R&S®RTP HIGH-PERFORMANCE OSCILLOSCOPE

HD 16 bit

Signal integrity in real time.
Just got better.



dataTec

Mess- und Prüftechnik. Die Experten.

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Product Brochure
Version 13.00

Oscilloscope innovation. Measurement confidence.

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

The R&S®RTP oscilloscope has an enhanced user interface and a large screen for the outstanding performance and flexibility you expect, combined with a very small footprint. This is perfect for signal integrity analysis in real time.

The R&S®RTP high-performance oscilloscope combines high-class signal integrity with fast acquisition and analysis. The Rohde&Schwarz frontend components offer an expandable oscilloscope platform from 4 GHz to 16 GHz. Dedicated acquisition and processing ASICs enable an unprecedented acquisition and processing rate of 750 000 waveforms/s. The unique 3 Gpoints per channel allow long acquisition periods. The high-precision digital trigger can catch the smallest signal anomalies and operate with hardware based clock data recovery (CDR) on embedded clock signals at an industry-leading data rate of 16 Gbit/s.

The R&S®RTP is the first oscilloscope that compensates impairment of signal contacting in real time while maintaining a high acquisition rate. Hardware based compensation filters are configured with user-applied S-parameters. The real-time math module, directly after the compensation filters, makes it possible to trigger even on deembedded differential and common mode signals.

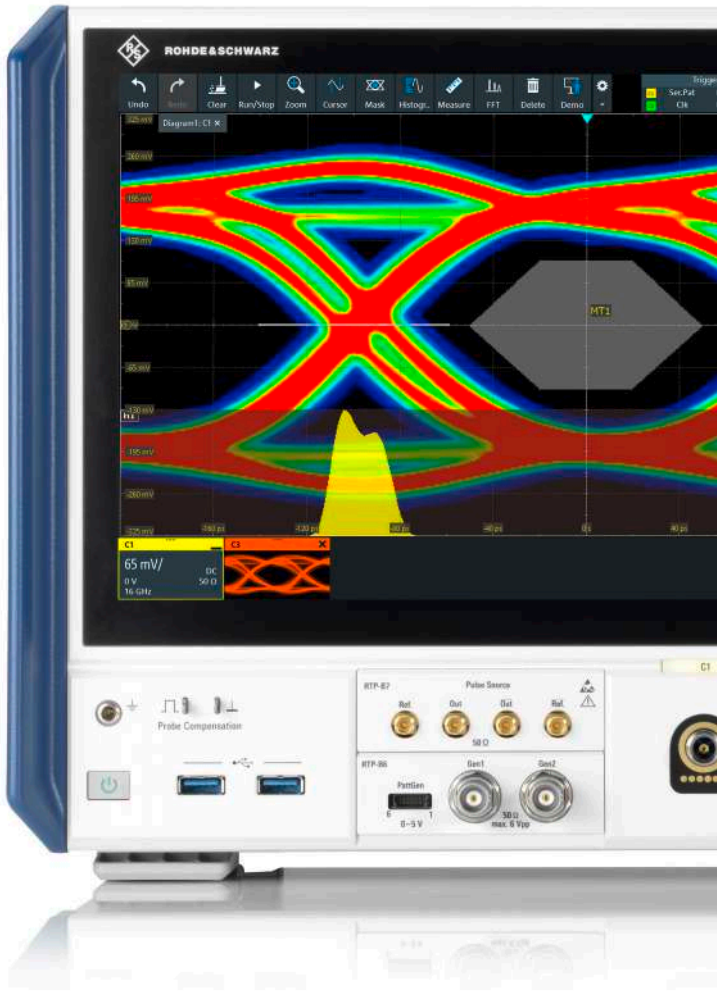
In one box, the R&S®RTP oscilloscope combines multiple instrument capabilities for time-correlated debugging. Additional integrated test resources such as MSO, arbitrary waveform generators, 16 GHz differential TDR/TDT sources and up to sixteen 18 bit high-precision voltage and current channels make the R&S®RTP the most flexible and powerful debugging tool on the market. Together with its compact format, large screen and silent operation, the R&S®RTP oscilloscope is ideal for any lab.

Just got better
13.3" FULL HD DISPLAY

Just got better
ENHANCED USER INTERFACE

Just got better
3 GPOINTS PER CHANNEL

Just got better
HDMI OUTPUT



BENEFITS

Oscilloscope innovation. Measurement confidence.
▶ page 4

Real-time signal integrity
▶ page 6

Compact and configurable
▶ page 10

Superior user experience
▶ page 12

Comprehensive analysis tools
▶ page 14

Multi-instrument capability
▶ page 26

Comprehensive probe portfolio
▶ page 32

OSCILLOSCOPE MODELS

Bandwidth
- ▶ R&S®RTP164B: 16 GHz (2 channels)/8 GHz (4 channels)
- ▶ R&S®RTP134B: 13 GHz (2 channels)/8 GHz (4 channels)
- ▶ R&S®RTP084B: 8 GHz (4 channels)
- ▶ R&S®RTP064B: 6 GHz (4 channels)
- ▶ R&S®RTP044B: 4 GHz (4 channels)

Sampling rate
- ▶ 40 Gsample/s (2 channels), 20 Gsample/s per channel

Acquisition memory
- ▶ 100 Mpoints per channel
- ▶ Max. 3 Gpoints

Acquisition rate
- ▶ 750 000 waveforms/s



Just got better
OPTIMIZED INSTRUMENT DESIGN

Just got better
SUPERIOR CONTROL

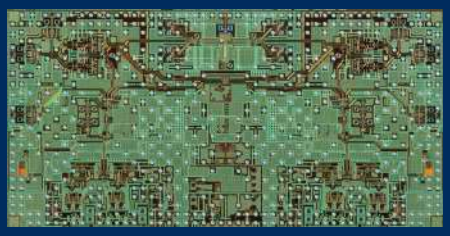
Just got better
MORE APPLICATIONS

Just got better
TRIGGER AND DECODE TECHNOLOGY PACKAGES

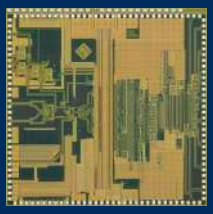
OSCILLOSCOPE INNOVATION. MEASUREMENT CONFIDENCE.

ENABLING TECHNOLOGIES

Rohde&Schwarz engineers focus on making oscilloscopes better. They use leading-edge technologies for hardware and software design and incorporate innovative features such as fastest signal acquisition, an entirely new trigger architecture and the touchscreen-optimized user interface. The new R&S®RTP high-performance oscilloscope family continues this tradition of innovation and offers a true first: high-performance signal integrity in real time in a compact instrument.



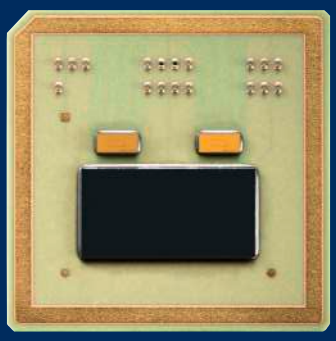




Rohde&Schwarz integrated circuits designed in house

High-performance analog ASICs

Measurement accuracy is highly dependent on the components in the signal path, e.g. amplifiers, samplers and A/D converters. Rohde&Schwarz uses its in-house expertise to design the best analog integrated circuits. Users benefit from low noise, high measurement dynamic range and extremely temperature-stable results.

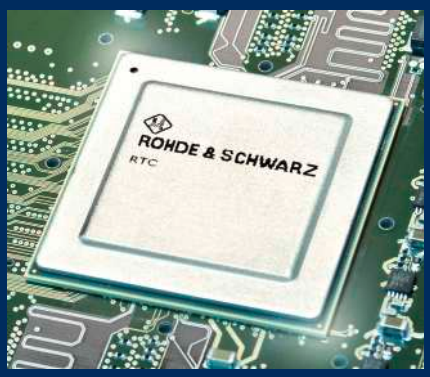




R&S®RTP multi-chip frontend module

Leading-edge multi-chip modules

Rohde&Schwarz uses multi-chip modules to combine the best of the different technologies for excellent frontend performance. As a critical component for both signal integrity and ruggedness, the termination resistor is manufactured with in-house technologies and laser-trimmed for precise input matching.



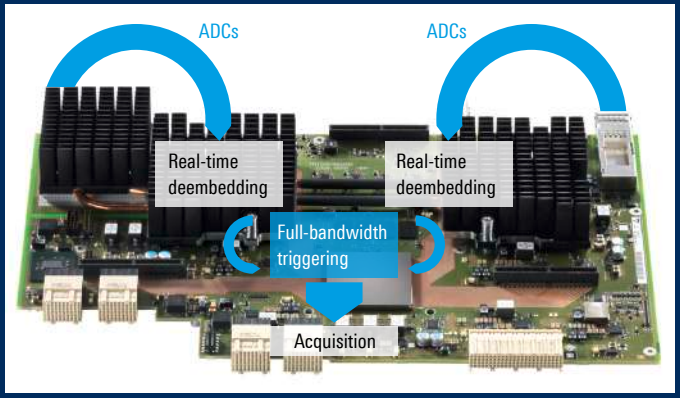
R&S®RTP processing ASIC

Fastest throughput processing with ASIC

A high acquisition and processing rate supports fast detection of rare signal faults and ensures a responsive instrument during operation. The highly integrated Rohde&Schwarz ASIC is capable of running multiple parallel processes, which dramatically reduces blind time.

Real-time deembedding and advanced triggering

The R&S®RTP features powerful processing components directly after the A/D converters for real-time correction of the transmission path from the DUT. The unique Rohde&Schwarz digital trigger system follows in the processing path and operates based on the same compensated A/D converter samples. Users benefit from highest acquisition speed even with activated real-time deembedding and precise triggering on compensated signal events up to the full bandwidth.



R&S®RTP real-time deembedding and trigger board

Quiet and compact

The R&S®RTP instrument platform is designed for minimal bench space and lowest acoustic noise. Managing power consumption is critical in such a highly integrated instrument. Sophisticated temperature management starts with the hardware design, uses advanced heat distribution concepts and includes an optimized air flow design. Users in the lab can enjoy a compact, extremely quiet instrument.



Extremely compact layout of the R&S®RTP

Premium front panel design

The 13.3" high-resolution capacitive touch display is embedded in a precisely milled solid aluminum front panel. This high-quality, long lifetime design supports precise operation of the touchscreen even in the corners. Multicolor LEDs at the channel inputs and on various sections of the front panel intuitively guide users. Key components of the Rohde&Schwarz graphical user interface, such as the multiple diagrams and unit annotation, have become established industry standards.



R&S®RTP premium front panel

REAL-TIME SIGNAL INTEGRITY

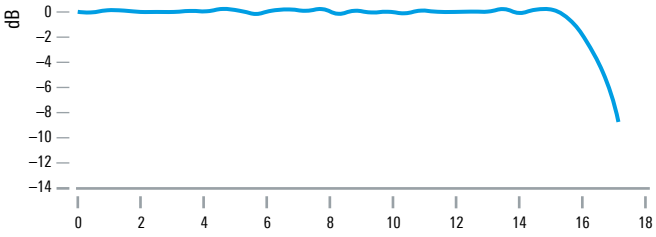
HIGH-PERFORMANCE FRONTEND FOR ACCURATE RESULTS

Flat frequency response and high SFDR for precise and fast measurements

The input components of the R&S®RTP assure high measurement fidelity without time-consuming correction in postprocessing. Users benefit from reliable results with an industry-leading acquisition rate of > 750 000 waveforms/s.

The R&S®RTP is ideal for precise measurements on high speed signals and wideband RF applications thanks to its flat frequency response, high effective number of bits and large spurious free dynamic range (SFDR excl. harmonics > 60 dBc).

Flat frequency response of the R&S®RTP164B



High input sensitivity of 2 mV/div for small signals

The instrument supports measurement of small signals with high vertical input sensitivity down to 2 mV/div without software magnification or limitations on the maximum measurement bandwidth.

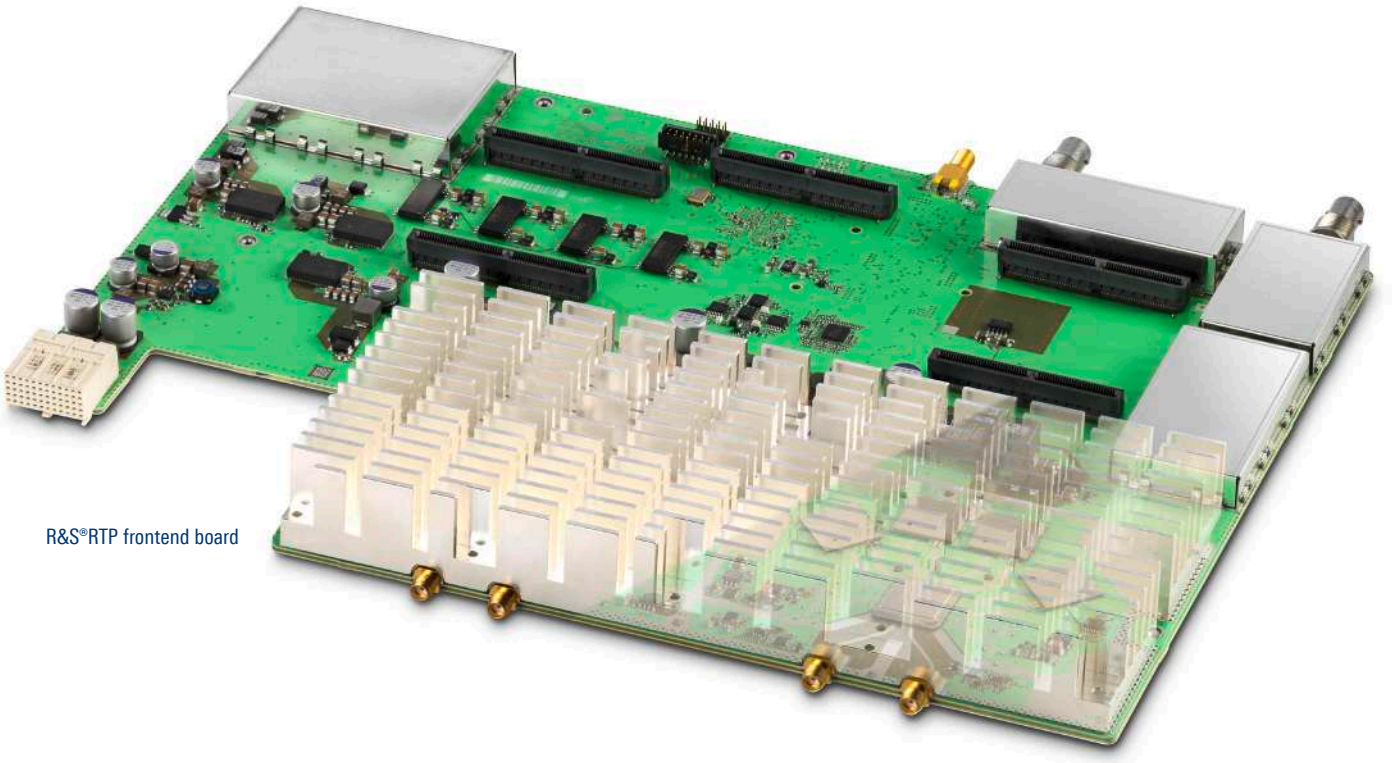
In combination with the sophisticated shielding design, a channel-to-channel isolation of > 60 dB maintains high measurement accuracy for multichannel measurements.

