

# R&S® RTB2000

## Oscilloscope

### Power of ten

- 1 70 MHz to 300 MHz
- 1 10-bit ADC
- 1 10 Msample standard memory
- 1 10.1" capacitive touchscreen

3  
year  
warranty



# R&S® RTB2000 Oscilloscope At a glance

Power of ten (10-bit ADC, 10 Msample memory and 10.1" touchscreen) combined with smart operating concepts make the R&S® RTB2000 oscilloscope the perfect tool for troubleshooting embedded designs, for university laboratories as well as for production and service departments.

Rohde & Schwarz stands for quality, precision and innovation in all fields of wireless communications. As an independent, family-owned company, Rohde & Schwarz finances its growth from its own funds. The company plans for the long term to the benefit of its customers. Purchasing Rohde & Schwarz products is an investment for the future.

The largest display (10.1") with the highest resolution of its class (1280 × 800 pixel) works just like your smartphone. It contains a capacitive touchscreen to quickly navigate in pop-up menus and a touch function to easily adjust scaling, to zoom in or to move a waveform.

The 10-bit A/D converter yields up to a four-fold improvement compared to conventional 8-bit A/D converters. You get sharper waveforms with more signal details.

10 Msample memory depth is available on each channel as soon as all channels are active. When interleaved, 20 Msample are available. This is 10 times more than comparable oscilloscopes offer. It therefore captures longer signal sequences for more detailed analysis results.



The R&S®RTB2000 provides users with more than just an oscilloscope. It includes a logic analyzer, protocol analyzer, waveform and pattern generator and digital voltmeter. Dedicated operating modes for frequency analysis, mask tests and long data acquisitions are integrated. Debugging all kinds of electronic systems is easy and efficient – and satisfies the all-important rule of investment protection at a very attractive price.

# Benefits

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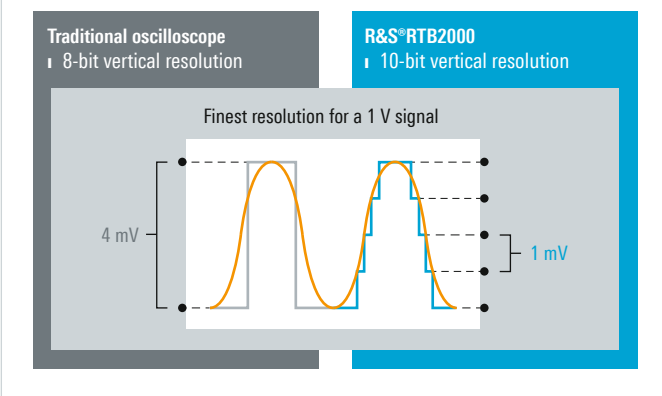
Choose your Rohde & Schwarz oscilloscope				
	R&S®RTC1000	R&S®RTB2000	R&S®RTM3000	R&S®RTA4000
<b>Number of oscilloscope channels</b>	2	2/4	2/4	4
<b>Bandwidth in MHz</b>	50, 70, 100, 200, 300	70, 100, 200, 300	100, 200, 350, 500, 1000	200, 350, 500, 1000
<b>Max. sampling rate in Gsample/s</b>	1/channel, 2 interleaved	1.25/channel, 2.5 interleaved	2.5/channel, 5 interleaved	2.5/channel, 5 interleaved
<b>Max. memory depth in Msample</b>	1/channel, 2 interleaved	10/channel, 20 interleaved; 160 Msample (optional) segmented memory	40/channel, 80 interleaved; 400 Msample (optional) segmented memory	100/channel, 200 interleaved; 1 Gsample (standard) segmented memory
<b>Timebase accuracy in ppm</b>	50	2.5	2.5	0.5
<b>Vertical bits (ADC)</b>	8	10	10	10
<b>Min. input sensitivity</b>	1 mV/div	1 mV/div	500 µV/div	500 µV/div
<b>Display</b>	6.5", 640 × 480 pixel	10" capacitive touch, 1280 × 800 pixel	10" capacitive touch, 1280 × 800 pixel	10" capacitive touch, 1280 × 800 pixel
<b>Update rate</b>	10 000 waveforms/s	300 000 waveforms/s in fast segmented memory mode	2 000 000 waveforms/s in fast segmented memory mode	2 000 000 waveforms/s in fast segmented memory mode
<b>MSO</b>	8 channels, 1 Gsample/s	16 channels, 2.5 Gsample/s	16 channels, 5 Gsample/s	16 channels, 5 Gsample/s
<b>Protocol (optional)</b>	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, audio (I <sup>2</sup> S/LJ/RJ/TDM), ARINC, MIL	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, audio (I <sup>2</sup> S), ARINC, MIL
<b>Generator(s)</b>	1 generator, 4-bit pattern generator	1 ARB, 4-bit pattern generator	1 ARB, 4-bit pattern generator	1 ARB, 4-bit pattern generator
<b>Math</b>	+, -, *, /, FFT (128k points)	+, -, *, /, FFT (128k points)	+, -, *, /, FFT (128k points), 21 advanced functions	+, -, *, /, FFT (128k points), 21 advanced functions
<b>Rohde &amp; Schwarz probe interface</b>	–	–	standard	standard
<b>RF capability</b>	FFT	FFT	spectrum analysis <sup>1)</sup>	spectrum analysis <sup>1)</sup>

<sup>1)</sup> The R&S®RTM-K18 and R&S®RTA-K18 options are not distributed in North America.

# See small signal details in the presence of large signals

- | 10-bit A/D converter resolution
- | 1 mV/div true vertical resolution

## 10-bit A/D converter: uncovers even small signal details



## 10-bit vertical resolution

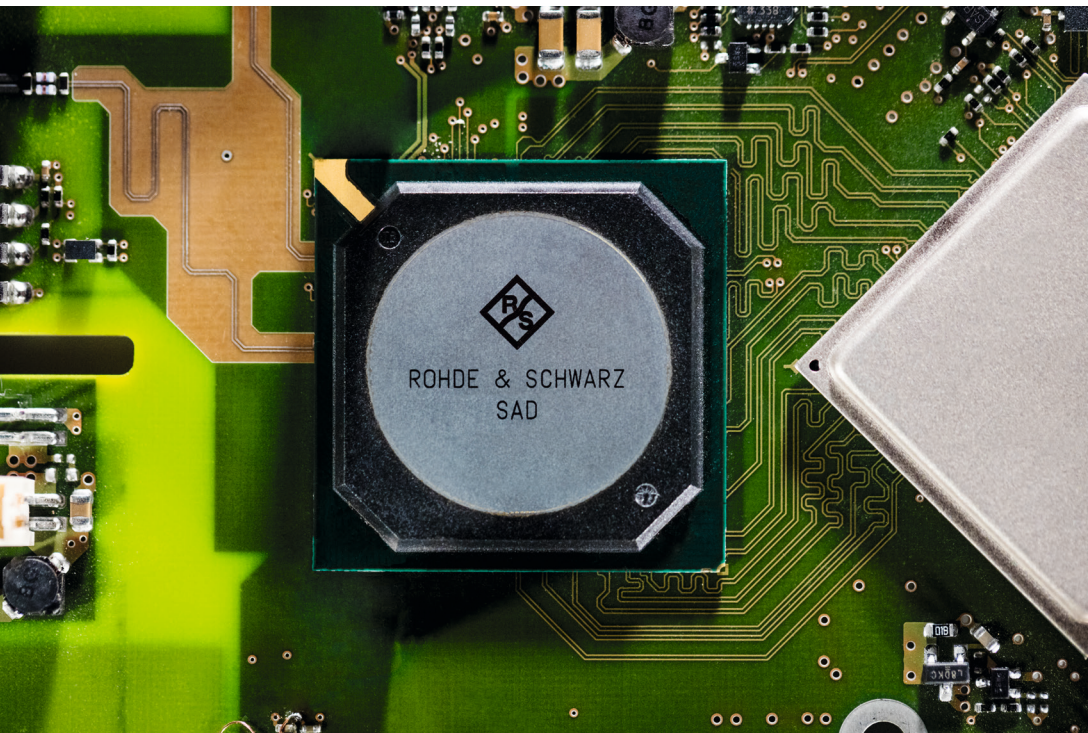
The R&S®RTB2000 features a customized Rohde & Schwarz designed 10-bit A/D converter that delivers a four-fold improvement compared to conventional 8-bit A/D converters.

