  | see trigger settings for "command and data word setup"   |
| error condition setup                | all, sync, parity, manchester, timing  |  |

## R&amp;S®RTA-K7

| ARINC 429 triggering and decoding |                             |  |
|-----------------------------------|-----------------------------|--|
| Protocol configuration            | source                      |  |
|                                   | R&S®RTA4004                 | channel 1, channel 2, channel 3, channel 4, logic channels from D15 to D0 (with R&S®RTA-B1 option)   |
|                                   | bit rate                    | high (100 kbit/s), low (12.5 kbit/s), or user-defined in range 10 kbit/s to 1 Mbit/s   |
|                                   | polarity                    | A leg, B leg, normal, inverted   |
|                                   | label list                  | associate numeric label with symbolic ID; optional definition of ARINC word format in terms of availability of label-specific SDI and SSM fields   |
|                                   | auto threshold setup        | assisted threshold configuration   |
| Trigger                           | trigger event setup         | word, label, label and data, error condition, transmission interval  |
|                                   | word setup                  | word start, word stop  |
|                                   | label setup                 | label (condition =, ≠, ≥, ≤, in range, out of range)   |
|                                   | data setup                  | data pattern up to 23 bit long (condition =, ≠, ≥, ≤, in range, out of range); data bit offset; SDI (00,01,10,11); SSM (00,01,10,11); label list can be used to determine availability of trigger properties SSM and SDI for given label value |
|                                   | error condition setup       | any combination of coding error, parity error, gap error   |
|                                   | transmission interval setup | label (condition =); SDI (optional); time interval (condition >, <, in range, out of range)  |
| Decode                            | display signals             | bus signal, logic signal or both; symbolic ID in bus signal when label list in use   |
|                                   | color coding                | word begin, word end, label, SDI, data, SSM, parity, error   |
|                                   | displayed format of data    | hex, decimal, binary, ASCII  |
|                                   | frame table                 | decode results displayed as tabulated list, errors highlighted in red; frame navigation; data export as CSV file; column with symbolic ID when label list in use   |
| Search                            | search events               | word, label, label and data, error condition   |
|                                   | word setup                  | word start, word stop  |
|                                   | label setup                 | see trigger settings for "label setup"   |
|                                   | data setup                  | see trigger settings for "data setup"  |
|                                   | error condition setup       | coding error, parity error, gap error, any   |

## R&amp;S®RTA-K18

| Spectrum analysis and spectrogram |                                 |  |
|-----------------------------------|---------------------------------|--|
| General                           | additional displays             | spectrum traces and/or spectrogram   |
| Spectrum                          | sources                         |  |
|                                   | R&S®RTA4004                     | channel 1, channel 2, channel 3, channel 4   |
|                                   | setup parameters                | center frequency, frequency span, automatic RBW, resolution bandwidth, gate position, gate width, vertical scale, vertical position, spectrum mode |
|                                   | scaling                         | dBm, dBV, V (RMS)  |
|                                   | span                            | 1 kHz to 1.25 GHz  |
|                                   | resolution bandwidth            | span/10 ≥ RBW ≥ span/1000  |
|                                   | windows                         | flat top, Hanning, Hamming, Blackman, rectangular  |
|                                   | trace types                     | normal, max. hold, min. hold, average  |
| Spectrogram                       | spectrum mode                   | optimized for dynamic range of frequency domain (disables time domain for the same channel)  |
|                                   | color                           | rainbow, temp. color, monochrome   |
| Marker                            | peak marker search              | standard search<br>parameter: min. level<br>advanced search<br>parameter: min. level, excursion, maximum width, distance to next peak              |
|                                   | reference marker                | selection via index or frequency range   |
|                                   | markers on peak                 | up to 100 markers  |
|                                   | sources                         | any spectrum trace   |
|                                   | table                           | frequency and magnitude, absolute or relative to reference marker  |
|                                   | marker result display           | indicated at wave form: level, frequency   |
| Cursor                            | measurements on spectrum traces | level, frequency, level and frequency, V-marker  |
|                                   | additional actions for cursor   | coupling of cursors, set to trace, set to screen, track scaling, set next and previous peak  |
| Spectrogram measurements          | two time cursor                 | t1, t2, delta t, total time, relative time between segments  |