High temperature stability for consistent results

The R&S®RTP frontend is optimized for almost zero DC drift and high temperature stability. Measure during the day without the interruption of calibration step updates. The tight temperature control of the R&S®RTP ensures stable results. And the speed-controlled fan keeps acoustic noise to a whisper.

Low intrinsic jitter

The sampling clock for A/D converters is optimized for low intrinsic jitter. An oven-controlled crystal oscillator (OCXO) acts as a reference for long-term jitter stability for acquisitions with deep memory up to 3 Gpoints.



R&S®RTP frontend board

REAL-TIME PROCESSING TO CATCH ALL SIGNAL DETAILS

Deembedding for waveform correction in real time

The R&S®RTP extends traditional deembedding capabilities with a flexible filter structure directly after the A/D converter. This allows waveform corrections in real time. The benefits relative to deembedding acquired waveforms during postprocessing include increased measurement speed and instrument responsiveness.

When real-time deembedding is switched on, the R&S®RTP retains the maximum acquisition rate of > 750 000 waveforms/s. Debugging tasks such as sporadic signal fault searches and eye diagram analyses can be done in a fraction of the time.

A cascade of signal path blocks can be defined for deembedding. The individual blocks are described by S-parameters that can be derived from simulation or measured with a vector network analyzer. Alternatively, the R&S®RTP-B7 pulse source option can be used to measure the transmission loss of the complete signal path. For both approaches, the deembedding software automatically calculates the correction filter for the overall system response.

For the first time, users can trigger on corrected waveforms with the R&S®RTP and focus on debugging the true device characteristics. The unique digital trigger system operates with sampling points from the A/D converter and the real-time deembedding filter. The trigger evaluates the real device signal by removing the distortion effects of the measurement path.

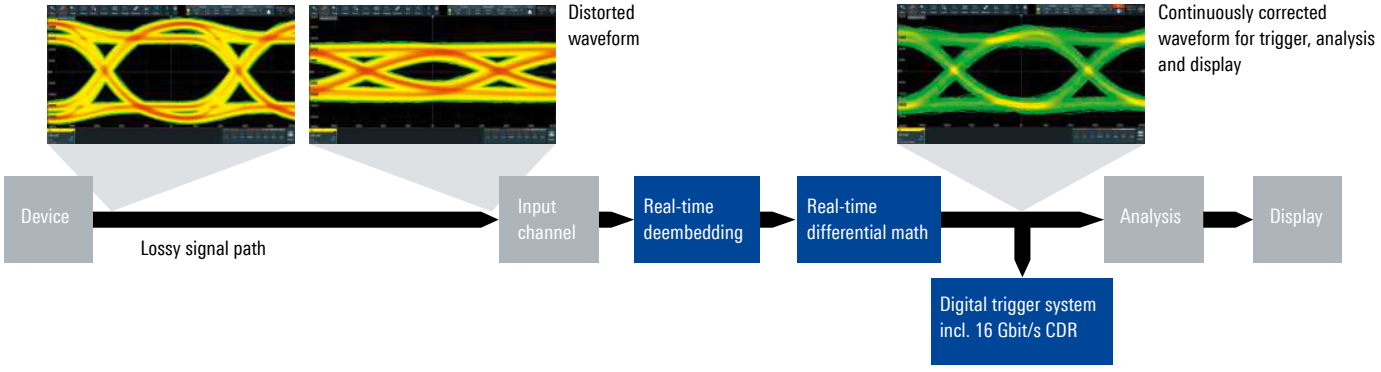
Real-time math for differential signals

The R&S®RTP features a differential signal math module directly after the real-time deembedding filter and before the trigger system. It supports calculation of differential and common mode signals for any two input channels, enabling fast analysis of differential signals, including triggering on differential or common mode voltage.



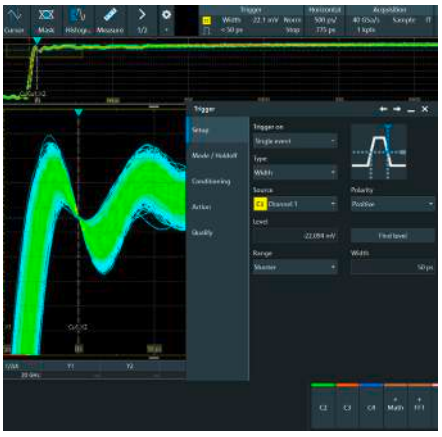
Deembedding setup for a differential signal acquired using two input channels and real-time differential signal math

Real-time processing architecture



Advanced trigger capabilities to isolate smallest and complex signal details

The powerful R&S®RTP trigger system goes beyond the limits of traditional high-performance oscilloscopes. In addition to the edge trigger, advanced triggers such as pulse width, runt and setup&hold can cover the full instrument bandwidth for quick isolation of high-frequency signal components. Trigger sensitivity can be adjusted from 0 div to 5 div and the trigger resolution can be extended up to 16 bit in high definition mode. Users can reliably trigger on even the smallest signal details.



Reliable triggering with width trigger shorter than 50 ps

Analyze high speed serial signals with the serial pattern trigger and 16 Gbit/s clock data recovery

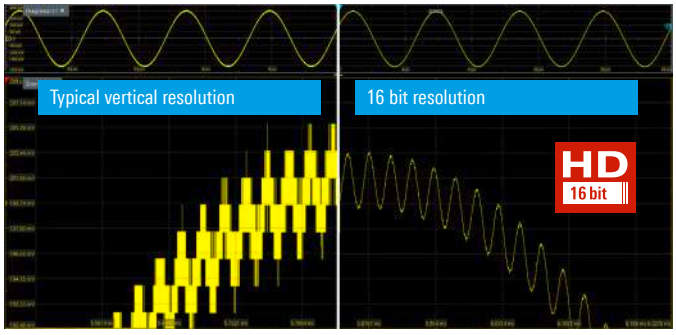
The R&S®RTP features a high speed serial pattern trigger that can operate using the extracted embedded clock of a serial signal. The R&S®RTP uses hardware based clock data recovery (CDR) that supports a maximum nominal data rate of 8 Gbit/s or 16 Gbit/s, depending on the software option. The CDR can use any of the four analog input channels. This function is available as an upgrade at any time since the options are license key enabled.
The high speed serial pattern trigger supports a variety of trigger events, including user-defined bit streams up to 160 bit and various decoding schemes such as 8b10b or 128b132b. By triggering on a “1” or a “0”, an eye diagram for NRZ data can be easily generated. Eye mask test and histogram functions are available for further signal integrity analyses.

Key parameters of the high speed serial pattern trigger

Parameter	Value range
CDR bit rate	
R&S®RTP-K140/-K141 option	21 kbit/s to 8 Gbit/s/16 Gbit/s
Trigger type	
Single-bit pattern	up to 160 bit
Dual-bit pattern	2 bit pattern up to 160 bit
Complex word	frame alignment; up to 4 bit pattern, logical conditions
PRBS error	7, 9, 11, 15, 16,17, 20, 23, 29, 31
Decoding	8b10b, 128b130b, 128b132b

Increase real-time resolution with 16 bit HD mode to see more

The low-noise frontend and single-core A/D converters form the foundation for the precise measurement accuracy and high dynamic range of R&S®RTP oscilloscopes. High definition (HD) mode activates configurable lowpass filtering of the signal after the A/D converters. The hardware implemented filters reduce noise in real time, effectively increasing the signal-to-noise ratio. Users can adjust the filter bandwidth and increase vertical resolution stepwise. The maximum 16 bit resolution is possible with a 200 MHz bandwidth. The digital trigger system benefits from increased resolution in the 16 bit HD mode from Rohde&Schwarz to trigger even on the smallest signal details.



The 16 bit HD mode makes signals details visible that are otherwise hidden in noise

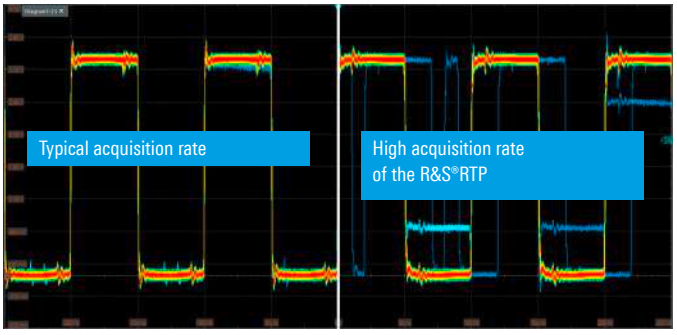
Resolution as a function of the filter bandwidth

Filter	Resolution
Inactive	8 bit
2 GHz	10 bit
1 GHz	11 bit
500 MHz	12 bit
200 MHz to 10 kHz	16 bit

HARDWARE-ACCELERATED PROCESSING FOR FAST RESULTS

Quickly find signal faults with > 750 000 waveforms/s

R&S®RTP oscilloscopes can process and display over 750 000 waveforms/s in standard operating mode. You can detect sporadic signals quickly and reliably. The update rate is unique for high-performance oscilloscopes. A high acquisition rate is even available for active zoom or cursor measurements.

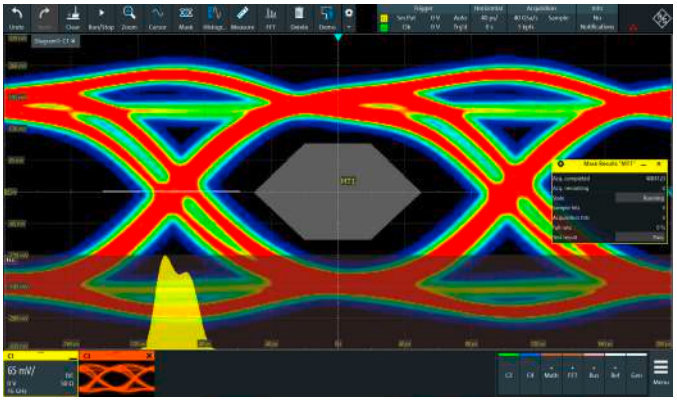


The high acquisition rate detects sporadic signal faults fast

Fast eye mask test and histogram

Mask tests and the histogram display are hardware accelerated with the R&S®RTP oscilloscope and deliver fast results with high statistical confidence. Signal anomalies and unexpected results can be quickly identified. A new mask can be defined directly on the display in just a few steps. Each mask can have up to eight segments.

The histogram on the R&S®RTP oscilloscope can be applied to input signal levels (vertical) or transitions in the timebase (horizontal) to analyze noise and jitter. Each histogram can display the statistical data together with other measurement functions.



The 16 Gbit/s HW-CDR trigger enable fastest eye diagram and histogram measurements

COMPACT AND CONFIGURABLE

FOR EVERYDAY LAB USE

13.3" high resolution, multitouch display
- ► 1920 × 1080 pixel resolution (Full HD)
- ► Gesture support speeds up scaling and zooming
- ► See all signal details

Interfaces
- ► 4 × USB 3.0 and 2 × USB 2.0
- ► USB device port
- ► HDMI and DisplayPort
- ► Removable SSD
- ► Gigabit LAN
- ► GPIB IEEE-488 interface

Scale up as your requirements grow
- ► 4 options slots to add hardware
- ► 16-channel, general purpose MSO
- ► Dual channel, 100 MHz arbitrary waveform generator
- ► 16 GHz differential pulse source
- ► 16 high precision (current and voltage) channels
- ► Upgradeable bandwidth and memory



Compact, lightweight instrument

The R&S®RTP saves up to 54 % of desk space, leaving plenty of room for the measurement setup.



R&S®RTP
441 × 316 mm, 18.0 kg

Instrument 1
467 × 406 mm, 23.4 kg
Approx. 36 %
more space needed

Instrument 2
436 × 492 mm, 23.7 kg
Approx. 54 %
more space needed

Customizable waveform display

- Quickly arrange your view with R&S®SmartGrid
- Simplified GUI for enhanced workflows
- Maximized waveform area
- Fast access to important tools via the toolbar
- Optimized icon arrangement
- Manage multiple diagrams simultaneously with tabs



Intuitive front panel increase productivity

- Fast, direct access to primary instrument settings
- Quickly adjust settings with knobs and buttons
- Selection layout makes finding the right button easy

Clear orientation with color-coded LEDs

- Color-coded buttons and dials enable fast association with sources
- Indication of currently selected channel
- Selection between fine/course adjustments made simple

Get to your signals

- 18 GHz BNC-compatible Rohde & Schwarz probe interface for measurement channels and external trigger
- Supports over 30 Rohde & Schwarz current and voltage probes
- True 50 Ω path for accurate signal capture
- 1 MΩ adapter to support an even wider range of passive and active probes, including ones from third parties