The increased resolution results in sharper waveforms with more signal details that would otherwise be missed. One example is the characterization of switched-mode power supplies. The voltages across the switching device must be determined during the on/off times within the same acquisition. For precise measurements of small voltage components, a high resolution of more than 8 bit is essential.

## 1 mV/div: full measurement bandwidth and low noise

The R&S®RTB2000 oscilloscope offers an outstanding sensitivity down to 1 mV/div. Traditional oscilloscopes reach this level of input sensitivity only by employing software-based magnification or by limiting the bandwidth. The R&S®RTB2000 oscilloscope shows the signal's real sampling points over the full measurement bandwidth – even at 1 mV/div. This ensures high measurement accuracy.

The accuracy of a signal displayed on the screen depends on the oscilloscope's inherent noise. The R&S®RTB2000 oscilloscope precisely measures even at the smallest vertical resolution by using low-noise frontends and state-of-the-art A/D converters.



The Rohde & Schwarz designed 10-bit A/D converter ensures highest signal fidelity at highest resolution

# Capture more time at full bandwidth

- ▮ 10 Msample standard, 20 Msample interleaved
- ▮ 160 Msample segmented memory with more than 13 000 recordings
- ▮ History mode: analysis of past acquisitions
- ▮ 1.25 Gsample/s, 2.5 Gsample/s interleaved

## 10 Msample standard and 20 Msample interleaved

The R&S®RTB2000 offers a class-leading memory depth: 10 Msample per channel are available, even 20 Msample in interleaved mode. This is 10 times more than similar oscilloscopes in the same instrument class. The user captures longer acquisition sequences even at high sampling rates for more detailed analysis results, e.g. when analyzing transients of switched-mode power supplies.

## Segmented memory: 160 Msample with history function

The R&S®RTB-K15 option with deep, segmented memory analyzes signal sequences over a long observation period. For example, protocol-based signals with communications gaps such as I<sup>2</sup>C and SPI can be captured over several seconds or minutes. Thanks to the variable segment size from 10 ksample to 10 Msample, the 160 Msample memory is optimally utilized; more than 13 000 cohesive individual recordings are possible.

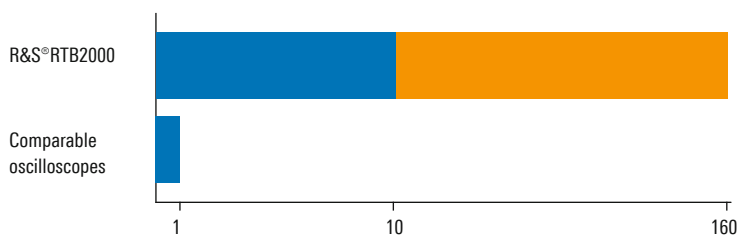
In history mode, previous acquisitions to the maximum segmented memory depth of 160 Msample are available for further analysis. Mask tests, QuickMeas function and FFT, for example, can be used for further analysis.

## Maintain fast sampling rates at all times

Signal faults and important events are detected better with an oscilloscope that offers a high sampling rate. Many applications require long acquisition cycles, for instance when analyzing serial protocols. With a sampling rate of up to 2.5 Gsample/s and a memory depth of up to 20 Msample, the R&S®RTB2000 oscilloscopes really excel here. They display signals, right down to the details, accurately and for long sequences.

### 10 to 160 times more memory depth than traditional oscilloscopes in the same instrument class

Capture the longest time periods with class-leading 160 Msample memory



■ Standard memory ■ Optional segmented memory

# 10.1" high-resolution capacitive touchscreen v

## Quick access to important tools

- ▀ Drag & drop use of analysis tools
- ▀ Toolbar for access to functions
- ▀ Sidebar for intuitive configuration of functions

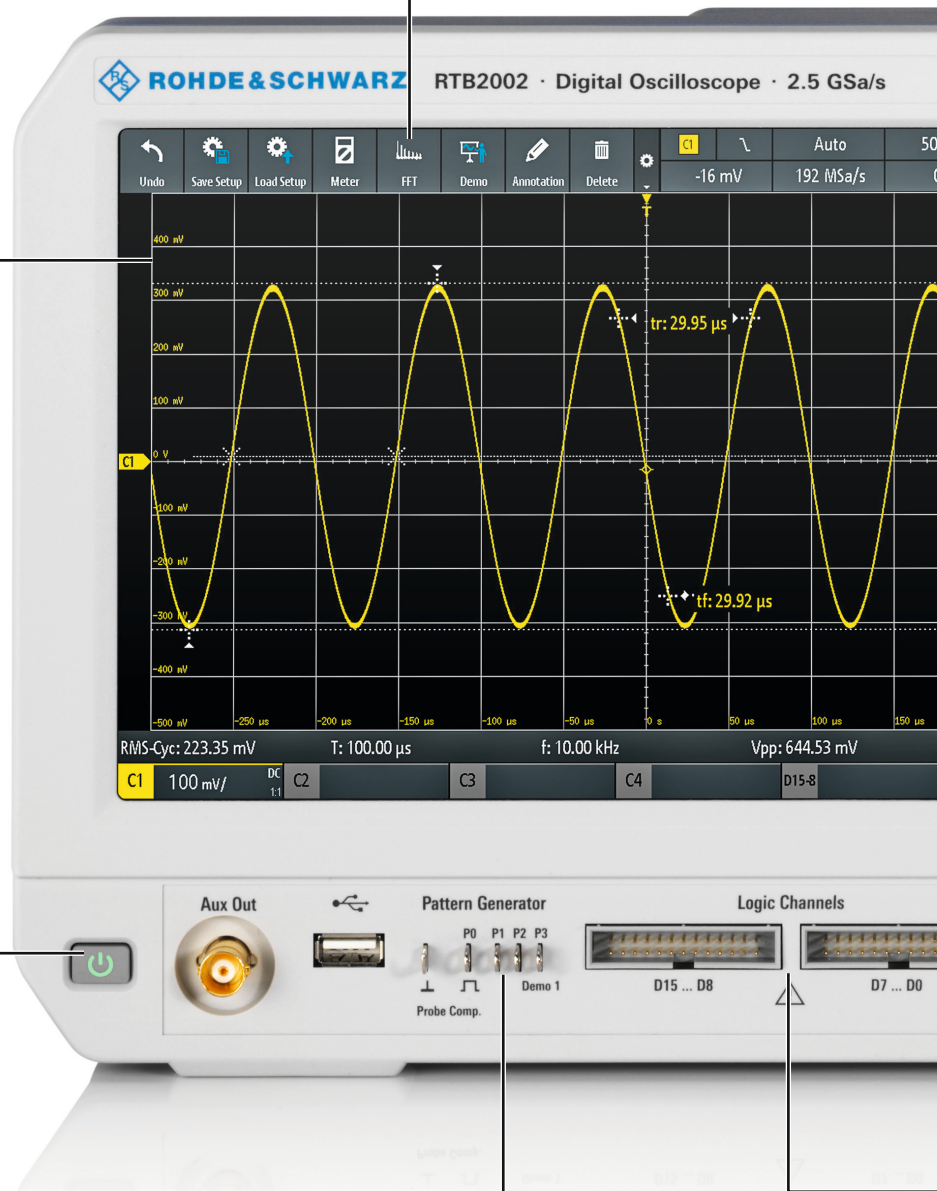
## Easily customizable waveform display with R&S® SmartGrid technology

- ▀ Configurable display
- ▀ Resizable waveform areas
- ▀ Scales labeled on all axes

## 10-second boot-up time

## Integrated waveform and pattern generator up to 50 Mbit/s

- ▀ Output of sine, square/pulse, ramp and noise waveforms
- ▀ Output of arbitrary waveform files and 4-bit signal patterns



# with gesture support

## 10.1" high-resolution capacitive touchscreen with gesture support

- ▮ Gesture support for scaling and zooming
- ▮ More than twice the display area compared to similar oscilloscopes
- ▮ Nine times the pixels of comparable oscilloscopes: 1280 × 800 pixel resolution
- ▮ 12 horizontal grid lines for more signal details