## R&amp;S®RTA-K31

| <b>Power analysis</b>  |  |  |
|------------------------|--|--|
| General description    | The R&S®RTA-K31 power analysis option extends the R&S®RTA 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 334 <sup>th</sup> 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 and electrical charge within up to 3 configurable measurement zones to analyze the inrush and post-inrush behavior  |
|                        | consumption  | long term measurement of consumed power and energy to analyze nonperiodical signals of e.g. standby devices  |
| Switching/control loop | slew rate  | The minimum and maximum slew rate of current or voltage is measured at start and end of the switching cycle.   |
|                        | modulation   | measures modulation of switching frequency, duty cycle ( $\pm$ ) and pulse width   |
|                        | dynamic on-resistance  | measures resistance of the switching transistor(s) in active state   |
| Power path             | efficiency   | measures input and output power to calculate the efficiency of a power device  |
|                        | switching 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; save/load of masks; export of mask violation data |
|                        | turn on/off time   | measures relationship between AC and DC current, when turning SMPS off and on  |
| Output                 | ripple   | measures AC components of output voltage or current, AC RMS, mean, period, 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 signals is compensated automatically.  |
| Zero offset            | automated  | automatic compensation of input offset   |
| Reporting              | Report data can be saved for every measurement. Report generation using user-selected test results from historical and current tests. Put repeated and/or different measurements in one report. R&S®Oscilloscope Report Creator can be downloaded from Rohde & Schwarz website free-of-charge. |  |



## Ordering information

| Designation   | Type          | Order No.    |
|---|---------------|--------------|
| <b>Choose your R&amp;S®RTA4000 base model</b>   |               |              |
| Oscilloscope, 200 MHz, 4 channels   | R&S®RTA4004   | 1335.7700.04 |
| Base unit (including standard accessories: 500 MHz passive probe per channel, power cord)   |               |              |
| <b>Choose your bandwidth upgrade</b>  |               |              |
| Upgrade of R&S®RTA4004 oscilloscopes to 350 MHz bandwidth   | R&S®RTA-B243  | 1335.7846.02 |
| Upgrade of R&S®RTA4004 oscilloscopes to 500 MHz bandwidth   | R&S®RTA-B245  | 1335.7852.02 |
| Upgrade of R&S®RTA4004 oscilloscopes to 1 GHz bandwidth   | R&S®RTA-B2410 | 1335.7869.02 |
| <b>Choose your options</b>  |               |              |
| Mixed Signal Upgrade for non-MSO models, 400 MHz  | R&S®RTA-B1    | 1335.7823.02 |
| Arbitrary Waveform and 4-bit Pattern Generator  | R&S®RTA-B6    | 1335.7830.02 |
| I <sup>2</sup> C/SPI Serial Triggering and Decoding   | R&S®RTA-K1    | 1335.7681.02 |
| UART/RS-232/RS-422/RS-485 Serial Triggering and Decoding  | R&S®RTA-K2    | 1335.7698.02 |
| CAN/LIN Serial Triggering and Decoding  | R&S®RTA-K3    | 1335.7717.02 |
| Audio (I <sup>2</sup> S, LJ, RJ, TDM) Triggering and Decoding   | R&S®RTA-K5    | 1335.7723.02 |
| MIL-STD-1553 Serial Triggering and Decoding   | R&S®RTA-K6    | 1335.7730.02 |
| ARINC 429 Serial Triggering and Decoding  | R&S®RTA-K7    | 1335.7746.02 |
| Spectrum Analysis and Spectrogram <sup>4</sup>  | R&S®RTA-K18   | 1335.7752.02 |
| Power Analysis  | R&S®RTA-K31   | 1335.7769.02 |
| Application Bundle, consists of the following options: R&S®RTA-K1, R&S®RTA-K2, R&S®RTA-K3, R&S®RTA-K6, R&S®RTA-K7, R&S®RTA-K18, R&S®RTA-K31, R&S®RTA-B6           | R&S®RTA-PK1   | 1335.7775.02 |
| <b>Choose your additional probes</b>  |               |              |
| <b>Single-ended passive probes</b>  |               |              |
| 500 MHz, 10 MΩ, 10:1, 300 V, 10 pF, 5 mm  | R&S®RT-ZP05S  | 1333.2401.02 |
| 500 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF, 2.5 mm   | R&S®RT-ZP10   | 1409.7550.00 |
| 38 MHz, 1 MΩ, 1:1, 55 V, 39 pF, 2.5 mm  | R&S®RT-ZP1X   | 1333.1370.02 |
| <b>Active broadband probes: single-ended</b>  |               |              |
| 1.0 GHz, 10:1, 1 MΩ, BNC interface  | R&S®RT-ZS10L  | 1333.0815.02 |
| 1.0 GHz, active, 1 MΩ, Rohde & Schwarz probe interface  | R&S®RT-ZS10E  | 1418.7007.02 |
| 1.0 GHz, active, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface  | R&S®RT-ZS10   | 1410.4080.02 |
| 1.5 GHz, active, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface  | R&S®RT-ZS20   | 1410.3502.02 |
| <b>Active broadband probes: differential</b>  |               |              |
| 1.0 GHz, active, differential, 1 MΩ, R&S®ProbeMeter, micro button, incl. 10:1 external attenuator, 1 MΩ, 70 V DC, 46 V AC (peak), Rohde & Schwarz probe interface | R&S®RT-ZD10   | 1410.4715.02 |
| 1.5 GHz, active, differential, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface  | R&S®RT-ZD20   | 1410.4409.02 |
| <b>Power rail probe</b>   |               |              |
| 2.0 GHz, 1:1, 50 kΩ, ±0.85 V, ±60 V offset, Rohde & Schwarz probe interface   | R&S®RT-ZPR20  | 1800.5006.02 |
| <b>High voltage single-ended passive probes</b>   |               |              |
| 250 MHz, 100:1, 100 MΩ, 850 V, 6.5 pF   | R&S®RT-ZH03   | 1333.0873.02 |
| 400 MHz, 100:1, 50 MΩ, 1000 V, 7.5 pF   | R&S®RT-ZH10   | 1409.7720.02 |
| 400 MHz, 1000:1, 50 MΩ, 1000 V, 7.5 pF  | R&S®RT-ZH11   | 1409.7737.02 |