SUPERIOR USER EXPERIENCE

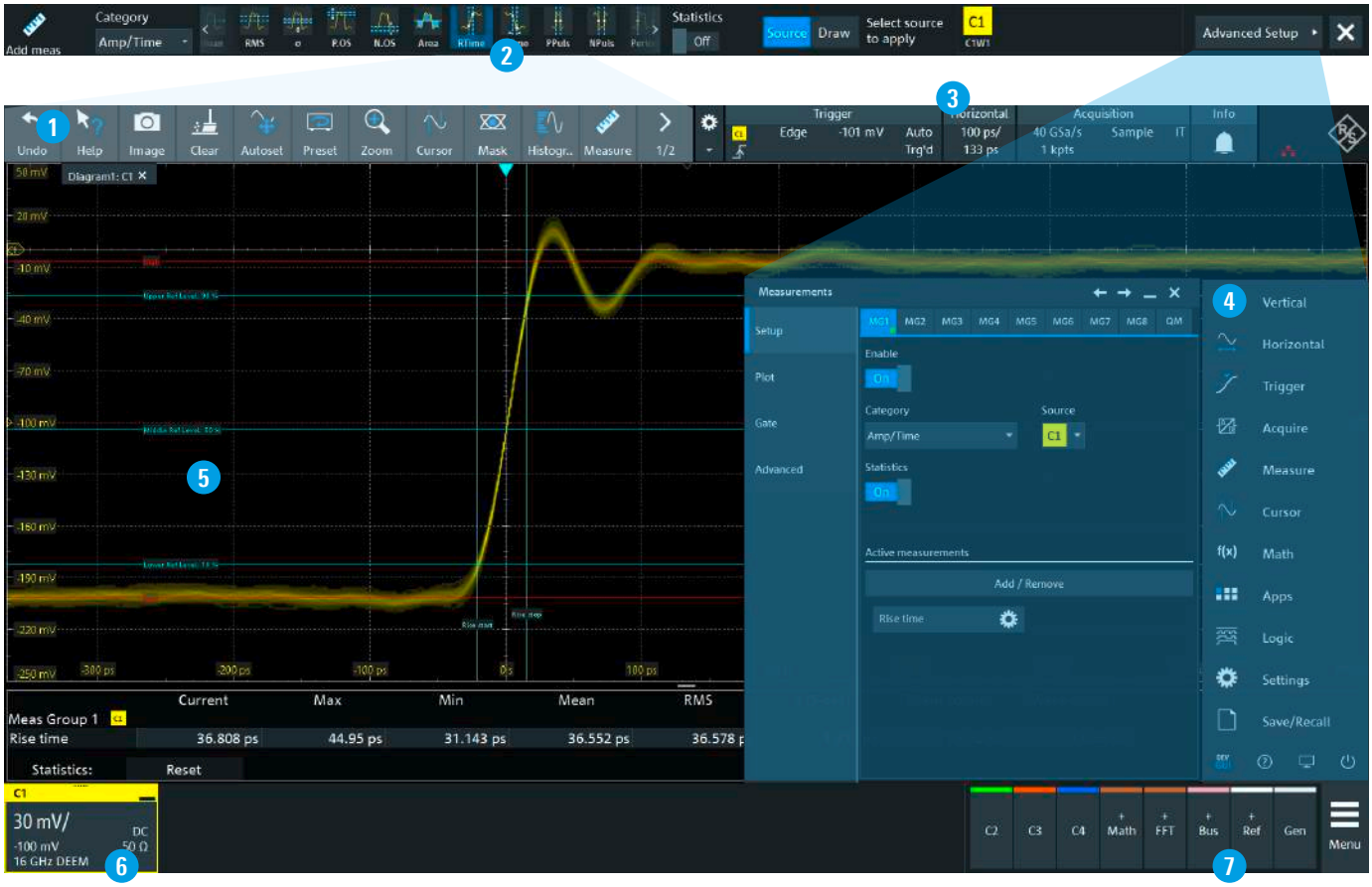
ADVANCED USABILITY, RICH TOOLSET, FAST REMOTE CONTROL

Quick access to important tools

The toolbar 1 enables quick access to important tools. The most common parameters can be directly set via a simple overlay menu, including selecting the type of measurements, source and category 2. Choose from 29 different tools for maximum flexibility. The upper menu also displays trigger, horizontal and acquisition settings 3.

Advanced setup with compact menu structure

An advanced setup 4 is available where detailed parameters can be defined, such as plotting measurements or gating specific parts of the signal. The compact menu structure allows users to directly see the impact of measurement modifications.



Signal bar and preview icons

Activated signals appear in the flexible R&S®SmartGrid 5, along with the fundamental signal parameters displayed in the signal bar 6. From here, drag and drop an individual waveform layout into the R&S®SmartGrid. Minimize unwanted signals in the signal bar, where a preview is still available.

Signal activators and main menu

Signals activators can 7 turn on different signals (analog channels, math, FFT, serial protocols, signal generator) with one touch/click, making configuration of measurement setups fast and straightforward. The main menu provides access to all instrument settings.

Language selection

The R&S®RTP oscilloscope supports multiple languages. Switch languages in just a few seconds while the instrument is running for a truly international oscilloscope.



Storage options		
Onefile	complete	stores waveform, setup, math channels, reference waveforms in one zip file
Contents	waveform	complete
		selection (zoom, cursor, gate, manual)
		number of acquisitions
		history memory
Evaluation		histograms
		measurement results
		long-term trend
Format	measurement data	binary, XML, CSV, 1 to 4 channels
	graphics	PNG, JPG, BMP, TIF, PDF
	reports	PDF, HTML, DOC
Drivers		VXi, LabView, LabWindows, .NET

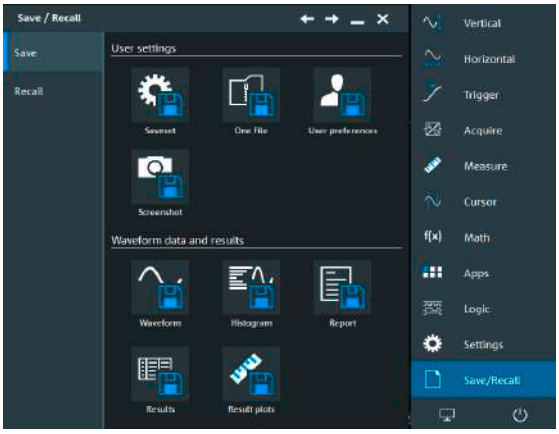
Remote control access: anytime, anywhere

Remote connection, viewing and control with the same user interface as the oscilloscope on a PC or mobile device. The Gigabit LAN interface makes it possible. All oscilloscope functions can be accessed via USB, Ethernet and GPIB interfaces.



Easy instrument setup

Each save set is stored with an instrument setup that includes a screenshot of the most recent oscilloscope display. To open a specific instrument setup later, simply scroll through the screenshots to find the right configuration.



Rich debugging toolset

Every R&S®RTP offers over 90 measurement functions that are organized by amplitude, time, jitter, eye, histogram, spectrum and protocol measurements.

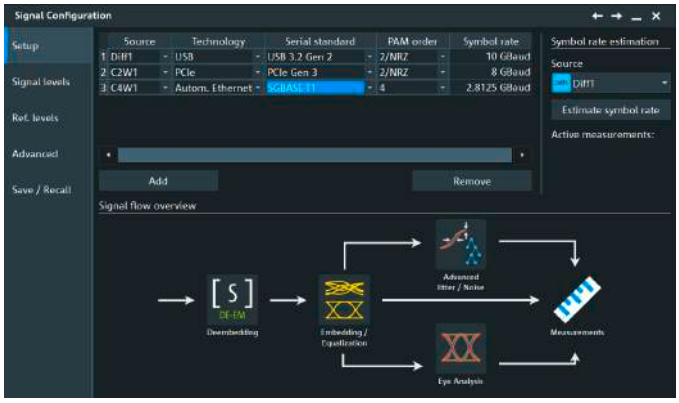
Available signal analysis options	
Statistics	display of average value, minimum/maximum value and standard deviation
Histogram	graphic display of events as histogram; definition of measurement range and resolution for histogram (manual or automatic)
Trend	long-term trend function for analyzing slowly developing variations in measurement results (easy identification of thermal dependencies within measurement results)
Track	analysis of rapidly changing measurement results in time periods; display results over entire acquisition period
Gating	restriction of the measurement range to a specific signal range (manually defined or linked to existing cursor or zoom ranges)
Reference lines	definition of reference lines (manual, automatic or averaged); optional display in the waveform
Result lines	graphic display of results on waveform, e.g. for documentation
Multiple measurements	definition of the maximum number of measurements per waveform

COMPREHENSIVE ANALYSIS TOOLS

ANALYZING THE WHOLE SIGNAL PATH

Signal configuration

The signal configurator is the central entry point for signal integrity analysis. Interface standards based on configurations, such as symbol rate, PAM order, CDR settings and equalizer coefficients are supported. Just select an input channel as source, the appropriate standard and configure deembedding, embedding and equalization, before starting an in-depth analysis with automated measurements, eye,jitter and noise tools.



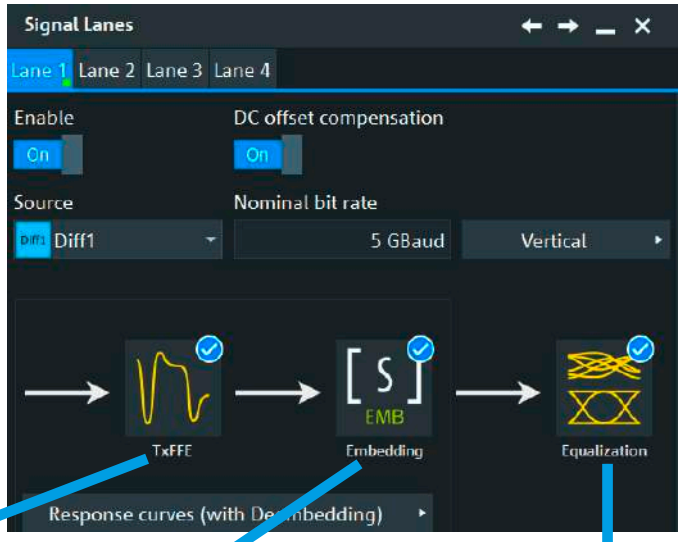
Signal configurator: select the appropriate interface standard for preconfiguration of CDR or equalizer parameters

Emulation of channel loss and TX/RX equalization

A high speed signal travelling through a transmission channel composed of chip housing, PCB traces, vias, connectors or cables will experience distortion. Different test points are typically defined or accessible for thorough signal analysis along the transmission channel. Common transmitter and receiver characteristics can be emulated by embedding dedicated channel loss and applying an adequate equalization filter.

The R&S®RTP lets a signal lane be flexibly configured to match the characteristics of a DUT and its target application. The R&S®RTP automatically computes FIR filters based on the loaded S-parameter files for embedding and the defined coefficients for the equalizers.

Benefit from preconfigured equalizer and embedding settings for many interface standards or customize your taps. Optimize the tap coefficients for FFE and DFE equalizers with automated training for your dedicated signal. Validate your setup with preview diagrams for transmission loss, step response or filter characteristics.



Define your signal lane:

- Transmitter equalizer (TxFFE): 1 precursor, 2 postcursors
- Embedding: up to 5 components
- Receiver equalizer
  1. CTLE with up to 6 zero and pole frequencies
  2. FFE with up to 40 taps
  3. DFE with up to 5 taps



JITTER AND NOISE ANALYSIS

Powerful basic jitter analysis functions

The R&S®RTP-K12 option enables a wide range of basic jitter analysis functions in R&S®RTP oscilloscopes. Automated cycle-to-cycle jitter and time interval error (TIE) jitter measurements are essential for jitter analysis of clock and data signals. When investigating further signal details, additional tools such as track, long-term trend and FFT on track can be used. Frequency interference can be determined by applying FFT analysis to the cycle-to-cycle jitter measurement track.

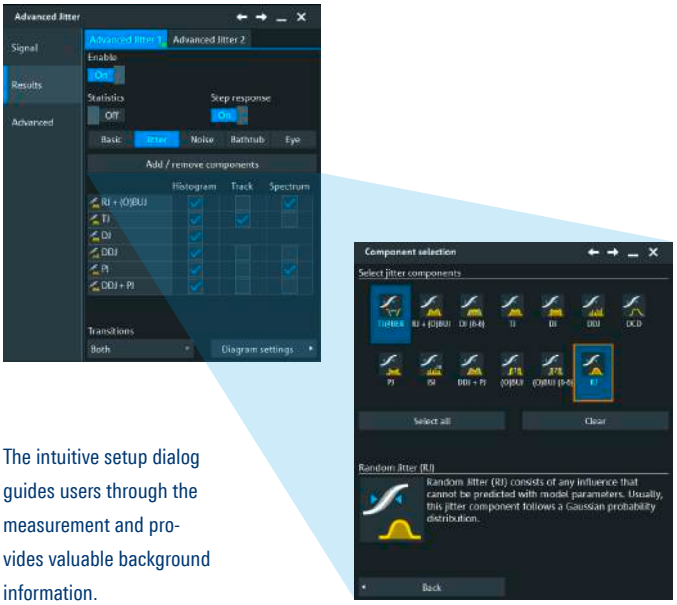
Jitter and noise measurement functions

R&S®RTP-K134 option
R&S®RTP-K133 option
R&S®RTP-K12 option

Standard functions			
Period	cycle-to-cycle jitter	TJ (meas.)	TN (meas.)
Frequency	N-cycle jitter	TJ (at BER)	EH (at BER)
Setup	cycle-to-cycle width	RJ	RN RN + OBUN
Setup/hold time	cycle-cycle duty cycle	RJ + OBUJ	DN
Setup/hold ratio	time interval error	DJ	DDN
	data rate	DJ (δδ)	ISIN
	unit interval	DDJ	LD
	skew delay	ISI	PN
	skew phase	DCD	DDN + PN
		PJ	OBUN
		DDJ + PJ	OBUN (δδ)
		OBUJ	
		OBUJ (δδ)	

Deep system insights with jitter and noise decomposition

Learn more about the individual jitter and noise components of your transmitter interface to characterize the jitter and noise budget and identify the root cause of failures. The R&S®RTP-K133 and R&S®RTP-K134 options decompose jitter and noise into random (RJ/RN) and data dependent (DDJ/DDN) components, periodic (PJ/PN) or other bounded uncorrelated components (OBUJ/OBUN). The Rohde&Schwarz decomposition algorithm calculates the step responses that fully characterize deterministic transmission system behavior. Users benefit from accurate measurement results even for relatively short signal sequences. The R&S®RTP-K133 and R&S®RTP-K134 options also help reconstruct synthetic eye diagrams and calculate and display BER bathtub curves for selected components to help understand their relevance to overall system behavior. The individual jitter and noise components can be displayed in the histogram track and spectrum view for in-depth individual analysis.



The intuitive setup dialog guides users through the measurement and provides valuable background information.



Displays step response, individual jitter and noise components in histograms, spectrum, synthetic eye diagrams and BER bathtub curve of an 8 Gbit/s PCIe Gen3 signal.

ADVANCED EYE ANALYSIS

Configurable 16 Gbit/s hardware implemented CDR for continuous analysis

The R&S®RTP offers a unique hardware implemented clock data recovery (HW-CDR) to bit slice an embedded clock serial data stream. You can configure the nominal bit rate (between 21 kbit/s and 16 Gbit/s), the tracking bandwidth and the relative bandwidth. The hardware CDR in the R&S®RTP continuously follows the input signal drift. Up to four eye diagrams can be calculated based on the time-stamps of the hardware CDR. Traditional eye diagrams use software CDR functions in postprocessing which is time-consuming and requires a PLL settling time for each waveform acquisition.

The hardware CDR timing information can also be saved with the input waveform for offline analysis. Two options are available for advanced eye analysis: the R&S®RTP-K136 with a maximum HW-CDR data rate of 8 Gbit/s and the R&S®RTP-K137 that supports 16 Gbit/s.



The configurable HW-CDR of the R&S®RTP supports data rates up to 16 Gbit/s for data eye analysis.

Advanced set of automatic eye measurements

Easy to use automated measurements are available for advanced eye analyses. Select from 15 measurements in the eye category and utilize all standard analysis functions such as statistics, track, histogram and trend displays.

Comprehensive mask library

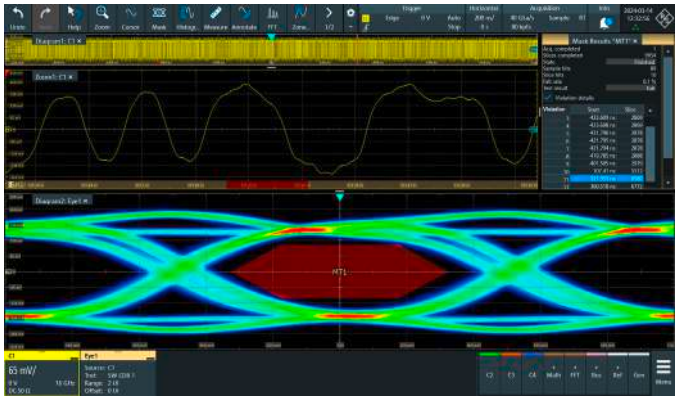
The standard histogram and the standard mask test function can be used for further analysis. Select from a comprehensive mask test library the right predefined mask for a dedicated standard such as USB, PCI Express and SATA.