## Documentation of results at the push of a button

- ▮ Documentation as a screenshot or of instrument settings

## Autoset function

- ▮ Automatic selection of vertical, horizontal and trigger settings for optimal viewing of active signals
- ▮ Setting of FFT parameters

## Color-coded controls indicate the selected channel

## QuickMeas: results at the push of a button

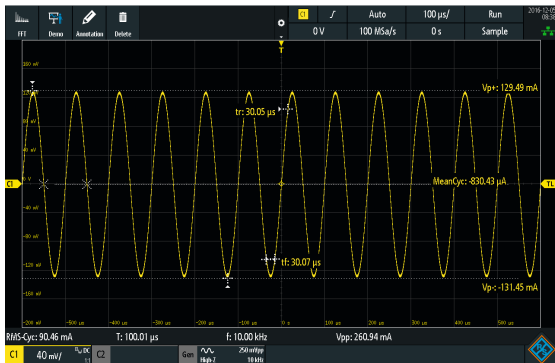
- ▮ Graphical display of key measurement results for the active signal

## Integrated logic analyzer (MSO)

- ▮ 16 additional digital channels
- ▮ Synchronous and time-correlated analysis of analog and digital components of embedded designs
- ▮ Fully retrofittable

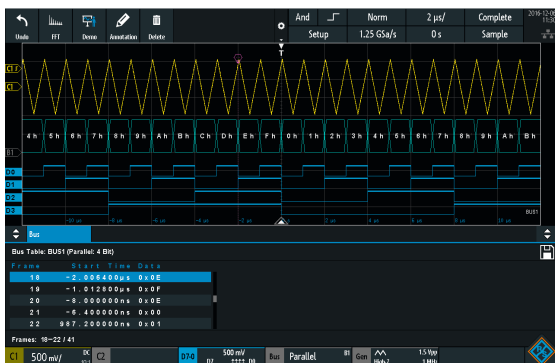


# X-in-1 oscilloscope



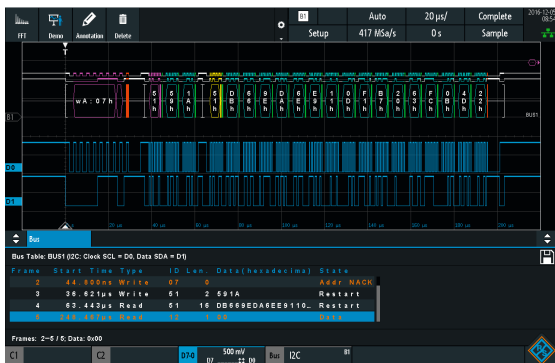
## Oscilloscope

With a sampling rate of up to 2.5 Gsample/s and a memory depth of up to 20 Msample, the R&S®RTB2000 oscilloscope excels in its class. A waveform update rate of more than 50 000 waveforms/s ensures a responsive instrument that reliably catches signal faults. Included standard tools provide quick results, e.g. QuickMeas, mask tests, FFT, math, cursors and automatic measurements, including statistics.



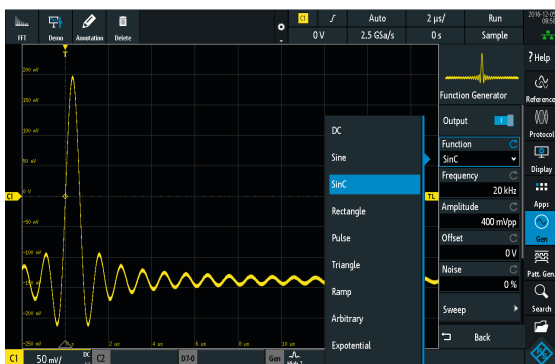
## Logic analyzer

The R&S®RTB-B1 option turns every R&S®RTB2000 into an intuitive-to-use MSO with 16 additional digital channels. The oscilloscope captures and analyzes signals from analog and digital components of an embedded design – synchronously and time-correlated to each other. For example, the delay between input and output of an A/D converter can conveniently be determined using the cursor measurements.



## Protocol analyzer

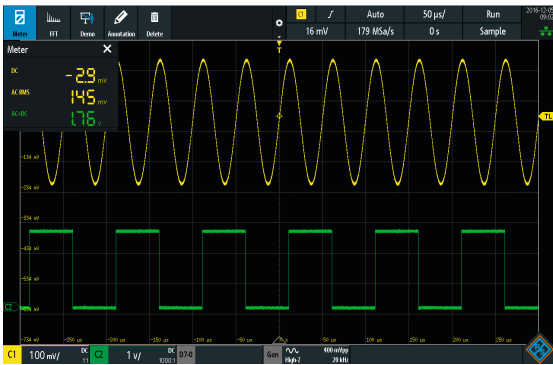
Protocols such as I<sup>2</sup>C, SPI and CAN/LIN frequently transfer control messages between integrated circuits. The R&S®RTB2000 has versatile options for protocol-specific triggering and decoding of serial interfaces. Selective acquisition and analysis of relevant events and data is possible. With the hardware-based implementation, smooth operation and a high update rate is ensured even for long acquisitions. This is advantageous, for example, to capture multiple packetized serial bus signals.



## Waveform and pattern generator

The integrated R&S®RTB-B6 waveform and pattern generator (up to 50 Mbit/s) is useful for educational purposes and for implementing prototype hardware. Apart from the common sine, square/pulse, ramp and noise waveforms, it outputs arbitrary waveforms and 4-bit signal patterns. Waveforms and patterns can be imported as CSV files or copied from oscilloscope waveforms. Before playing signals back, the user can preview them to quickly check signal correctness. Predefined patterns for e.g. I<sup>2</sup>C, SPI, UART and CAN/LIN can be used.





### Digital voltmeter

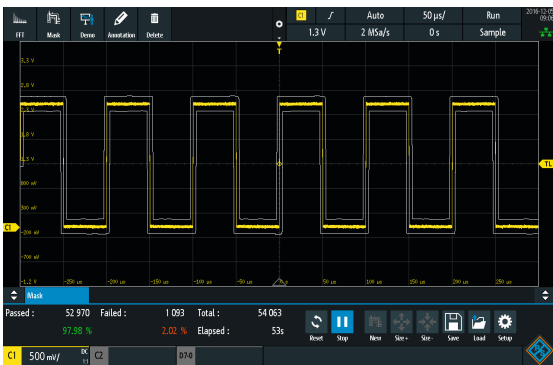
The R&S®RTB2000 features a three-digit digital voltmeter (DVM) and six-digit frequency counter on each channel for simultaneous measurements. Measurement functions include DC, AC + DC (RMS) and AC (RMS).<sup>1)</sup>

<sup>1)</sup> Included in scope of delivery.



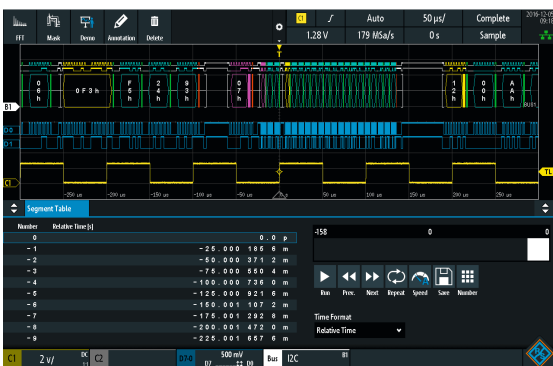
### Frequency analysis mode

Difficult-to-find faults often result from the interaction between time and frequency signals. The FFT function of the R&S®RTB2000 is activated at the push on a button and by entering center frequency and span. Due to the high-performance FFT functionality of the R&S®RTB2000 oscilloscopes, signals can be analyzed with up to 128k points. Other tools include cursor measurements and autoset in the frequency domain.



### Mask test mode

Mask tests quickly reveal whether a specific signal lies within defined tolerance limits. By using statistical pass/fail evaluation, they assess the quality and stability of a DUT. Signal anomalies and unexpected results are quickly identified. When the mask is violated, the measurement stops. Each violation can generate a pulse output at the AUX-OUT connector on the R&S®RTB2000. This pulse output can be used to trigger actions in the measurement setup.



### History and segmented memory mode

The R&S®RTB-K15 history function option increases the memory from 10 Msample to 160 Msample. Users scroll through past acquisitions and analyze the data using the oscilloscope tools, e.g. protocol decode and logic channels. Serial protocol and pulse sequences are recorded practically without interruptions.