<sup>4</sup> The R&S®RTA-K18 option is not distributed in North America.

| Designation  | Type                       | Order No.    |
|--|----------------------------|--------------|
| <b>High voltage probes: differential</b>   |                            |              |
| 25 MHz, 20:1/200:1, 4 M $\Omega$ , 1.4 kV (CAT III), BNC interface   | R&S <sup>®</sup> RT-ZD002  | 1337.9700.02 |
| 25 MHz, 10:1/100:14 M $\Omega$ , 700 V (CAT II), BNC interface   | R&S <sup>®</sup> RT-ZD003  | 1337.9800.02 |
| 100 MHz, 8 M $\Omega$ , 1 kV (RMS) (CAT III), BNC interface  | R&S <sup>®</sup> RT-ZD01   | 1422.0703.02 |
| 200 MHz, 10:1, $\pm$ 20 V, BNC interface   | R&S <sup>®</sup> RT-ZD02   | 1333.0821.02 |
| 800 MHz, 10:1, 200 k $\Omega$ , $\pm$ 15 V, BNC interface  | R&S <sup>®</sup> RT-ZD08   | 1333.0838.02 |
| 200 MHz, 250:1/25:1, 5 M $\Omega$ , 750 V (peak), 300 V CAT III, Rohde & Schwarz probe interface                                   | R&S <sup>®</sup> RT-ZHD07  | 1800.2307.02 |
| 100 MHz, 500:1/50:1, 10 M $\Omega$ , 1500 V (peak), 1000 V CAT III, Rohde & Schwarz probe interface                                | R&S <sup>®</sup> RT-ZHD15  | 1800.2107.02 |
| 200 MHz, 500:1/50:1, 10 M $\Omega$ , 1500 V (peak), 1000 V CAT III, Rohde & Schwarz probe interface                                | R&S <sup>®</sup> RT-ZHD16  | 1800.2207.02 |
| 100 MHz, 1000:1/100:1, 40 M $\Omega$ , 6000 V (peak), 1000 V CAT III, Rohde & Schwarz probe interface                              | R&S <sup>®</sup> RT-ZHD60  | 1800.2007.02 |
| <b>Current probes</b>  |                            |              |
| 20 kHz, AC/DC, 0.01 V/A and 0.001 V/A, $\pm$ 200 A and $\pm$ 2000 A, BNC interface   | R&S <sup>®</sup> RT-ZC02   | 1333.0850.02 |
| 100 kHz, AC/DC, 0.1 V/A, 30 A, BNC interface   | R&S <sup>®</sup> RT-ZC03   | 1333.0844.02 |
| 2 MHz, AC/DC, 0.01 V/A, 500 A (RMS), Rohde & Schwarz probe interface   | R&S <sup>®</sup> RT-ZC05B  | 1409.8204.02 |
| 10 MHz, AC/DC, 0.01 V/A, 150 A (RMS), BNC interface  | R&S <sup>®</sup> RT-ZC10   | 1409.7750K02 |
| 10 MHz, AC/DC, 0.01 V/A, 150 A (RMS), Rohde & Schwarz probe interface  | R&S <sup>®</sup> RT-ZC10B  | 1409.8210.02 |
| 50 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface  | R&S <sup>®</sup> RT-ZC15B  | 1409.8227.02 |
| 100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), BNC interface   | R&S <sup>®</sup> RT-ZC20   | 1409.7766K02 |
| 100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface   | R&S <sup>®</sup> RT-ZC20B  | 1409.8233.02 |
| 120 MHz, AC/DC, 1 V/A, 5 A (RMS), BNC interface  | R&S <sup>®</sup> RT-ZC30   | 1409.7772K02 |
| <b>EMC near-field probes</b>   |                            |              |
| Probe Set for E and H Near-Field Measurements, 30 MHz to 3 GHz   | R&S <sup>®</sup> HZ-15     | 1147.2736.02 |
| <b>Logic probes</b>  |                            |              |