Select from an advanced set of automated Eye measurements

Investigate mask test failures quickly

Use the eye stripe function of the advance eye option to investigate the details of mask test failures within the waveform. The eye stripe marks each of the mask test violations on the waveform. When zoom coupling is on, violations are directly in focus and users can navigate between mask violations easily.



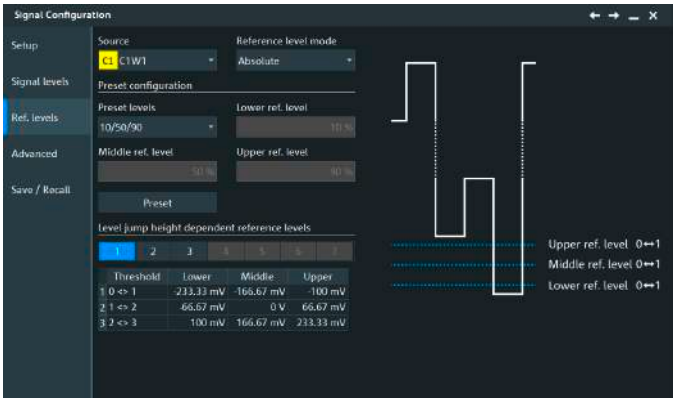
The eye stripe function helps navigate between mask test failure and the position in the original waveform

MOST POWERFUL PAM-N ANALYSIS

Up to PAM-8 order

The R&S®RTP-K135 PAM-N analysis option enables measurements of signals up to the PAM-8 order. When the option is installed, R&S®RTP oscilloscopes can be used for additional PAM-N analysis together with the advanced eye, jitter and noise analysis options.

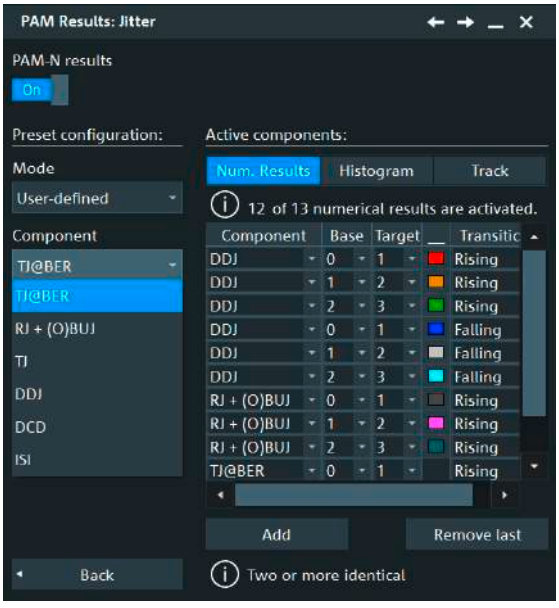
Select an interface standard via the easy signal configuration menu. For advanced customization, use full control to define signal levels and reference levels for all PAM levels and transitions.



Signal configurator: full control of signal and reference levels for PAM signals up to PAM-8

Jitter and noise decomposition at dedicated PAM levels

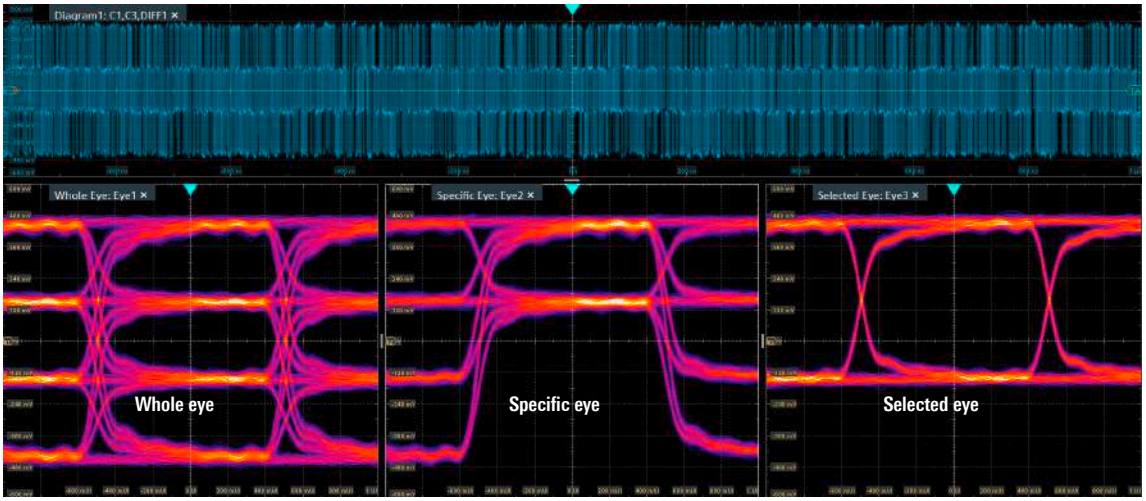
The R&S®RTP-K135 PAM option enables additional jitter and noise analysis functions. The PAM enabled SW-CDR lets jitter and noise decomposition become available for various PAM signal components. Dedicated jitter and noise components can be selected for defined bases, in-depth analysis and to define target PAM levels.



PAM-N level specific result selection

Unique eye analysis and HW-CDR

The R&S®RTP has a unique HW-CDR that also supports PAM signals with a maximum symbol rate of 3.8 GBd/s for live-eye analysis. When the PAM option is activated, the PAM-N eye mask tests and eye measurements are available. Dedicated transitions and eye levels can be defined for the individual eye measurements. For the actual eye diagram, the user can choose between whole eye, specific eye and selected eye filter modes.

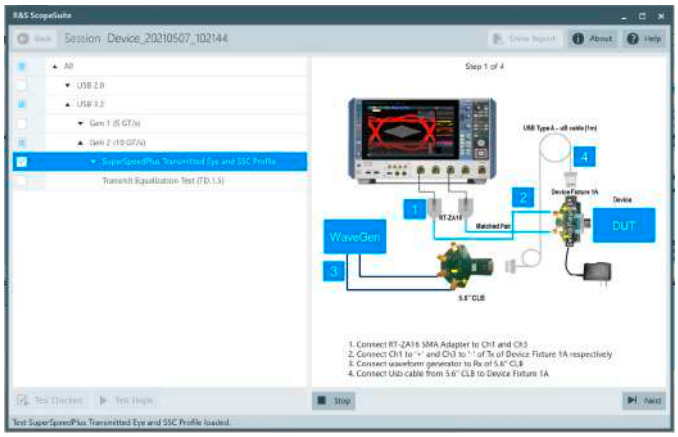


PAM-4 signal analysis: Eye diagram display with whole, selected and specific filter mode

AUTOMATIC COMPLIANCE TESTS

Easy configuration and automatic control with R&S®ScopeSuite

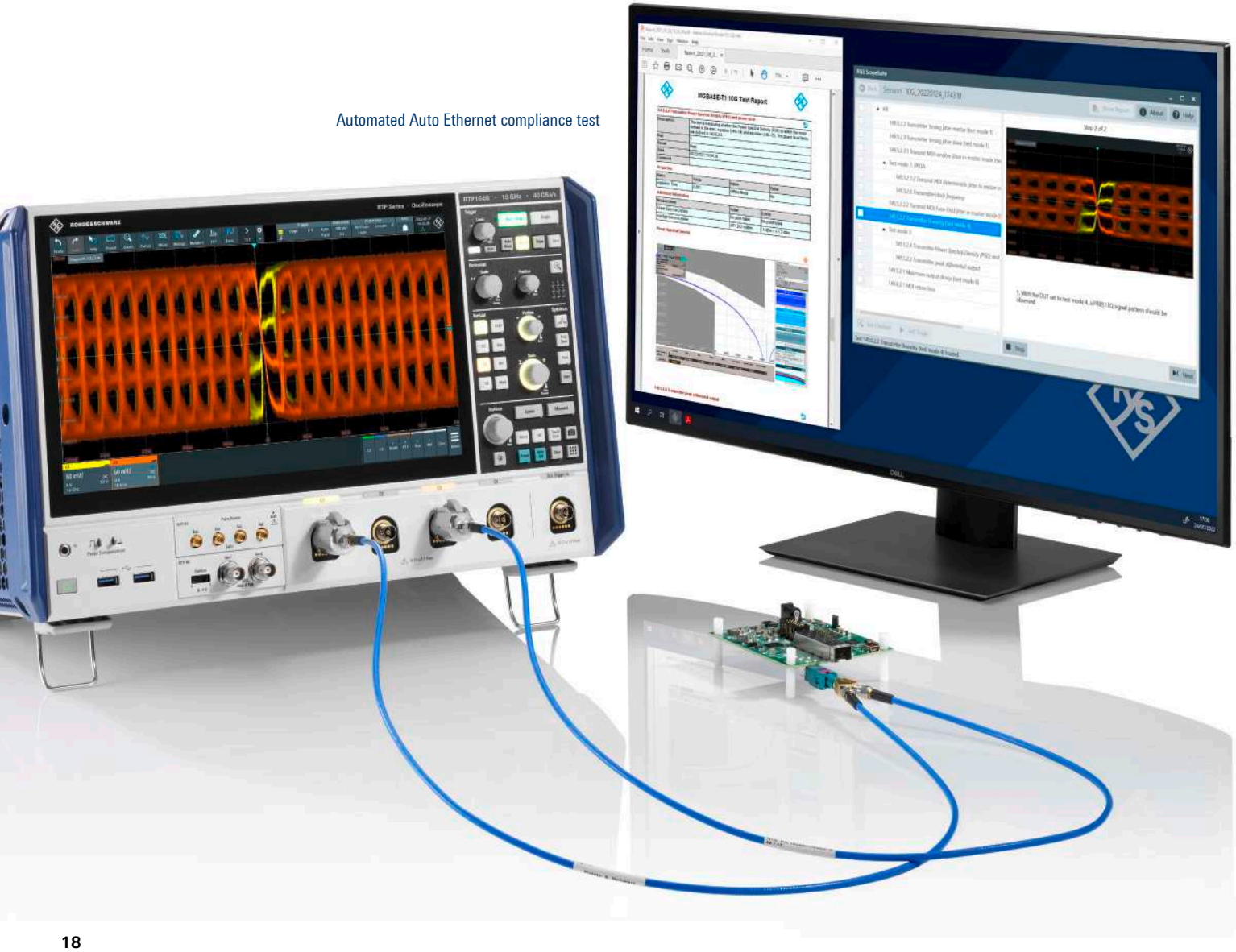
R&S®ScopeSuite is a generic compliance test software that runs on an R&S®RTP oscilloscope or a separate Windows PC. It controls the measurement settings and test sequences on an R&S®RTP and guides you through all the selected tests. Detailed, image based instructions make it easy to correctly connect oscilloscopes, probes, test fixtures and devices under test. User data, test setup settings and measurement report definitions are simple to configure. The limit editor lets you individually adjust test limits.



R&S®ScopeSuite guides the user through the measurement

Flexible test execution

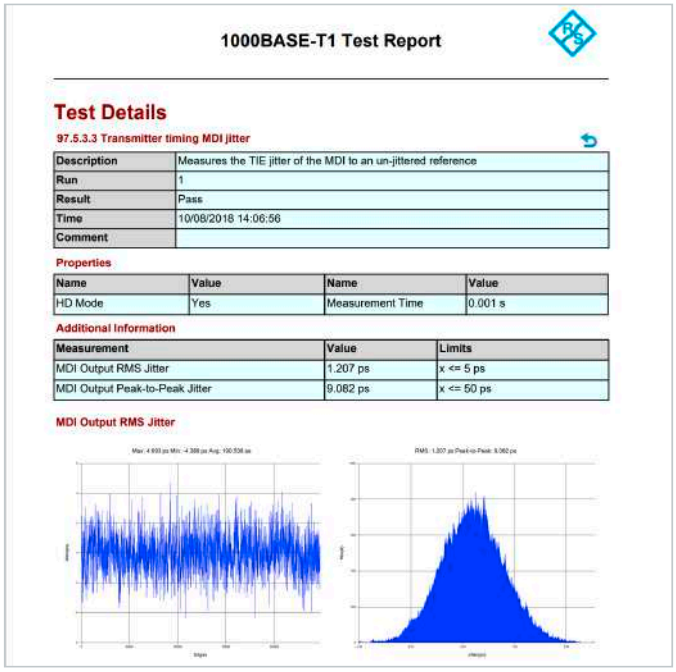
Single tests and test sequences can be repeated to debug during development or for stability verification. Limit lines and other parameters can be adjusted for each test repetition.



Automated Auto Ethernet compliance test

Configurable reports for result documentation

Documenting measurement results is essential to compliance tests. R&S®ScopeSuite offers an extensive range of documentation functions. You can add measurement details and screenshots to pass/fail results. The reports are available in PDF, DOC and HTML formats.



1000BASE-T1 Test Report

Test Details

97.5.3.3 Transmitter timing MDI jitter

Description	Measures the TIE jitter of the MDI to an un-jittered reference
Run	1
Result	Pass
Time	10/08/2018 14:06:56
Comment	

Properties

Name	Value	Name	Value
HD Mode	Yes	Measurement Time	0.001 s

Additional Information

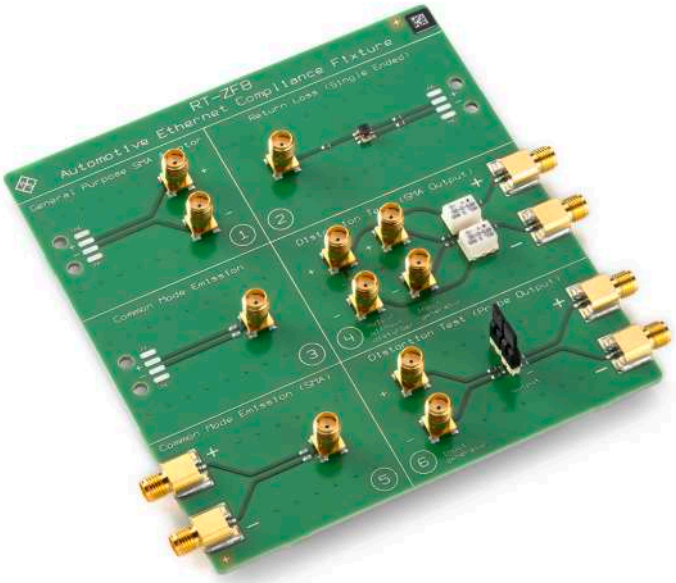
Measurement	Value	Limits
MDI Output RMS Jitter	1.207 ps	x <= 5 ps
MDI Output Peak-to-Peak Jitter	9.082 ps	x <= 50 ps

MDI Output RMS Jitter

Compliance test report 1000BASE-T1

Test fixture sets from Rohde&Schwarz

Different interface standards define the connection between measuring equipment and the device under test. Rohde&Schwarz offers the necessary test fixture sets.