# Frequency response analysis (Bode plot)

- ▮ Analyze the frequency response of passive filters and amplifier circuits
- ▮ Perform control loop response measurements
- ▮ Perform power supply rejection ratio measurements
- ▮ Simple and fast documentation

## Perform low-frequency response analysis with an oscilloscope

The R&S®RTB-K36 frequency response analysis (Bode plot) option lets you perform low-frequency response analysis on your oscilloscope easily and quickly. It characterizes the frequency response of a variety of electronic devices, including passive filters and amplifier circuits. For switch mode power supplies, it measures the control loop response and power supply rejection ratio. The frequency response analysis option uses the oscilloscope's built-in waveform generator to create stimulus signals ranging from 10 Hz to 25 MHz. Measuring the ratio of the stimulus signal and the output signal of the DUT at each test frequency, the oscilloscope plots gain and phase logarithmically.



The R&S®RTB-K36 frequency response analysis (Bode plot) option characterizes the frequency response of a variety of electronic devices, including passive filters and amplifier circuits



The amplitude output level of the generator signal can be varied during the measurement to suppress the noise behavior of the DUT

## Features and functionalities

### Amplitude profile

The R&S®RTB-K36 frequency response analysis (Bode plot) option allows users to profile the amplitude output level of the generator. This helps to suppress the noise behavior of the DUT when performing a control loop response or power supply rejection ratio and to improve signal-to-noise ratio (SNR). It is possible to define up to 16 steps.

### Improve resolution and markers support

You can choose the points per decade to set up and modify the resolution of your plot. The oscilloscope supports up to 500 points per decade. Markers can be dragged to the desired position, directly on the plotted trace. A legend displays the coordinates of the markers. To determine the crossover frequency, set one marker to 0 dB and the second marker to  $-180^\circ$  phase shift. Now you can easily determine the phase and gain margin.



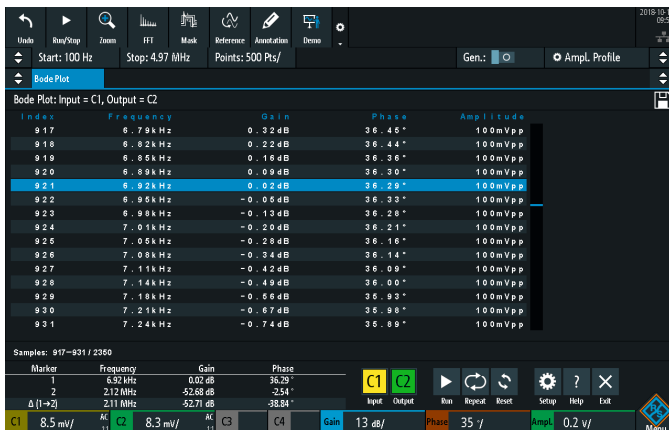
The measurement resolution can be varied by changing the points per decade

### Measurement table

You can view the results in a table. This table details information about each measured point, consisting of frequency, gain and phase shift. In case you use cursors, for ease of use, the associated row of the result table is highlighted. For reporting, screenshots, table results or both can be quickly saved to a USB device.

### Broad probe portfolio

Accurate control loop response or power supply rejection ratio characterization highly depends on choosing the right probes, since peak-to-peak amplitudes of  $V_{in}$  and  $V_{out}$  can be very low at some test frequencies. These values would be buried in the oscilloscope's noise floor and/or in the switching noise of the DUT itself. We recommend the low-noise R&S®RT-ZP1X 38 MHz bandwidth 1:1 passive probes. These reduce measurement noise and provide the best SNR.



A table of measurement results provides detailed information about each measurement point, consisting of frequency, gain and phase shift



R&S®RT-ZP1X 38 MHz bandwidth 1:1 passive probe

# The best choice for education

- Education mode to disable automatic functions
- X-in-1 integration

## Ready for the teaching lab

In the teaching lab, the R&S®RTB2000 oscilloscope is the perfect choice to teach students how to measure with an oscilloscope. This Rohde&Schwarz oscilloscope has an easy-to-use concept combined with state-of-the-art technology – at an affordable price. Students appreciate the intuitive and quick access to frequently used functions via dedicated buttons and capacitive touchscreen operation. And they solve their lab tutorial without worrying about oscilloscope functionality.

The large 10.1" high-resolution screen shows every signal detail, and one instrument can be shared among several students. Reports can be efficiently created with the handy and flexible screen annotation tool.

Professors especially like the password-protected education mode that disables automatic functions such as Autoset. This helps students understand the concepts. The built-in web server functionality enables professors to display their oscilloscope screen content to the classroom and over a network.

Updating and monitoring hundreds of units? The remote interfaces make these tasks as easy as switching on a light bulb.

## X-in-1 integration saves space and costs

With the R&S®RTB2000, students and professors in a university lab get an oscilloscope plus logic and protocol analyzer, waveform and pattern generator and digital voltmeter. Dedicated operation modes for frequency analysis, mask tests and long data acquisitions are also integrated. Debugging all kinds of electronic systems is easy and efficient – and satisfies the all-important rule of investment protection at a very attractive price. The compact design and small footprint save precious bench space in the lab.

Perfect instruments for everyday use at universities and colleges thanks to diverse functionality, rugged design and small footprint



# And there is so much more ...

- | Efficient reporting capabilities
- | Localized GUI and online help
- | Fully upgradeable via software licenses
- | Web server functionality for instrument access
- | Extensive range of probes and accessories

## Grows with your needs

The R&S®RTB2000 oscilloscopes flexibly adapt to needed project updates by installing software licenses. This applies to e.g. triggering and decoding of serial protocols and the history and segmented memory mode. The waveform and pattern generator and the MSO capabilities<sup>1)</sup> are built-in and just need to be activated. Via keycode, the bandwidth can be upgraded up to 300 MHz. All this makes retrofitting really easy.

## Multilingual support: choose among thirteen languages

The R&S®RTB2000 oscilloscope's user interface and online help support thirteen languages (English, German, French, Spanish, Italian, Portuguese, Czech, Polish, Russian, simplified and traditional Chinese, Korean and Japanese). Users can change the language in just a few seconds while the instrument is running.

<sup>1)</sup> The R&S®RTB-B1 MSO option additionally contains two logic probes with 16 digital channels.

## Protection of data

The secure erase function protects sensitive data. This function removes all user data and settings, including device setups and reference waveforms.

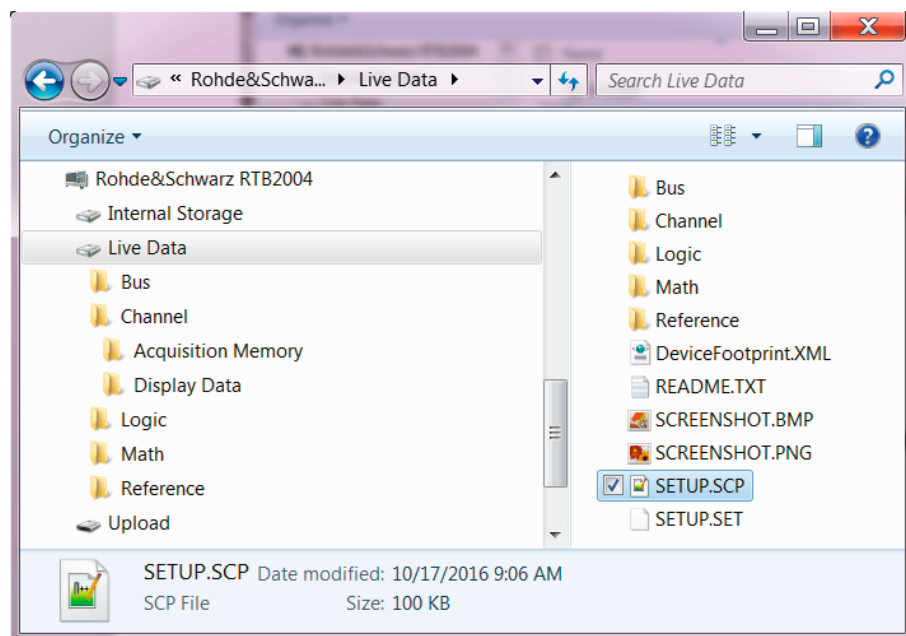
## Connectivity

The R&S®RTB2000 can be directly connected to a PC via the built-in USB host and USB device ports. The USB host transfers screenshots or instrument settings to a USB stick. Media transfer protocol (MTP) implementation ensures seamless integration. The USB device port and the LAN interface also enable remote control. The built-in web server functionality allows users to control the oscilloscope and display their screen content to an audience. Data and programming interfaces are included, e.g. for seamless MATLAB® integration.