| 400 MHz Logic Probe, 8 channels  | R&S <sup>®</sup> RT-ZL04   | 1333.0721.02 |
| <b>Probe accessories</b>   |                            |              |
| Probe Power Supply for R&S <sup>®</sup> RT-ZC10/20/30  | R&S <sup>®</sup> RT-ZA13   | 1409.7789.02 |
| External Attenuator 10:1, 2.0 GHz, 1.3 pF, 60 V DC, 42.4 V AC (peak) for R&S <sup>®</sup> RT-ZD20/30 probes                        | R&S <sup>®</sup> RT-ZA15   | 1410.4744.02 |
| Probe Pouch  | R&S <sup>®</sup> RT-ZA19   |              |
| Power Deskew and Calibration Test Fixture  | R&S <sup>®</sup> RT-ZF20   | 1800.0004.02 |
| 3D Positioner with central tensioning knob for easy clamping and positioning of probes (span width: 200 mm, clamping range: 15 mm) | R&S <sup>®</sup> RT-ZA1P   | 1326.3641.02 |
| <b>Choose your accessories</b>   |                            |              |
| Front Cover  | R&S <sup>®</sup> RTB-Z1    | 1333.1728.02 |
| Soft Bag   | R&S <sup>®</sup> RTB-Z3    | 1333.1734.02 |
| Rackmount Kit  | R&S <sup>®</sup> ZZA-RTB2K | 1333.1728.02 |

| <b>Warranty</b>   |                      |   |
|---|----------------------|---|
| Base unit   |                      | 3 years   |
| All other items <sup>5</sup>                                      |                      | 1 year  |
| <b>Options</b>  |                      |   |
| Extended Warranty, one year                                       | R&S <sup>®</sup> WE1 | Please contact your local Rohde & Schwarz sales office. |
| Extended Warranty, two years                                      | R&S <sup>®</sup> WE2 |   |
| Extended Warranty with Calibration Coverage, one year             | R&S <sup>®</sup> CW1 |   |
| Extended Warranty with Calibration Coverage, two years            | R&S <sup>®</sup> CW2 |   |
| Extended Warranty with Accredited Calibration Coverage, one year  | R&S <sup>®</sup> AW1 |   |
| Extended Warranty with Accredited Calibration Coverage, two years | R&S <sup>®</sup> 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 <sup>6</sup>. Necessary calibration and adjustments carried out during repairs are also covered.

#### **Extended warranty with calibration (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 <sup>6</sup> 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 <sup>6</sup> and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

<sup>5</sup> For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

<sup>6</sup> 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
- | Long-term dependability

## Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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- | Longevity and optimized total cost of ownership

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**ISO 14001**

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R&S®RTA4000 Oscilloscope

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