R&S®RT-ZF8 automotive Ethernet compliance test fixture

Compliance test options

Interface standard	Compliance test option
USB	
USB 1.0/1.1/2.0/HSIC	R&S®SPLUS-K400
USB 3.2 Gen1/Gen2	R&S®RTP-K101
USB 3.2 Gen1/Gen2 RX	R&S®RTP-K102
Ethernet	
10BASE-T1L Ethernet	R&S®RTP-K89
10/100 Mbit Ethernet	R&S®RTP-K22
1 Gbit Ethernet	R&S®RTP-K22
2.5G/5GBASE-T Ethernet	R&S®RTP-K23
10 Gbit Ethernet	R&S®RTP-K23
10M/100M/1GBASE-T Energy Efficient Ethernet	R&S®RTP-K822
Automotive Ethernet	
10BASE-T1S Ethernet	R&S®RTP-K89
100BASE-T1 BroadR-Reach Ethernet	R&S®RTP-K24
1000BASE-T1 Ethernet	R&S®RTP-K87
MultiGBASE-T1 Ethernet (2.5G/5G/10G)	R&S®RTP-K88
PCIe Express	
PCIe Express 1.1/2.0/3.0	R&S®SPLUS-K440
MIPI	
MIPI D-PHY 1.1	R&S®RTP-K26
MIPI D-PHY 2.5	R&S®RTP-K27
MIPI C-PHY 2.1	R&S®RTP-K28

Interface standard	Compliance test option
HDMI	
HDMI 1.4/2.0/2.1	R&S®RTP-K110
DisplayPort	
DisplayPort (DP) 1.4a	R&S®RTP-K114
Embedded DisplayPort (eDP) 1.4b/1.5	R&S®RTP-K115
Memory	
DDR3/DDR3L/LPDDR3	R&S®RTP-K91
DDR4/LPDDR4	R&S®RTP-K93
DDR5	R&S®RTP-K94
LPDDR5	R&S®RTP-K95
eMMC (HS200/HS400)	R&S®RTP-K92
SerDes	
GMSL2	R&S®SPLUS-K107
ASA-ML	R&S®SPLUS-K105

SERIAL PROTOCOL ANALYSIS

Isolate protocol-specific events

The R&S®RTP supports protocol aware triggering for fast and straightforward to tracking down of protocol errors or specific content within a frame, such as address or data fields.

Segmented memory for long time capture

A standard R&S®RTP function makes it ideal for serial protocols. Only relevant packets are captured and those that have long been idle between transmissions are ignored. Users can capture over 100 000 time stamped packets.

Fast and efficient data searches

Comprehensive search and filter functions simplify analysis of long signal sequences. Users can quickly find specific data types, content and errors. All detected events appear in a table with timestamps, where the user can examine individual events or navigate between them. A zoom window can be applied to correlate the analog capture to individual events, all time correlated.

Clear decoded data display

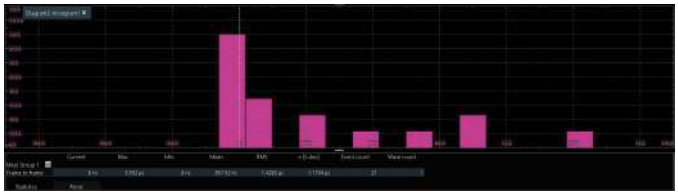
All individual protocol fields in the logical signals are color-coded for easy readability. Formats from hex, bin and ASCII can be selected. The R&S®SmartGrid function supports flexible placement of relevant signals in a suitable diagram. The protocol data can also be displayed in a decode table.



Clear display of decoded data in the waveform and in the decode table

Advanced bus measurements

The R&S®RTP-K500 bus measurement option enables in-depth analysis of decoded data. Users can quickly determine the stability of a bus by detecting the frame error rate including consecutive frame errors or precisely measure the delay between frames as well as between the trigger event and the bus frame.



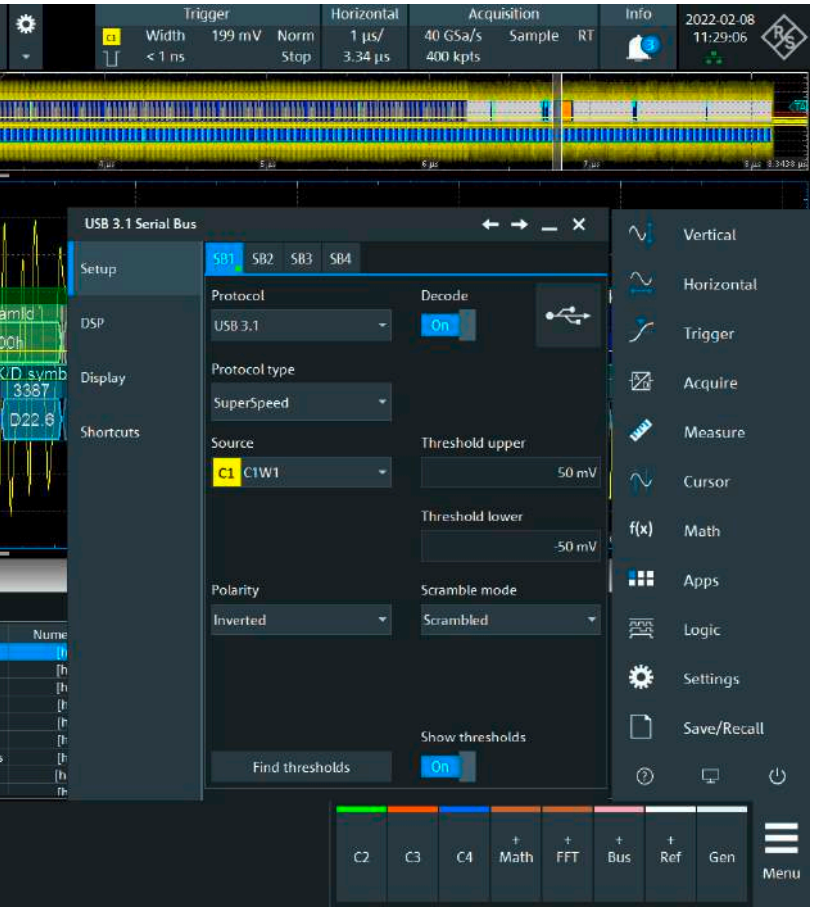
Advanced bus measurements

Trigger and decode technology packages

Type	Designation	Supported protocols
R&S®RTP-K500	bus analysis	
R&S®RTP-K510	low speed serial buses	I²C/SPI/RS-232/UART
R&S®RTP-K520	automotive protocols	CAN/LIN/CAN FD/CAN XL incl. CAN-dbc file import
R&S®RTP-K530	aerospace protocols	MIL-STD-1553/ARINC 429/SpaceWire
R&S®RTP-K540	Ethernet protocols	10BASE-T/100BASE-T/MDIO
R&S®RTP-K550	MIPI low speed	MIPI RFFE/SPMI/I³C
R&S®RTP-K560	automotive Ethernet	IEEE 10BASE-T1S/100BASE-T1/1000BASE-T1
R&S®RTP-K570	USB protocols	USB 1.0/1.1/USB 2.0/HSIC/USB 3.2 Gen 1/Gen 2/USB power delivery (USB-PD)/USB SSIC)
R&S®RTP-K580	MIPI high speed	MIPI D-PHY v.1.2, DSI v.1.3 and CSI-2 v.1.2/MIPI M-PHY 4.0 and UniPro 1.6
R&S®RTP-K590	PCI Express	8b10b/PCI Express 1.1/2.0/3.0
R&S®RTP-K600	generic decode	8b10b/Manchester/Manchester II/NRZ unclocked/clocked
R&S®RTP-TDBDL1	low speed trigger and decode bundle	R&S®RTP-K500/-K510/-K520/-K530/-K540/-K550/-K600
R&S®RTP-TDBDL2	high speed trigger and decode bundle	R&S®RTP-K560/-K570/-K580/-K590/-K600
R&S®RTP-ALLTD	all trigger and decode bundle	R&S®RTP-K500/-K510/-K520/-K530/-K540/-K550/-K560/-K570/-K580/-K590/-K600

Easy configuration

R&S®RTP oscilloscopes have a broad selection of trigger and decoding options for serial protocol analysis. Configuring any given protocol requires just a few steps in the intuitive dialog. Users only see relevant settings. Many protocols support the Autoset function for quicker debugging.



SPECTRUM ANALYSIS

Multichannel frequency analysis

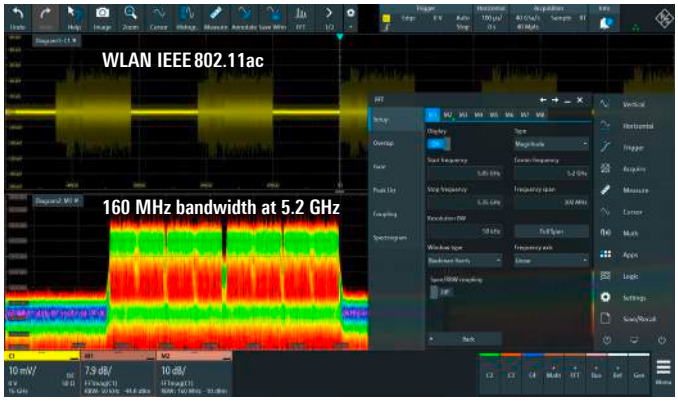
R&S®RTP oscilloscopes feature a fast and responsive FFT on up to four channels in parallel. The low-noise frontend and the high effective number of bits in the A/D converter provide an outstanding spurious-free dynamic range and even weak signals can be identified.



R&S®RTP multichannel frequency analysis of DRFM input and output

Frequency analysis setup made easy

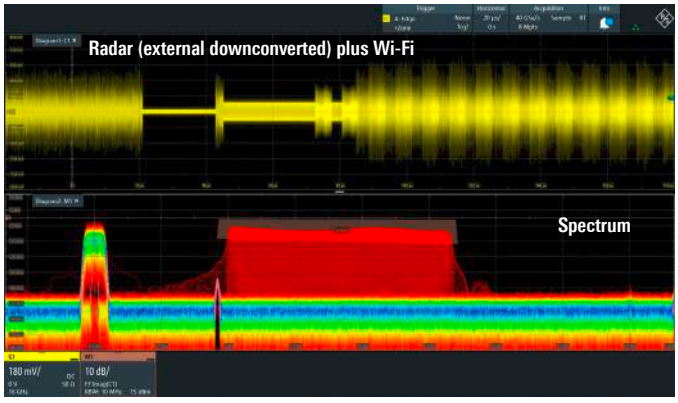
Configure the frequency analysis function of the R&S®RTP by simply entering typical parameters: center frequency, span and resolution bandwidth (RBW). The RBW is independent of the time/div setting. Parameters such as window type, FFT overlap, gating and scaling parameters can be optionally configured.



Setup of frequency analysis made easy with typical parameters

Zone trigger in frequency display

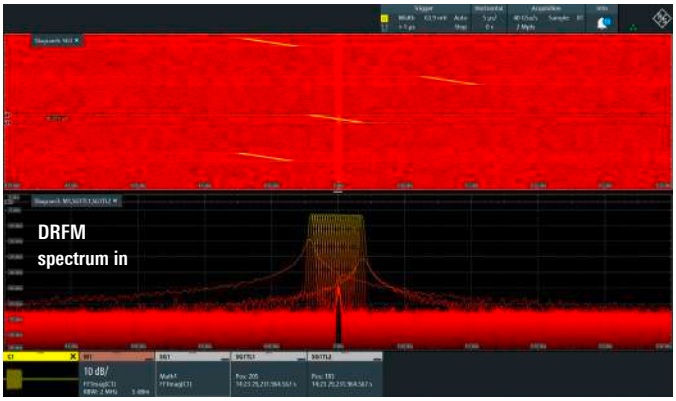
R&S®RTP oscilloscopes offer a zone trigger in the frequency domain. Up to eight zones can be graphically defined in the spectrum display and used to trigger the oscilloscope. Typical applications include fast detection and analysis of unwanted emissions, frequency hopping patterns and radar bursts.



Zone trigger in the spectrum to isolate events

Spectrogram: display changes in power and frequency over time

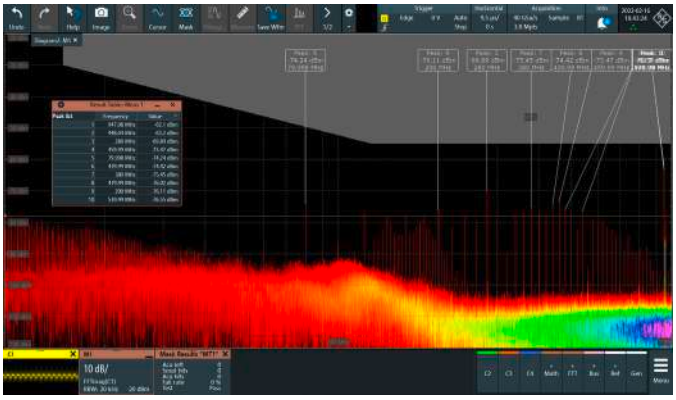
The R&S®RTP-K37 spectrogram option analyzes time-varying signals in the frequency domain. The spectrogram visualizes the variance of power and frequency versus time. This feature allows you to quickly analyze AM/FM modulated signals as well as signals from radar and frequency hopping systems.



Analysis and display of power and frequency variance of a DRFM chirp signal plotted over time

Logarithmic display

A logarithmic scaling of the frequency axis is useful to better display values of several orders of magnitude for measurements such as EMI debugging. The R&S®RTP-K37 spectrogram option supports this function for frequency and spectrogram displays.



Display of EMI measurement results on a logarithmic y-axis

Automatic peak list measurement

The power and frequency of each peak has to be measured when analyzing harmonic and intermodulation products for a device. The R&S®RTP-K37 option automatically makes the peak list measurement. Each peak is measured individually and displayed directly in the measurement graph and in an optional table. The peaks are marked in the frequency display. Frequency and power are also displayed.



Analysis of harmonic and intermodulation products with the automatic peak list measurement

WIDEBAND RF SIGNAL ANALYSIS

Precise wideband RF signal analysis up to 170 GHz

The R&S®RTP can perform precise multichannel wideband RF measurements up to 16 GHz and accurately analyze RF signals with a sensitivity of –157 dBm (1 Hz) and a dynamic range of 107 dB.