## Probes to measure accurately

A comprehensive probe portfolio for accurate measurements rounds out the R&S®RTB2000 oscilloscope offering. Each R&S®RTB2000 is delivered with passive voltage probes. Single-ended high-voltage probes, differential probes and current probes are also available and can be ordered additionally.

- ▶ For more information, see the product brochure: [Probes and accessories for Rohde & Schwarz oscilloscopes \(PD 3606.8866.12\)](#).



With the USB MTP implementation, easy access to live channel data and screenshots and integration into customers computing environment is possible

# Oscilloscope portfolio



R&S®	RTH1000	RTC1000	RTB2000	RTM3000
<b>Vertical</b>				
Bandwidth	60/100/200/350/500 MHz <sup>1)</sup>	50/70/100/200/300 MHz <sup>1)</sup>	70/100/200/300 MHz <sup>1)</sup>	100/200/350/500 MHz/1 GHz <sup>1)</sup>
Number of channels	2 plus DMM/4	2	2/4	2/4
Resolution	10 bit	8 bit	10 bit	10 bit
V/div 1 MΩ	2 mV to 100 V	1 mV to 10 V	1 mV to 5 V	500 μV to 10 V
V/div 50 Ω	–	–	–	500 μV to 1 V
<b>Horizontal</b>				
Sampling rate per channel (in Gsample/s)	1.25 (4-channel model); 2.5 (2-channel model); 5 (all channels interleaved)	1; 2 (2 channels interleaved)	1.25; 2.5 (2 channels interleaved)	2.5; 5 (2 channels interleaved)
Max. memory (per channel/1 channel active)	125 ksample (4-channel model); 250 ksample (2-channel model); 500 ksample (50 Msample in segmented memory mode <sup>2)</sup> )	1 Msample; 2 Msample	10 Msample; 20 Msample (160 Msample in segmented memory mode <sup>2)</sup> )	40 Msample; 80 Msample (400 Msample in segmented memory mode <sup>2)</sup> )
Segmented memory	option	–	option	option
Acquisition rate (in waveforms/s)	50000	10000	50000 (300000 in fast segmented memory mode <sup>2)</sup> )	64000 (2000000 in fast segmented memory mode <sup>2)</sup> )
<b>Trigger</b>				
Options	advanced, digital trigger (14 trigger types) <sup>2)</sup>	elementary (5 trigger types)	basic (7 trigger types)	basic (10 trigger types)
<b>Mixed signal option</b>				
No. of digital channels <sup>1)</sup>	8	8	16	16
Sampling rate of digital channels (in Gsample/s)	1.25	1	1.25	two logic probes: 2.5 on each channel; one logic probe: 5 on each channel
Memory of digital channels	125 ksample	1 Msample	10 Msample	two logic probes: 40 Msample per channel; one logic probe: 80 Msample per channel
<b>Analysis</b>				
Cursor meas. types	4	13	4	4
Stand. meas. functions	33	31	32	32
Mask test	elementary (tolerance mask around the signal)	elementary (tolerance mask around the signal)	elementary (tolerance mask around the signal)	elementary (tolerance mask around the signal)
Mathematics	elementary	elementary	basic (math on math)	basic (math on math)
Serial protocols triggering and decoding <sup>1)</sup>	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, CAN-FD, SENT (7)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN (5)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN (5)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I <sup>2</sup> S, MIL-STD-1553, ARINC429 (8)
Display functions	data logger	–	–	–
Applications <sup>1), 2)</sup>	high-resolution frequency counter, advanced spectrum analysis, harmonics analysis	digital voltmeter (DVM), component tester, fast Fourier transform (FFT)	digital voltmeter (DVM), fast Fourier transform (FFT), frequency response analysis <sup>3)</sup>	power, digital voltmeter (DVM), spectrum analysis and spectrogram, frequency response analysis <sup>3)</sup>
Compliance testing <sup>1), 2)</sup>	–	–	–	–
<b>Display and operation</b>				
Size and resolution	7", color, 800 × 480 pixel	6.5", color, 640 × 480 pixel	10.1", color, 1280 × 800 pixel	10.1", color, 1280 × 800 pixel
Operation	optimized for touchscreen operation, parallel button operation	optimized for fast button operation	optimized for touchscreen operation, parallel button operation	–
<b>General data</b>				
Dimensions in mm (W × H × D)	201 × 293 × 74	285 × 175 × 140	390 × 220 × 152	390 × 220 × 152
Weight in kg	2.4	1.7	2.5	3.3
Battery	lithium-ion, > 4 h	–	–	–

<sup>1)</sup> Upgradeable.

<sup>2)</sup> Requires an option.

<sup>3)</sup> Available Q1 2019.

RTA4000	RTE1000	RTO2000	RTP
200/350/500 MHz/1 GHz <sup>1)</sup>	200/350/500 MHz/1/1.5/2 GHz <sup>1)</sup>	600 MHz/1/2/3/4/6 GHz <sup>1)</sup>	4/6/8/13/16 GHz <sup>1)</sup>
4	2/4	2/4 (only 4 channels in 4 GHz and 6 GHz models)	4
10 bit	8 bit (up to 16 bit with HD mode)	8 bit (up to 16 bit with HD mode) <sup>2)</sup>	8 bit (up to 16 bit with HD mode) <sup>2)</sup>
500 µV to 10 V	500 µV to 10 V	1 mV to 10 V (500 µV to 10 V) <sup>2)</sup>	
500 µV to 1 V	500 µV to 1 V	1 mV to 1 V (500 µV to 1 V) <sup>2)</sup>	1 mV to 1 V
2.5; 5 (2 channels interleaved)	5	10; 20 (2 channels interleaved in 4 GHz and 6 GHz model)	20
100 Msample; 200 Msample (1 Gsample in segmented memory mode)	50 Msample/200 Msample	standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample	standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample
standard	standard	standard	standard
64 000 (2 000 000 in fast segmented memory mode)	1 000 000 (1 600 000 in ultra-segmented memory mode)	1 000 000 (2 500 000 in ultra-segmented memory mode)	950 000 (3 200 000 in ultra-segmented memory mode)
basic (10 trigger types)	advanced, digital trigger (13 trigger types)	advanced (includes zone trigger), digital trigger (14 trigger types) <sup>2)</sup>	advanced, digital trigger (14 trigger types) with realtime deembedding <sup>2)</sup> , zone trigger <sup>2)</sup>
16	16	16	16
two logic probes: 2.5 on each channel; one logic probe: 5 on each channel	5	5	5
two logic probes: 100 Msample per channel; one logic probe: 200 Msample per channel	100 Msample	200 Msample	200 Msample
4	3	3	3
32	47	47	47
elementary (tolerance mask around the signal)	advanced (user-configurable, hardware based)	advanced (user-configurable, hardware based)	advanced (user-configurable, hardware based)
basic (math on math)	advanced (formula editor)	advanced (formula editor)	advanced (formula editor)
I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I <sup>2</sup> S, MIL-STD-1553, ARINC 429 (8)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I <sup>2</sup> S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, USB 2.0/HSIC, Ethernet, Manchester, NRZ, SENT, SpaceWire, CXPI, USB Power Delivery, automotive Ethernet 100BASE-T1 (19)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I <sup>2</sup> S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, SENT, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, CXPI, USB 3.1 Gen1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, automotive Ethernet 100BASE-T1 (27)	I <sup>2</sup> C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, MIPI D-PHY, MIPI M-PHY/UniPro, USB 3.1 Gen1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, automotive Ethernet 100BASE-T1 (20)
–	histogram, trend, track <sup>2)</sup>	histogram, trend, track <sup>2)</sup>	histogram, trend, track
power, digital voltmeter (DVM), spectrum analysis and spectrogram, frequency response analysis <sup>3)</sup>	power, 16-bit high definition mode (standard), advanced spectrum analysis and spectrogram	power, 16-bit high definition mode, advanced spectrum analysis and spectrogram, jitter, clock data recovery, I/Q data, RF analysis	16-bit high definition mode, advanced spectrum analysis and spectrogram, jitter, RF analysis, realtime deembedding
–	–	various options available (see PD 3607.2684.22)	various options available (see PD 5215.4152.22)
10.1", color, 1280 × 800 pixel	10.4", color, 1024 × 768 pixel	12.1", color, 1280 × 800 pixel	12.1", color, 1280 × 800 pixel
optimized for touchscreen operation, parallel button operation			
390 × 220 × 152	427 × 249 × 204	427 × 249 × 204	441 × 285 × 316
3.3	8.6	9.6	18
–	–	–	–