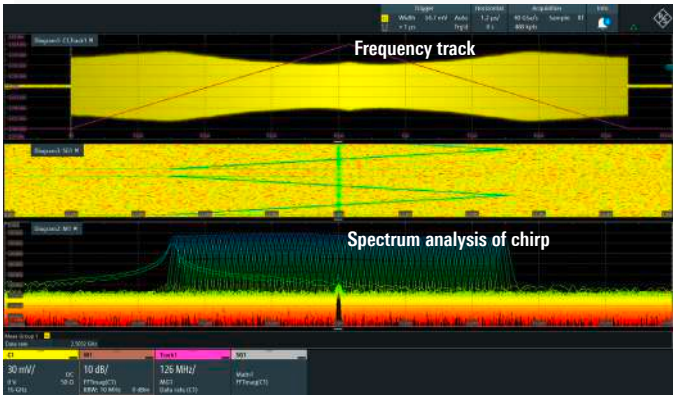
Combine the R&S®RTP with R&S®FExx external frontend modules to extend the analysis frequency into the sub-terahertz range. The R&S®FE170SR covers the D band (110 GHz to 170 GHz) and addresses early sub-terahertz and 6G research activities. The R&S®FE44S and the R&S®FE50DTR modules cover the 5G FR2 frequencies up to 44 GHz and 50 GHz, respectively.

For multichannel test setups, connect up to four R&S®FExx modules to the R&S®RTP. Users benefit from fully integrated control via the R&S®RTP firmware (with the R&S®RTP-K553 external frontend control option), a built-in local oscillator (LO) and automated compensation.

Generic R&S®RTP oscilloscope functions such as spectrum view, spectrogram and track display of timing measurements in combination with a powerful trigger system allow fast and intuitive RF signal analysis. Combine the R&S®RTP with the R&S®RTP-K11 I/Q interface option and R&S®VSE vector signal explorer software to further analyze pulsed and modulated RF signals.



R&S®RTP with R&S®FE170SR external frontend (110 GHz to 170 GHz frequency range)

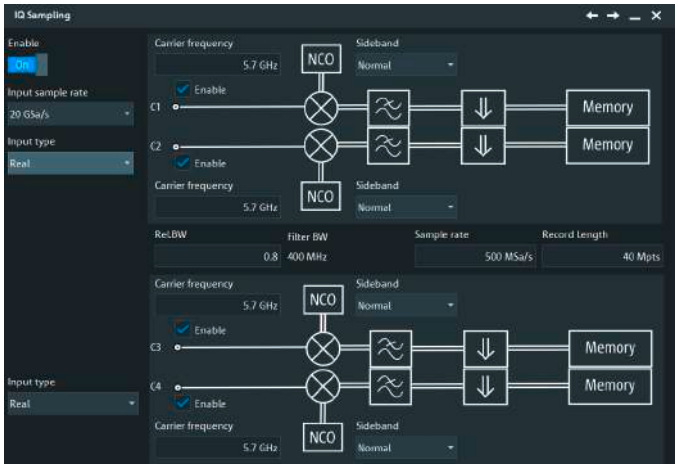


Pulse analysis of up/down chirp in time and frequency domain with generic R&S®RTP oscilloscope functions

Converting modulated signals to I/Q data

The R&S®RTP-K11 I/Q interface significantly simplifies modulated signal analysis. The option converts modulated signals to I/Q data, saving acquisition memory and extending the maximum acquisition time.

The I/Q data can be processed with dedicated R&S®VSE vector signal explorer software or with customized implementations such as those in MATLAB.



Setup dialog for the R&S®RTP-K11 I/Q interface

Advanced RF signal analysis

R&S®VSE vector signal explorer application software analyzes complex signals, such as pulsed radar and digitally modulated signals. The software provides a wide range of analysis tools for debugging and optimizing circuit designs. The R&S®VSE provides generic I/Q analysis and analog demodulation. Additional options such as pulse and transient analysis and powerful vector signal analysis are available. The R&S®VSE software runs directly on the R&S®RTP or an external PC. The oscilloscope-only R&S®VSE-KTxxx option is a cost-effective solution if you only need to install and run R&S®VSE on an R&S®RTP. These options only run on the device they were purchased for and already have the R&S®VSE core functions installed.

R&S®VSE vector signal explorer software

Analysis option R&S®VSE (flexible installation)	Analysis option R&S®VSE (oscilloscope-only)	Typical measurements	Waveform mode	I/Q mode [1]
General purpose				
R&S®VSE base software I/Q analyzer	core function already included in specific options	baseband I/Q analysis	•	•
R&S®VSE-K7	R&S®VSE-KT7	AM/FM/PM modulation analysis	•	•
R&S®VSE-K18	R&S®VSE-KT18	amplifier measurements	•	•
R&S®VSE-K70	R&S®VSE-KT70	vector signal analysis	•	•
R&S®VSE-K96	R&S®VSE-KT96	analysis of user-defined OFDM and OFDMA signals	•	•
R&S®VSE-K544	R&S®VSE-KT544	user-defined frequency correction by SnP file	•	•
Radar				
R&S®VSE-K6	R&S®VSE-KT6	pulse measurements	•	•
R&S®VSE-K6A	R&S®VSE-KT6A	multichannel pulse analysis	•	•
R&S®VSE-K60	R&S®VSE-KT60	transient measurements	•	•
Cellular systems				
R&S®VSE-K10	R&S®VSE-KT10	GSM measurements		•
R&S®VSE-K72	R&S®VSE-KT72	3GPP WCDMA uplink and downlink signal analysis		•
R&S®VSE-K100/-K102/-K104	R&S®VSE-KT100/-KT102/-KT104	LTE and LTE-Advanced signal analysis		•
R&S®VSE-K106	R&S®VSE-KT106	LTE narrowband IoT analysis		•
R&S®VSE-K144	R&S®VSE-KT144	3GPP 5G NR downlink and uplink measurement application		•
R&S®VSE-K144X	R&S®VSE-KT144X	3GPP 5G NR cross-correlation		•
R&S®VSE-K146	R&S®VSE-KT146	3GPP 5G NR downlink MIMO measurements		•
R&S®VSE-K148	R&S®VSE-KT148	3GPP 5G NR Release 16 extension for uplink/downlink		•
R&S®VSE-K171	R&S®VSE-KT171	3GPP 5G NR Release 17 extension for uplink/downlink		•
R&S®VSE-K175	R&S®VSE-KT175	O-RAN measurements		•
R&S®VSE-K184	R&S®VSE-KT184	Beyond 5G measurements		•
Wireless				
R&S®VSE-K8	R&S®VSE-KT8	Bluetooth® BR/EDR/LE measurements	•	•
R&S®VSE-K8E	R&S®VSE-KT8E	Bluetooth® 6.0 Low Energy Channel Sounding measurements	•	•
R&S®VSE-K91	R&S®VSE-KT91	WLAN signal analysis (IEEE 802.11a/ac/ax/b/be/bn/g/n/p)		•
R&S®VSE-K91X	R&S®VSE-KT91X	WLAN OFDM cross-correlation		•
R&S®VSE-K149	R&S®VSE-KT149	HRP UWB measurements	•	•
R&S®VSE-K201	R&S®VSE-KT201	OneWeb reverse link	•	•

[1] R&S®RTP-K11 I/Q software interface required.

MULTI-INSTRUMENT CAPABILITY

Time-correlated analysis of multiple signal types

R&S®RTP oscilloscopes address current and future test requirements for highly integrated devices by combining multiple test instrument capabilities in a single box:

- The high bandwidth **analog channels** have superior signal fidelity for measurements of fast signals, such as those from high speed buses and wideband RF transmitters
- The **400 MHz digital channels** (MSO) can perform logic analysis or **protocol** based testing of low speed serial buses as a general purpose resource.
- The R&S®RTP provides comprehensive tools for detailed signal analysis in the **frequency domain** on up to four channels in parallel
- The unique **18 bit high-precision voltage and current channels** enable time-correlated analysis of multiple power rails for debugging power consumption and power integrity issues
- The **two-channel 100 MHz arbitrary waveform generator** is a useful general purpose signal source, the plug-in options include an additional eight-channel pattern generator that can drive low speed bus signal sequences for DUT control
- As a unique tool, the R&S®RTP features a **16 GHz differential pulse source** for device stimulation or signal path characterization

All tools are integrated into a single instrument with a consistent interface, making the R&S®RTP the most versatile high speed debugging instrument on the market.

The R&S®RTP oscilloscope: multiple test instruments in one



Analog
- Voltage and time measurements

Logic
- Data verification
- Timing verification
- Bus decoding

Protocol
- Protocol decoding
- Protocol triggering
- Symbol mapping

Frequency
- Spectrum analysis
- Signal analysis
- EMI debugging

Power
- Power consumption
- Power sequencing
- Power integrity

Generator
- Reference clock
- Arbitrary waveforms
- Modulated signals
- Protocol pattern

Pulse source
- Input characterization
- Deskew
- TDR/TDT

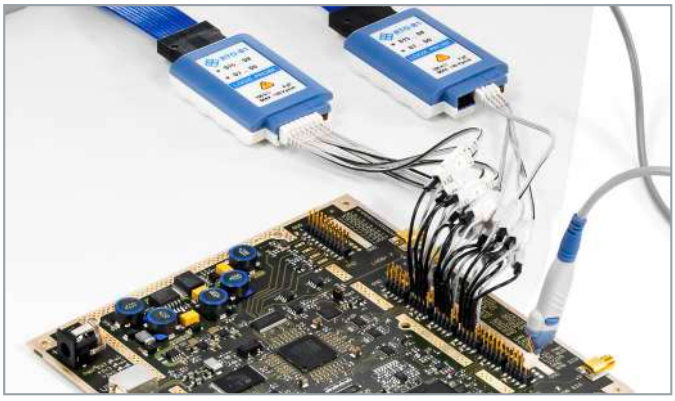
GENERAL PURPOSE MSO

Upgrade any R&S®RTP with the mixed signal option

The R&S®RTP-B1 mixed signal option (MSO) adds 16 digital channels to the instrument without compromising the other test resources. The option can be installed in the option slots at the front or rear of the R&S®RTP oscilloscope. The R&S®RTP-B1 provides a high time resolution of 200 ps for all digital channels with a sampling rate of 5 Gsample/s. The sampling rate is available over the entire memory depth of 200 Msample per channel. The MSO option offers comprehensive trigger capabilities to detect critical events such as narrow glitches or certain pattern combinations.

R&S®RTP-B1 MSO option

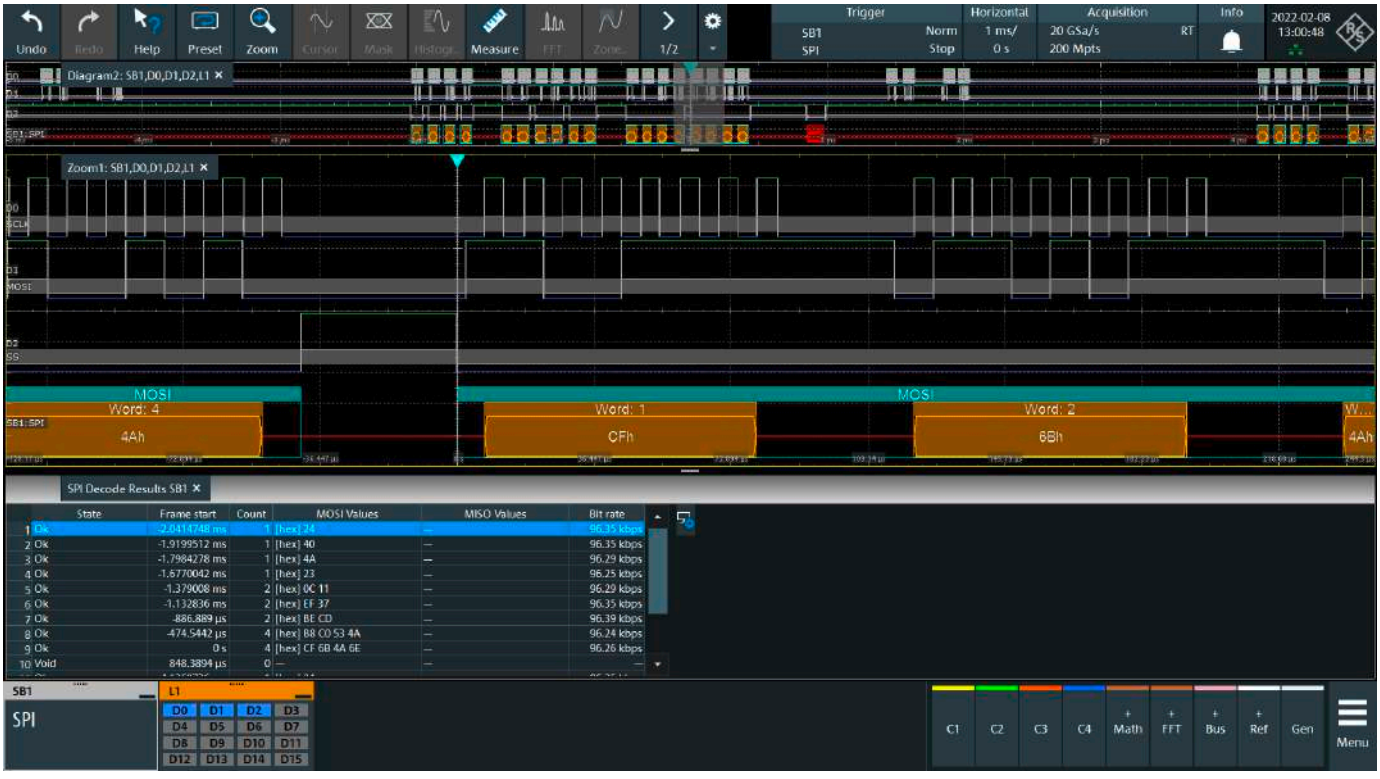
- 16 digital channels (2 logic probes)
- 100 kΩ || 4 pF input impedance
- 400 MHz signal frequency
- 5 Gsample/s per channel sampling rate
- 200 Msample per channel acquisition rate



Every R&S®RTP can be upgraded on site with 16 digital channels

Analysis of low speed serial protocols with digital channels

Today, high speed interfaces are often combined in a single device with low speed control or programming buses. Use the digital channels in the R&S®RTP-B1 option to trigger and decode low speed serial protocols such as SPI and I²C with the appropriate protocol options. All protocol analysis tools for analog channels, such as decode table and search, are also available for digital channels. Trigger on protocol details such as start, address and data to focus on dedicated events.



The digital channels are ideal for triggering and decoding low speed serial interfaces such as SPI.

HIGH-PRECISION VOLTAGE AND CURRENT CHANNELS

Additional 8 voltage and 8 current channels

The R&S®RTP oscilloscope supports up to two R&S®RT-ZVC multichannel power probe modules with four current and four voltage channels each. These 16 high-precision measurement channels are usable in parallel with the R&S®RTP high speed analog channel.

A key application is time-correlated measurement of DUT power consumption in ramp-up, standard operation and sleep modes.