# Base unit

## Vertical system

Input channels	R&S®RTB2002	2 channels
	R&S®RTB2004	4 channels
Input impedance	R&S®RTB2002, R&S®RTB2004	1 MΩ ± 2 % with 9 pF ± 2 pF (meas.)
Analog bandwidth (–3 dB)	R&S®RTB2002 and R&S®RTB2004	> 70 MHz
	R&S®RTB2002 with -B221 option and R&S®RTB2004 with -B241 option	> 100 MHz
	R&S®RTB2002 with -B222 option and R&S®RTB2004 with -B242 option	> 200 MHz
	R&S®RTB2002 with -B223 option and R&S®RTB2004 with -B243 option	> 300 MHz
Lower frequency limit (–3 dB)	at AC coupling	< 2 Hz (meas.)
Analog bandwidth limits (max. –1.8 dB, min. –3.5 dB)	R&S®RTB2002 and R&S®RTB2004	20 MHz
Rise time (10 % to 90 %, calculated)	R&S®RTB2002 and R&S®RTB2004	< 5 ns
	R&S®RTB2002 with -B221 option and R&S®RTB2004 with -B241 option	< 3.5 ns
	R&S®RTB2002 with -B222 option and R&S®RTB2004 with -B242 option	< 1.75 ns
	R&S®RTB2002 with -B223 option and R&S®RTB2004 with -B243 option	< 1.15 ns
Vertical resolution		10-bit, up to 16-bit with high-resolution decimation mode
DC gain accuracy	offset and position = 0, maximum operating temperature change of ±5 °C after self-alignment	
	input sensitivity > 5 mV/div	±1.5 % of full scale
	input sensitivity ≤ 5 mV/div	±2 % of full scale
Offset accuracy		±0.5 % ± 0.1 div ± 1 mV
DC measurement accuracy	after adequate suppression of measurement noise by using high-resolution sampling mode or waveform averaging	±(DC gain accuracy ×  reading – offset setting  + offset accuracy)
Input coupling		DC, AC, GND
Input sensitivity		1 mV/div to 5 V/div
Maximum input voltage		300 V (RMS), max. 400 V (V <sub>p</sub> ), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
Position range		±5 div (depends on offset)
Offset range	input sensitivity	
	200 mV/div to ≤ 5 V/div	±(40 V – position × input sensitivity)
	1 mV/div to < 200 mV/div	±(1.2 V – position × input sensitivity)
Channel-to-channel isolation (each channel at same input sensitivity)	input frequency < analog bandwidth	> 50 dB

## Horizontal system

Timebase range		selectable between 1 ns/div and 500 s/div
Channel deskew		±500 ns
Trigger offset range	min.	memory depth/actual sampling rate
	max.	2 <sup>33</sup> /actual sampling rate
Modes		normal, roll ≥ 50 ms/div
Timebase accuracy	after delivery/calibration, at +23 °C	±2.5 ppm
	during calibration interval	±3.5 ppm



## Acquisition system

Maximum realtime sampling rate	normal mode	1.25 Gsample/s
	interleaved mode, following channels are not used simultaneously: <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>	2.5 Gsample/s
Memory depth per channel	normal	10 Msample per channel
	If following channels are not used simultaneously: <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>	20 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
Number of averaged waveforms		2 to 100 000
Waveform acquisition rate	dot display, single channel, auto record length	up to 50 000 waveforms/s

## Trigger system

Trigger level	range (min)	±5 div from center of screen
Trigger modes		auto, normal, single, n single with R&S®RTB-K15 option
Hold-off range	time	inactive or 50 ns to 10 s
Trigger types		edge, width, video, pattern, serial bus, timeout, line
Edge trigger	trigger events	rising edge, falling edge, both edges
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option), external trigger input
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-B1 option), external trigger input
	coupling (analog channels, external trigger input)	DC, AC, HF reject (attenuates > 50 kHz (meas.)), LF reject (attenuates < 50 kHz (meas.)), noise reject (enlarges trigger hysteresis)
Width trigger	trigger events	pulse width is smaller, greater, equal, unequal, inside interval, outside interval
	min. pulse width	6.4 ns
	max. pulse width	13.5 s
	polarity	positive, negative
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-B1 option)

Video trigger	trigger events	selectable line, all lines, even frame, odd frame, all frames
	supported standards	PAL, NTSC, SECAM, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
	sources	
	R&S®RTB2002	channel 1, channel 2, external trigger input
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, external trigger input
	sync pulse polarity	positive, negative
Pattern trigger	trigger events	logic condition between active channels
	sources	
	R&S®RTB2002	channel 1, channel 2, logic channels from D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15 (with R&S®RTB-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
	min. duration time	6.4 ns
	max. duration time	13.5 s
Serial bus trigger	supported standards	
	R&S®RTB-K1 option	I <sup>2</sup> C/SPI (two- and three-wire)
	R&S®RTB-K2 option	UART/RS-232/RS-422/RS-485
	R&S®RTB-K3 option	CAN/LIN
Trigger sensitivity R&S®RTB2002/R&S®RTB2004	with DC, AC, LF reject	
	input sensitivity > 5 mV/div	< 0.8 div (meas.)
	2 mV/div ≤ input sensitivity < 5 mV/div	< 1.5 div (meas.)
	input sensitivity < 2 mV/div	< 2 div (meas.)
	with HF reject	
	all input sensitivities	< 1 div (meas.)
External trigger input	input impedance	
	R&S®RTB2002/R&S®RTB2004	1 MΩ ± 2 % with 9 pF ± 2 pF (meas.)
	maximum input voltage at 1 mΩ	300 V (RMS), max. 400 V (V <sub>p</sub> ), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
	trigger level	±5 V
	sensitivity	300 mV (V <sub>pp</sub> )
	input coupling	DC, AC, LF reject, HF reject
Trigger output (AUX OUT connector)	functionality	
	A pulse is generated for every acquisition trigger event.	
	output voltage	
	at high impedance	0 V to 4.8 V
	at 50 Ω	0 V to 2.4 V
	pulse polarity	high active
	output delay	depends on trigger settings

## 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, peak+, peak-, frequency, period, amplitude, top level, base level, positive overshoot, negative overshoot, pulse width+, pulse width-, duty cycle+, duty cycle-, rise time, fall time, delay, phase, crest factor, slew rate+, slew rate-, $\sigma$ .std. deviation, $\sigma$ .std. deviation cycle
	measurements on trigger signal	trigger period, trigger frequency implemented by means of six-digit hardware counter
	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	4
Cursor	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®RTB2002	channel 1, channel 2
	R&S®RTB2004	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)
Sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
Number of measurements		up to 4
Resolution		up to 3 digits
Bandwidth		1 MHz

## Frequency counter

Measurements		frequency, period
Sources	R&S®RTB2002	trigger signal source (edge, video): line, channel 1, channel 2, external trigger in
	R&S®RTB2004	trigger signal source (edge, video): line, channel 1, channel 2, channel 3, channel 4, external trigger in
Number of measurements		2
Resolution		6 digits
Frequency range		0.05 Hz to bandwidth of scope (limited by bandwidth of trigger filter)

## Mask testing

Sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	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)

## Waveform maths

Number of math waveforms		up to 5
Functions		addition, subtraction, multiplication, division, square, square root, absolute value, reciprocal, inverse, log10, ln, derivation, integration
Sources	R&S®RTB2002	channel 1, channel 2, math waveforms 1 to 4
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveforms 1 to 4
FFT	sources	
	R&S®RTB2002	channel 1, channel 2, math waveforms, reference waveform
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveforms, reference waveform
	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 from 2 to 1024)
	scaling	dBm, dBV, V (RMS)