R&S®RT-ZVC multichannel power probe module

- Voltage ranges: ±1.88 V, ±3.75 V, ±7.5 V, ±15 V
- Current ranges: low-gain mode with shunt
  ±4.5 µA; ±45 µA with 10 kΩ shunt
  ±4.5 mA; ±45 mA with 10 Ω shunt
  ±4.5 A; ±10 A with 10 mΩ shunt
  ±45 mV [1]; ±450 mV [1] with external shunt

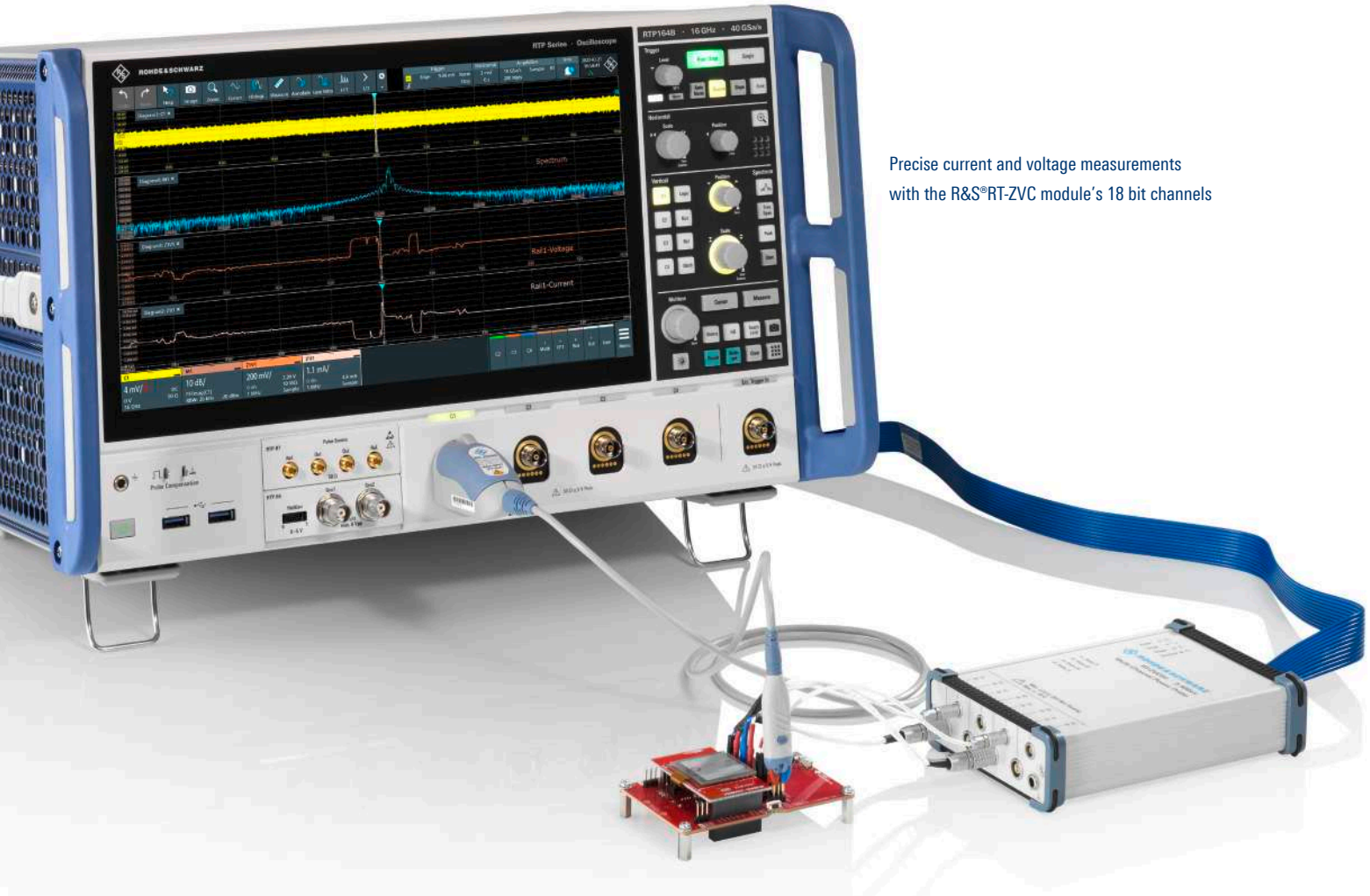
[1] Current range depends on shunt value.

Very high dynamic range with 18 bit resolution

Each R&S®RT-ZVC channel operates with an 18 bit 5 Msample/s A/D converter (ADC) with high DC accuracy of 0.1 % for voltage measurements and 0.2 % for current measurements. The high ADC resolution provides the measurement dynamic range to verify current consumption transitions from µA to A as happens when battery-powered devices switch from or into sleep mode. The high DC accuracy is ideal for precise monitoring of timing and tolerances for power rail voltages in sophisticated embedded devices.

Full GUI integration

R&S®RT-ZVC module operation is fully integrated into the R&S®RTP oscilloscope graphical user interface (GUI). The R&S®RT-ZVC channels can be handled like standard oscilloscope channels, including their position on the display, vertical scaling and analysis tools such as cursors and automated measurements.



Precise current and voltage measurements with the R&S®RT-ZVC module's 18 bit channels

INTEGRATED ARBITRARY WAVEFORM GENERATOR

Device stimulus with a two-channel 100 MHz arbitrary waveform generator

The R&S®RTP oscilloscope with the R&S®RTP-B6 hardware option offers a fully integrated two-channel 100 MHz function arbitrary waveform generator with an eight-channel pattern generator. This integrated generator with 500 Msample/s and 14 bit resolution saves test bench space, while providing both standard and arbitrary stimulus to the DUT. By combining both generator channels, differential device inputs can also be stimulated. This can also be used in combination with R&S®ScopeSuite automated compliance testing software to toggle the test modes for PCIe or USB devices. Another powerful feature is the ability to manipulate the playback of captured waveforms by changing the amplitude and offset level or superimposing noise to evaluate a device against design criteria.

Specifications in brief	
Analog output	2 channels
Bandwidth	100 MHz
Sampling rate	500 Msample/s
Resolution	14 bit
Operating modes	▶ Function generator (sine, square, ramp, DC, pulse, cardinal sine, cardiac, Gauss, Lorentz, exponential rise/fall) ▶ Modulation generator (AM, FM, FSK) ▶ Sweep generator ▶ Arbitrary waveform generator
Pattern generator	8 channels
Memory	40 Msample per channel

Protocol based programming with the eight-channel pattern generator

The R&S®RTP-B6 can be used for protocol based programming of devices under test. For instance, an SPI based programming sequence can be used to control a device during the debug and verification process. The generator will control the device and change the configuration while the DUT is being measured with the oscilloscope, making it easy to analyze switching effects and timing related parameters.



Measurement of LVDS signals using the integrated arbitrary waveform generator as the clock signal and the 8 bit pattern generator to program and control the device

TDR/TDT ANALYSIS

16 GHz differential pulse signal with configurable parameters

The R&S®RTP-B7 pulse source provides a highly symmetrical differential pulse signal with a steep rise time of 22 ps.

The key pulse source parameters are user adjustable. The output level ranges from –50 mV to –200 mV and can be set in 10 mV steps. The pulse repetition rate and the duty cycle can be programmed for the 5 Hz to 250 MHz range and 10 % to 90 %.

With an output skew of < 0.5 ps, the R&S®RTP-B7 is also an accurate source for deskewing measurement setups with multiple channels. The differential nature of the R&S®RTP-B7 makes it ideal for deskewing cables and probes for differential or phase-coherent measurements.

Parameter	Value range
Analog bandwidth, rise time	> 16.5 GHz, 22 ps
Skew	< 0.5 ps
Output low level	–200 mV to –50 mV, 10 mV steps
Repetition rate	
Locked	5/10/20/50/100/200/500 Hz, 1/5/10/25/50/100/250 MHz
Free running	5/10/20/50/100/200/500 Hz, 1/5/10/25/50 MHz
Duty cycle	
Repetition rate < 5 MHz	10 % to 90 %, 10 % steps
Repetition rate > 5 MHz	50 % (const.)
Clock mode	locked, unlocked/free running



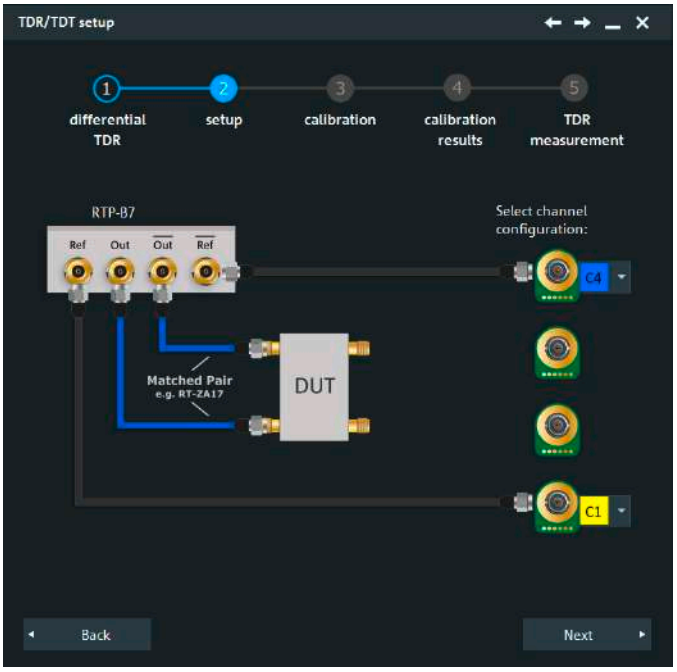
Wizard guided, integrated differential TDR and TDT analysis

Fully integrated TDR/TDT analysis solution

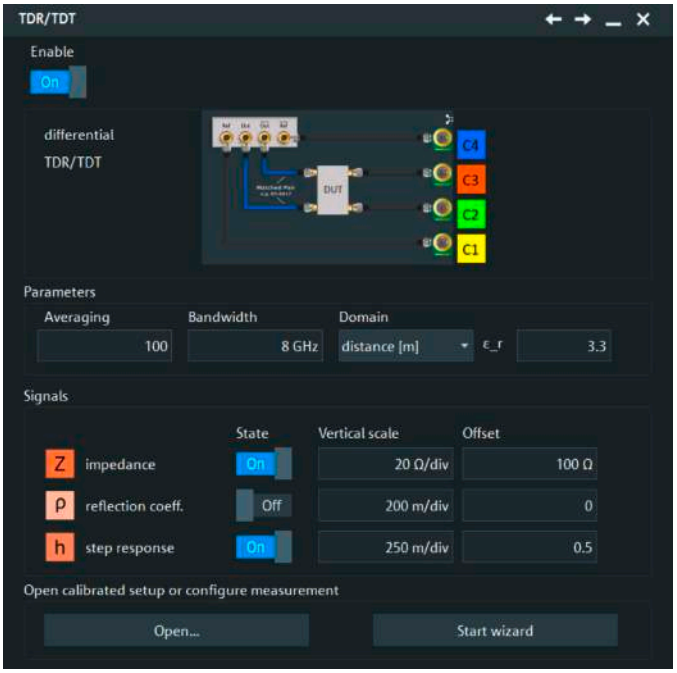
The R&S®RTP-K130 option combines the R&S®RTP-B7 pulse source and R&S®RTP oscilloscope analog input channels to create a time domain reflection (TDR) and transmission (TDT) analysis system that supports characterization and debugging of signal paths, including PCB traces, cables and connectors.

The option allows both single-ended and differential measurements. The TDR/TDT software includes a wizard that guides the user through setup, calibration and analysis. The resulting TDR waveforms can be displayed as impedance or reflection coefficients over time or distance. The step response signal illustrates the transmission loss (TDT). All the oscilloscope analysis tools such as cursor and automated measurements can be used to analyze impedance, reflection coefficient and step response signal details.

The R&S®RTP-B7 pulse source option comes with all the accessories such as load and short termination and SMA cables needed for single-ended measurements. For differential measurements, use the R&S®RT-ZA17 phase-matched cable pair.



TDR/TDT wizard supports setup, calibration and analysis



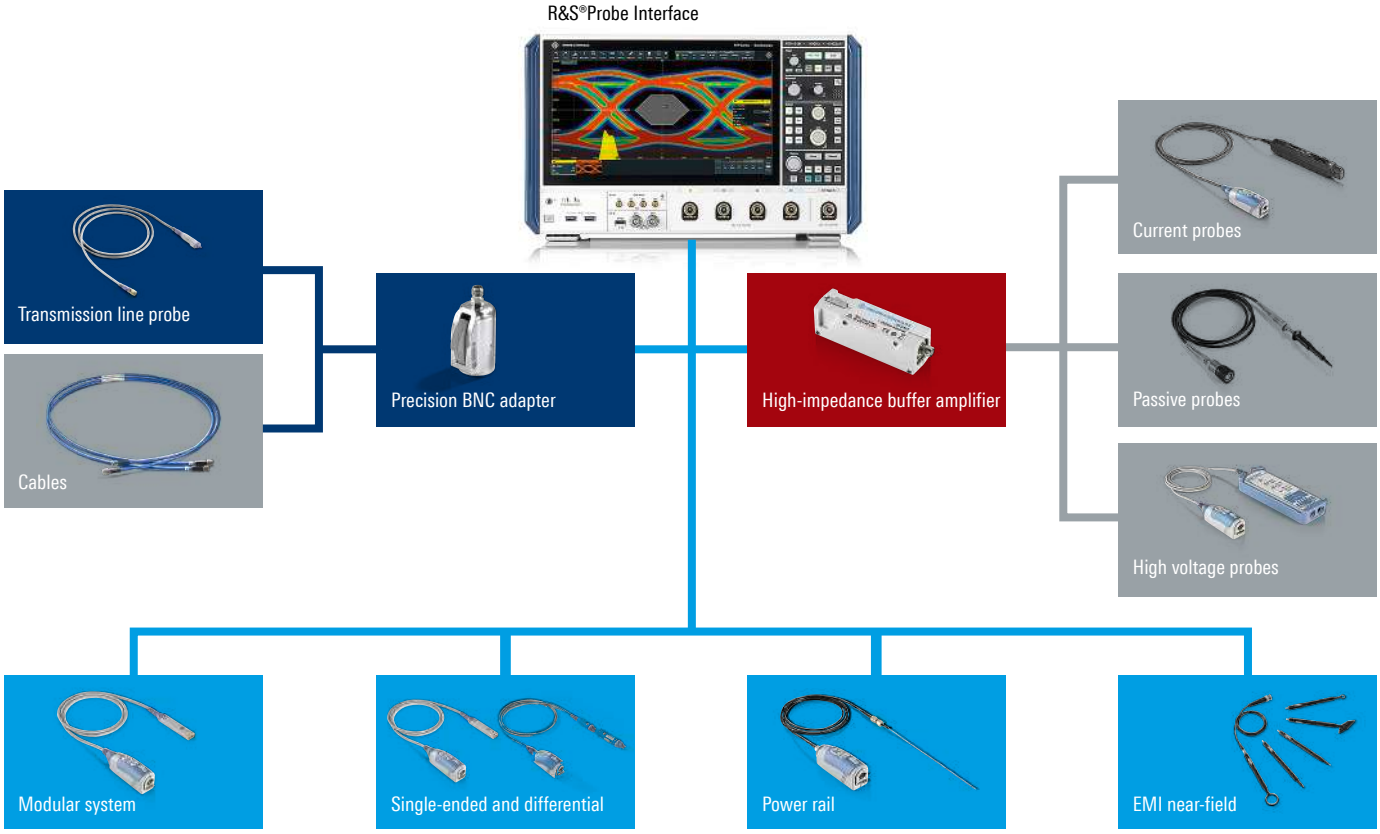
Differential TDR/TDT measurement: Select impedance, reflection coefficient and step response signals for display and analysis

COMPREHENSIVE PROBE PORTFOLIO

Diverse probing options

R&S®RTP oscilloscopes support a broad range of probing solutions that meet various measurement requirements. The oscilloscope automatically detects active Rohde&Schwarz probes and corrects the frequency response for a flat characteristic. R&S®RTP oscilloscopes come with a high-precision BNC to SMA adapter for applications with a 50 Ω SMA connector.