## Search function

Functions	search types	edge, width, peak, rise/fall time, runt, data2clock, pattern, protocol (available with R&S®RTB-K3 option)
	configuration	manual level setting, adjustable hysteresis
	display of search events	in diagram (markers) and in result table
Sources	R&S®RTB2002	channel 1, channel 2, math waveform, D0 to D15 (with R&S®RTB-B1 option)
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4, math waveform, D0 to D15 (with R&S®RTB-B1 option)

## Display characteristics

Diagram types	manually changeable vertical window size	Yt, XY, zoom, FFT
XY mode		parallel display of XY diagram and Yt diagrams of input signals for X, Y
Zoom		horizontal zoom with fast navigation, split screen with overview signal and zoomed signal
FFT mode		split screen with Yt diagrams and dedicated frequency diagram
Interpolation		sin(x)/x, linear, sample & hold
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
Sources		analog and digital channels, math, reference, spectrum

## Protocol and logic

Bus decode	number of bus signals	2 <sup>1</sup>
	bus types	parallel, parallel clocked
	R&S®RTB-K1 option	SPI (2-wire, 3-wire, 4-wire <sup>1</sup> ), I <sup>2</sup> C
	R&S®RTB-K2 option	UART/RS-232/RS-422/RS-485
	R&S®RTB-K3 option	CAN, LIN
	display types	decoded bus, logical signal, frame table (depends on decoded bus)
	data format of decoded bus	hex, decimal, binary

## Miscellaneous

Save/recall	device settings	save and recall on internal file system or USB flash drive or on a PC via web interface or USB-MTP (media transfer protocol)
	reference waveforms	save and recall on internal file system or USB flash drive or on a PC via web interface or USB-MTP
	waveforms	save on USB flash drive 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 flash drive or download and save on a PC via web interface or USB-MTP; available file formats: BMP, PNG
Camera button (one touch)		configurable button, actions on press: <ul style="list-style-type: none"> <li>• save device settings (setup)</li> <li>• save waveforms</li> <li>• save screenshot</li> <li>• search/bus/statistic results</li> </ul>
Instrument security		secure erasure of internal file system and all settings

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

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		undo/redo function

## Input and outputs

<b>Front</b>		
Channel inputs		BNC, for details see Vertical system
External trigger input		BNC, for details see Trigger system
AUX OUT (BNC)	trigger out	for details see Trigger system
	reference frequency	10 MHz ± 3.5 ppm (meas.)
	mask violation	pulse
	waveform generator (with R&S®RTB-B6 option only)	for details see Waveform generator
Probe compensation output	signal shape rectangle	$V_{low} = 0\text{ V}$ , $V_{high} = 2.5\text{ V}$ (meas.)
	frequency	1 kHz during probe adjust setup or manual configurable
Pattern source (with R&S®RTB-B6 option only)	P3 to P0 (with R&S®RTB-B6 option only)	4 lugs, for details see 4-bit pattern generator
Digital channel inputs	D15 to D8, D7 to D0	with R&S®RTB-B1 option only
Ground lug		connected to ground
USB host interface		1 port, type A plug, version 2.0, memory sticks only
<b>Rear</b>		
USB device interface		1 port, type B plug, version 2.0
Ethernet interface		1 port, 1 Gbit
Security slot		for standard Kensington style lock
Fixation loop		for securing the instrument with a cable

## 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
Maximum of sound pressure level		28.3/30.2 dB (A) at 1.0/0.8 m distance (at +23 °C, 947 mbar (hPa), 20 % rel. humidity), in line with ISO EN 3744
<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>2</sup>
Certifications		VDE, cCSA <sub>US</sub>
Calibration interval		1 year
<b>Power supply</b>		
AC supply		100 V to 240 V at 50 Hz to 400 Hz, 0.95 A to 0.5 A
Power consumption		max. 60 W
Safety		in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1
Power consumption in stand-by		0.5 W (meas.)
<b>Mechanical data</b>		
Dimensions	W × H × D	390 mm × 220 mm × 152 mm (15.4 in × 8.66 in × 5.98 in)
Weight	(nom.)	2.5 kg (5.5 lb)

<sup>2</sup> Test criterion is displayed noise level within ±1 div for input sensitivity of 5 mV/div.

# Options

## R&S®RTB-B1

<b>Mixed signal option, additional 16 logic channels</b>		
Vertical system		
Input channels		16 logic channels (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 kΩ ± 2 %    ~4 pF (meas.) at probe tips
Maximum input frequency	signal with minimum input voltage swing and hysteresis setting: normal	300 MHz (meas.)
Maximum input voltage		±40 V (V <sub>p</sub> )
Minimum input voltage swing	hysteresis small	300 mV (V <sub>pp</sub> ) (meas.)
	hysteresis medium	800 mV (V <sub>pp</sub> ) (meas.)
	hysteresis large	1500 mV (V <sub>pp</sub> ) (meas.)
Threshold groups		D15 to D8 and D7 to D0
Threshold level	range	-2 V to 8 V in 10 mV steps
	predefined	CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, TTL, ECL
Threshold accuracy		±(100 mV + 3 % of threshold setting) (meas.)
Comparator hysteresis		small, medium, large
Horizontal system		
Channel-to-channel skew		max. 800 ps (meas.)
Acquisition system		
Sampling rate		1.25 Gsample/s for every channel
Memory depth		10 Msample for every channel
Trigger system		see Trigger system
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, value at the cursor position
Additional cursor function		display of decoded parallel bus value at the cursor position
Display characteristics		
Channel activity display		independent of the scope acquisition, the state (stays low, stays high or toggles) of the channels from D15 to D0 is displayed



## R&S®RTB-B6

<b>Waveform generator and 4-bit pattern generator</b>		
<b>Waveform generator</b>		
Resolution		14-bit
Sample rate		250 Msample/s
Amplitude	level	
	high Z	20 mV to 5 V ( $V_{pp}$ )
	50 $\Omega$	10 mV to 2.5 V ( $V_{pp}$ )
	accuracy	3 %
DC offset	level	
	high Z	$\pm 2.5$ V
	50 $\Omega$	$\pm 1.25$ V
	accuracy	3 % or $\pm 5$ mV whatever is greater
Sine	frequency	0.1 Hz to 25 MHz
	SFDR	> 40 dBc (meas.)
	THD	> 40 dBc (meas.)
Rectangle	frequency	0.1 Hz to 10 MHz
Pulse	frequency	0.1 Hz to 10 MHz
	edge time	adjustable
	duty cycle	1 % to 99 %
Ramp, triangle, sinc, exponential	frequency	0.1 Hz to 1 MHz
Arbitrary	sample rate	max. 10 Msample/s
	memory depth	16k points
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, triangle
Burst	number of cycle	1 to 1024
	idle time	28 ns to 17 s
	start phase	0° to 360°
	trigger	continuous, manually
<b>4-bit pattern generator</b>		
Functions		probe adjust/square wave, bus signal source 4-bit counter, programmable 4-bit pattern
Probe adjust		1 kHz/1 MHz square wave signal approx. 2.5 V ( $V_{pp}$ ) (tr < 4 ns)
Bus signal source		SPI, I <sup>2</sup> C, UART, CAN, LIN
	bandwidth	9600 bit/s to 1 Mbit/s
4-bit counter	frequency	1 mHz to 25 MHz
Programmable pattern	sample rate	20 ns to 1 s, up/down
	memory depth	2048 bit
	pattern idle time	50 ns to 1 s

## R&S®RTB-Bxx bandwidth upgrades

Option	Model	Analog bandwidth upgrade from 70 MHz to
R&S®RTB-B221	R&S®RTB2002	100 MHz
R&S®RTB-B222	R&S®RTB2002	200 MHz
R&S®RTB-B223	R&S®RTB2002	300 MHz
R&S®RTB-B241	R&S®RTB2004	100 MHz
R&S®RTB-B242	R&S®RTB2004	200 MHz
R&S®RTB-B243	R&S®RTB2004	300 MHz

## R&S®RTB-K1

<b>I<sup>2</sup>C triggering and decoding</b>		
Bus configuration	sources for SCL and SDA	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	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 and trigger event are displayed in different colors
	displayed format of address	hex
	displayed format of data	ASCII, binary, decimal or hex
<b>SPI triggering and decoding</b>		
Bus configuration	sources for CS, CLK, MOSI and MISO	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	up to 25 Mbps
	chip select (CS)	active low, active high or missing (two-wire SPI)
	clock (CLK) slope	rise or fall
	data symbol size	1 bit to 32 bit
	idle time for two-wire SPI	< 1 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 and trigger event are displayed in different colors
	displayed format of data	ASCII, binary, decimal or hex
	data decoding	MSB or LSB first

## R&S®RTB-K2

UART/RS-232/RS-422/RS-485 triggering and decoding		
Bus configuration	source for RX and TX	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	300/600/1200/2400/4800/9600/19200/38400/57600/115200 bps or user-selectable up to 3 Mbps
	end of frame	timeout, none
	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
Trigger	trigger events	start bit, start of frame, symbol number, any symbol, pattern of symbols, parity error, frame 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 and trigger event are displayed in different colors
	displayed format of data	ASCII, binary, decimal or hex

## R&S®RTB-K3

CAN triggering and decoding		
Bus configuration	signal type	CAN_H, CAN_L
	sources	channel 1, channel 2, channel 3, channel 4, logic channels from D0 to D15
	bit rate	10/20/33.3/50/83.3/100/125/250/500/1000 kbps or user-selectable in range from 100 bps to 2 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; three table positions (top, bottom, full screen); 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 1 kbps to 2.5 Mbps
	polarity	active high or active low
	label list	associate frame identifier with symbolic ID
Trigger	source	any input channel
	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)
	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 =, ≠, >, <
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; three table positions (top, bottom, full screen); 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&S®RTB-K15

History and segmented memory				
Memory segmentation	function	additional memory segments for the acquisition		
	number of segments <sup>3</sup>	record length	segments (up to)	total memory (per channel)
		10 ksample	13 107	131 Msample
		20 ksample	13 107	262 Msample
		50 ksample	4 369	218 Msample
		100 ksample	2 621	262 Msample
		200 ksample	1 456	291 Msample
		500 ksample	624	312 Msample
		1 Msample	319	319 Msample
		2 Msample	159	318 Msample
		5 Msample	64	320 Msample
		10 Msample	32	320 Msample
		20 Msample	16	320 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 2.5 µs (up to 300 000 waveforms/s)			
History mode	function	The history mode always provides access to past acquisitions in the segmented memory.		
	timestamp resolution	6.4 ns		
	history player	replays the recorded waveforms; start and stop waveform could be set; repetition possible		

## R&S®RTB-K36

Frequency response analysis – Bode plot		
Stimulus	frequency mode	single sweep or repeated sweep
	frequency range	10 Hz to 25 MHz
	amplitude mode	fixed or amplitude profile
	amplitude level	20 mV to 5 V into high Z 10 mV to 2.5 V into 50 Ω
Input and output sources	R&S®RTB2002	channel 1, channel 2
	R&S®RTB2004	channel 1, channel 2, channel 3, channel 4
Number of test points		10 points to 500 points per decade
Dynamic range		typ. > 70 dB based on 0 dBm (630 mV (V <sub>pp</sub> ) into 50 Ω, gain noise < 1 dB, phase noise < 5°)
Measurement		dual pair of tracking gain and phase cursors
Diagram types	manually changeable vertical window size	parallel display of result window and input and output signal view
Result table		navigation and export functions
Scaling	during and after test	auto-scale and manual scaling and positioning

<sup>3</sup> In interleaved mode.

# Ordering information

Designation	Type	Order No.
<b>Choose your R&amp;S®RTB2000 base model</b>		
Oscilloscope, 70 MHz, 2 channels	R&S®RTB2002	1333.1005.02
Oscilloscope, 70 MHz, 4 channels	R&S®RTB2004	1333.1005.04
Base unit (including standard accessories: R&S®RT-ZP03 passive probe per channel, power cord)		
<b>Choose your bandwidth upgrade</b>		
Upgrade of R&S®RTB2002 oscilloscopes to 100 MHz bandwidth	R&S®RTB-B221	1333.1163.02
Upgrade of R&S®RTB2002 oscilloscopes to 200 MHz bandwidth	R&S®RTB-B222	1333.1170.02
Upgrade of R&S®RTB2002 oscilloscopes to 300 MHz bandwidth	R&S®RTB-B223	1333.1186.02
Upgrade of R&S®RTB2004 oscilloscopes to 100 MHz bandwidth	R&S®RTB-B241	1333.1257.02
Upgrade of R&S®RTB2004 oscilloscopes to 200 MHz bandwidth	R&S®RTB-B242	1333.1263.02
Upgrade of R&S®RTB2004 oscilloscopes to 300 MHz bandwidth	R&S®RTB-B243	1333.1270.02
<b>Choose your options</b>		
Mixed signal option for non-MSO models, 300 MHz	R&S®RTB-B1	1333.1105.02
Arbitrary waveform generator	R&S®RTB-B6	1333.1111.02
I <sup>2</sup> C/SPI serial triggering and decoding	R&S®RTB-K1	1333.1011.02
UART/RS-232/RS-422/RS-485 serial triggering and decoding	R&S®RTB-K2	1333.1028.02
CAN/LIN serial triggering and decoding	R&S®RTB-K3	1333.1034.02
History and segmented memory	R&S®RTB-K15	1333.1040.02
Frequency response analysis (Bode plot)	R&S®RTB-K36	1335.8007.02
Application bundle, consists of the following options: R&S®RTB-K1, R&S®RTB-K2, R&S®RTB-K3, R&S®RTB-K15, R&S®RTB-K36, R&S®RTB-B6	R&S®RTB-PK1	1333.1092.02
<b>Choose your additional probes</b>		
Single-ended passive probes		
300 MHz, 10 MHz, 10:1/1:1, 10 MΩ/1 MΩ, 400 V, 12 pF/82 pF	R&S®RT-ZP03	3622.2817.02
500 MHz, 500 MHz, 10:1, 300 V (RMS), 10 pF	R&S®RT-ZP05	3623.2927.02
500 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF	R&S®RTM-ZP10	1409.7708.02
38 MHz, 1 MΩ, 1:1, 55 V, 39 pF	R&S®RT-ZP1X	1333.1370.02
High-voltage single-ended passive probes		
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
Current probes		
20 kHz, AC/DC, 10 A/1000 A	R&S®RT-ZC02	1333.0850.02
100 kHz, AC/DC, 30 A	R&S®RT-ZC03	1333.0844.02
10 MHz, AC/DC, 150 A	R&S®RT-ZC10	1409.7750.02
100 MHz, AC/DC, 30 A	R&S®RT-ZC20	1409.7766.02
120 MHz, AC/DC, 5 A	R&S®RT-ZC30	1409.7772.02
Power supply for current probes	R&S®RT-ZA13	1409.7789.02
Active differential probes		
100 MHz, 1000:1/100:1, 8 MΩ, 1000 V (RMS), 3.5 pF	R&S®RT-ZD01	1422.0703.02
200 MHz, 10:1, 1 MΩ, 20 V diff., 3.5 pF	R&S®RT-ZD02	1333.0821.02
Logic probes		
Active 8 channel logic probe	R&S®RT-ZL03	1333.0715.02
<b>Probe accessories</b>		
Feedthrough termination 50 Ω	R&S®HZ22	3594.4015.02
Probe pouch	R&S®RT-ZA19	1335.7875.02
<b>Choose your accessories</b>		
Front cover	R&S®RTB-Z1	1333.1728.02
Soft case	R&S®RTB-Z3	1333.1734.02
Transit case	R&S®RTB-Z4	1335.9290.02
Rackmount kit	R&S®ZZA-RTB2K	1333.1711.02

<b>Warranty</b>		
Base unit		3 years
All other items <sup>4</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>5</sup>. 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 <sup>5</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>5</sup> and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

<sup>4</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>5</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

## Service that adds value

- | Worldwide
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- | 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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- | Energy efficiency and low emissions
- | Longevity and optimized total cost of ownership

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**ISO 9001**

Certified Environmental Management

**ISO 14001**

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[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

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