Diverse probing options



Recommended broadband probes

Oscilloscope model	R&S®RTP044B	R&S®RTP064B	R&S®RTP084B	R&S®RTP134B	R&S®RTP164B
R&S®RT-ZM modular probes					
R&S®RT-ZM160					
R&S®RT-ZM130					
R&S®RT-ZM90					
R&S®RT-ZM60					
R&S®RT-ZZ transmission line probe					
R&S®RT-ZZ80					
R&S®RT-ZS/R&S®RT-ZD single-ended/differential active probes					
R&S®RT-ZS60					
R&S®RT-ZD40					

A VARIETY OF GENERAL PURPOSE PROBES

Active broadband probes

High input impedance of 1 MΩ, low input capacitance of < 1 pF and a wide dynamic range are typical characteristics of Rohde&Schwarz active broadband probes. Useful supplemental functions, such as offset compensation in the probe, an integrated, high-precision voltmeter and a micro button for convenient oscilloscope control help users with their daily work.

The Rohde&Schwarz probe interface allows the oscilloscope to automatically detect probes when they are connected and load the probe type-specific correction factor for a flat frequency response.

The probes are available in single-ended (R&S®RT-ZSxx)and differential (R&S®RT-ZDxx) models. The probe bandwidth ranges from 1 GHz to 6 GHz for R&S®RT-ZSxx probes and 1 GHz to 4.5 GHz for R&S®RT-ZDxx probes.




R&S®RT-ZS60


R&S®RT-ZD40

Model	Bandwidth	Attenuation factor	Input impedance	Dynamic range	Offset compensation
R&S®RT-ZS60 single-ended	6 GHz	10:1	1 MΩ || 0.3 pF	±8 V	±10 V
R&S®RT-ZD40 differential	4.5 GHz, typ. 5.5 GHz	10:1	1 MΩ || 0.4 pF	±5 V	±5 V

R&S®RT-ZZ80 passive broadband probe

Low noise, high linearity and a purely passive implementation make passive broadband probes an economical solution for measuring controlled impedance lines.



Model	Bandwidth	Attenuation factor	Input impedance	Dynamic range	Comment
R&S®RT-ZZ80	8 GHz	10:1	500 Ω || 0.3 pF	20 V (RMS) max. input voltage	connect with R&S®RT-ZA16 high-precision SMA adapter

MODULAR PROBING SOLUTIONS

Versatile and flexible modular probe system

The R&S®RT-ZM modular probe system addresses current requirements with a technically sophisticated, yet user friendly design. The various solutions meet the demands for high probing bandwidth and dynamic range together with the need for low capacitive loads. The R&S®RT-ZM probe system includes probe tip modules for various measurement tasks and conditions. The probe tip modules are connected to the amplifier modules with bandwidths ranging from 1.5 GHz to 16 GHz.

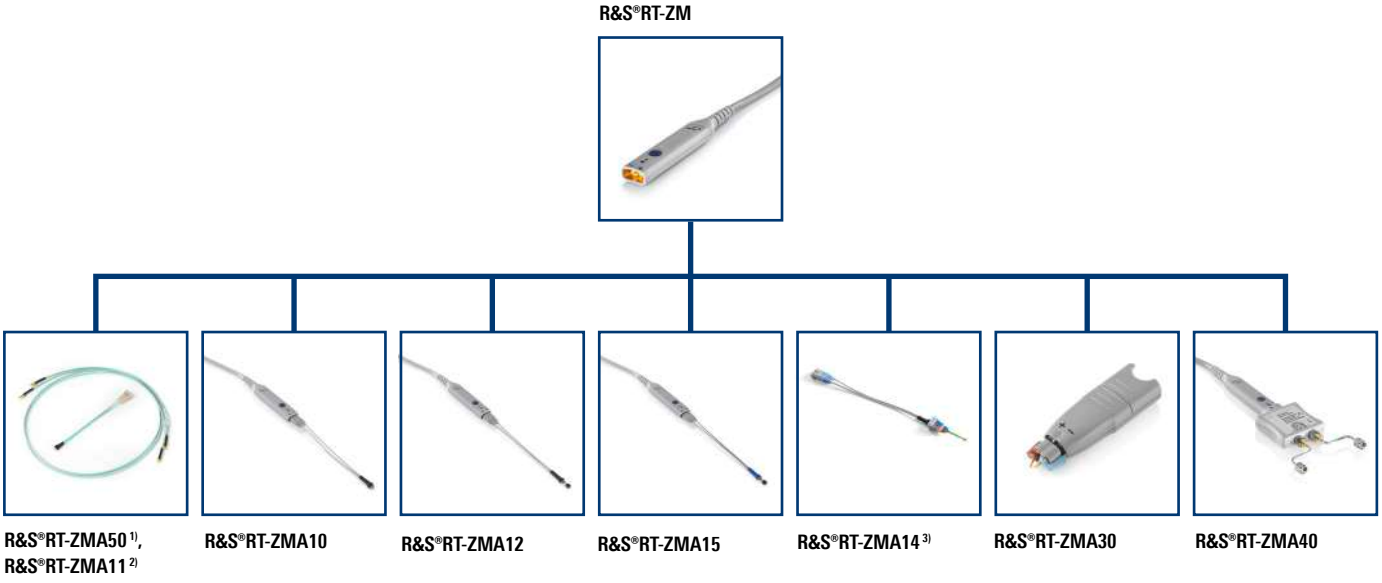
The modular probe system has a multimode function and a unique offset compensation range of ±16 V at the tip of the probe. The integrated R&S®ProbeMeter also performs high-precision, 18 bit based DC voltage measurements in parallel and independently of the oscilloscope settings.



R&S®RT-ZM amplifier module with the Rohde&Schwarz probe interface

Probe tip modules for the R&S®RT-ZM

► For detailed information, see R&S®RT-ZM flyer PD 3607.5690.32



1) Contains the R&S®RT-ZMA11 and a pair of matched extension cables (length: 1 m).
2) For the R&S®RT-ZMA50.
3) Contains 10 solder-in flex tips.

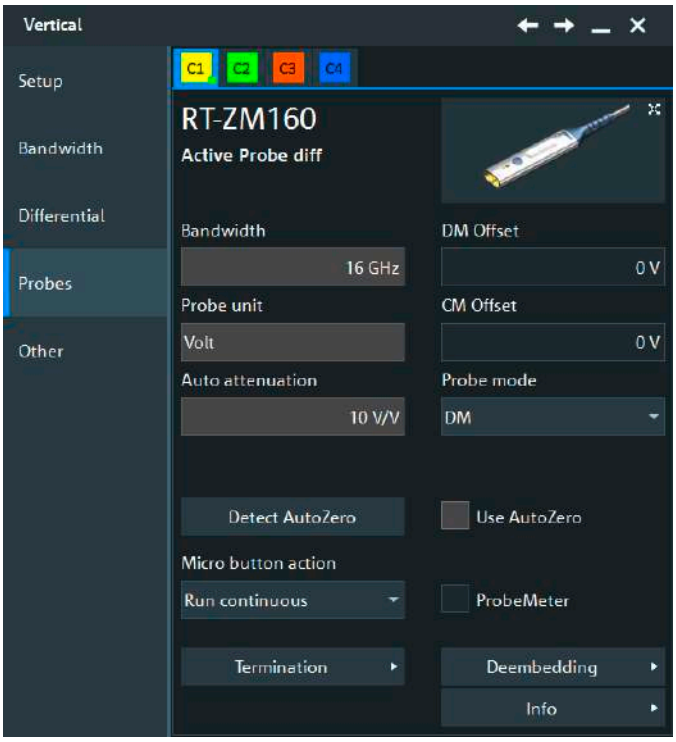
Multimode: multiple measurements with a single connection

The multimode function allows you to switch between single-ended, differential and common mode measurements without reconnecting or resoldering the probe tip.

The multimode function is available in the company-designed, high speed R&S®RT-ZM amplifier ASIC and can be easily controlled from the oscilloscope GUI.

Offset compensation for maximum resolution

The R&S®RT-ZM modular probe system has a high offset compensation range of ±16 V. The DC components in a measured signal can be compensated at the probe tip to extend the operating voltage window beyond the dynamic range of the probe amplifier module. The signal components of interest can then be displayed on the oscilloscope with maximum resolution.



Setup dialog with user-configurable parameters of the modular probe

Model	System bandwidth	Rise time (10 % to 90 %)	Multimode [1]	Comment	Order No.
Probe amplifier modules					
R&S®RT-ZM15	> 1.5 GHz	< 230 ps			1800.4700.02
R&S®RT-ZM30	> 3 GHz	< 100 ps			1419.3005.02
R&S®RT-ZM60	> 6 GHz	< 75 ps			1419.3105.02
R&S®RT-ZM90	> 9 GHz	< 50 ps			1419.3205.02
R&S®RT-ZM130	> 13 GHz	< 35 ps			1800.4500.02
R&S®RT-ZM160	16 GHz	< 28 ps			1800.4600.02
Probe tip modules					
R&S®RT-ZMA10	16 GHz (meas.)	28 ps	P/N/DM/CM	length: 15 cm (5.9 in)	1419.4301.02
R&S®RT-ZMA10-6				set of 6 R&S®RT-ZMA10 solder-in probe tip modules	1801.4349.02
R&S®RT-ZMA11	16 GHz (meas.)	28 ps	P/N/DM/CM	length: 15 cm (5.9 in), suitable for R&S®RT-ZMA50	1419.4318.02
R&S®RT-ZMA12	6 GHz (meas.)	75 ps	P/N/DM/CM	length: 15 cm (5.9 in)	1419.4324.02
R&S®RT-ZMA14	16 GHz (meas.)	28 ps	P/N/DM/CM	length: 15 cm (5.9 in), incl. 10 solder-in flex tips	1338.1010.02
R&S®RT-ZMA15	12 GHz (meas.)	37 ps	P/N/DM/CM	length: 15 cm (5.9 in)	1419.4224.02
R&S®RT-ZMA30	16 GHz (meas.)	28 ps	DM		1419.4353.02
R&S®RT-ZMA40	16 GHz (meas.)	28 ps	P/N/DM/CM	50 Ω/100 Ω, suitable for SMA, 3.5 mm and 2.92 mm systems, termination voltage ±4 V, supplied from R&S®RT-ZM probe amplifier module	1419.4201.02
R&S®RT-ZMA50	12 GHz (meas.)	37 ps	P/N/DM/CM	cable length: 1 m (39.37 in); consists of R&S®RT-ZMA11 and a pair of matched extension cables, temperature range: –55 °C to +125 °C	1419.4218.02
Accessories					
R&S®RT-ZM FLEXPCB				10x solder-in flex tips for R&S®RT-ZMA14 probe tip module	1337.9781.02
R&S®RT-ZMA1				for up to 6 R&S®RT-ZMAxx probe tip modules	1419.3928.02
R&S®RT-ZAP				3D probe positioner	1326.3641.02
R&S®RT-ZF30				test fixture for probe characterization with R&S®RTP-B7	1333.2099.02

[1] Multimode:
DM: differential measurement, CM: common mode measurement, P: single-ended measurement on positive pin, N: single-ended measurement on negative pin.

POWER INTEGRITY PROBES

Power rail characterization

High bandwidth, high sensitivity, very low noise and extra-large offset compensation make the R&S®RT-ZPR an excellent probe for characterizing power rails. With a bandwidth of up to 4 GHz, excellent sensitivity due to the 1:1 attenuation ratio and low noise, the R&S®RT-ZPR40 excels at precise ripple measurements. Coupled with the powerful oscilloscope frequency analysis, R&S®RT-ZPR probes can isolate periodic and random disturbances (PARD). An integrated high-precision, 18 bit DC voltmeter provides instantaneous DC voltage readouts in parallel.



Measuring small voltages riding on large DC offsets

With the ±60 V offset compensation range, R&S®RT-ZPR power rail probes allow you to focus on small DC voltage ripples in the power rail. Whether you need to zoom in on a 1 V or higher DC level, the probe provides the required offset while maintaining the lowest vertical resolution.



The high bandwidth of the R&S®RT-ZPR power rail probes allows you to capture high-frequency noise components

R&S®ProbeMeter: integrated high-precision DC voltmeter

The R&S®RT-ZPR power rail probe incorporates a high-precision DC voltmeter to accurately measure the DC levels in a power rail. The integrated 18 bit DC voltmeter with an input voltage range of ±60 V easily and accurately monitors long-term drift in the DC level.



Correlate power supply ripple to jitter components such as periodic jitter in high speed signals

Model	Bandwidth	Attenuation factor	Input impedance	Dynamic range	Comment	Order No.
R&S®RT-ZPR40	4.0 GHz	1:1	50 kΩ	±0.85 V (±60 V offset compensation), optional AC coupling	R&S®ProbeMeter	1800.5406.02

CONNECTIVITY

High impedance requirements

The R&S®RT-Z1M high-impedance buffer amplifier can extend R&S®RTP oscilloscope functionality and allow probes to be used that require high impedance input. You can connect standard passive and high voltage probes as well as current probes to the oscilloscope.

The integrated R&S®ProbeMeter also supports high-precision DC voltage measurements with 0.01 % measurement accuracy.



Model	Bandwidth	Input impedance	Offset range	Input coupling	Comment	Order No.
R&S®RT-Z1M	500 MHz	1 MΩ ± 1 % || 12 pF	±60 V (max.)	DC, AC, GND	R&S®ProbeMeter	1337.9200.02

Connectivity

R&S®RTP oscilloscopes come with two R&S®RT-ZA16 precision BNC to SMA adapters. The adapters enables a coaxial SMA connection to the 18 GHz BNC-compatible probe interface in the R&S®RTP oscilloscope.



R&S®RT-ZA16 precision BNC to SMA adapter

A low-loss and phase-matched one-meter cable pair (R&S®RT-ZA17) is available for high-precision measurements. The cables are configured with 3.5 mm male connectors on both sides. The specified skew error between the matched cables is less than 5 ps.



R&S®RT-ZA17 cable

R&S®RT-ZA17 specification in brief	
Cable length	1 m
Connectors	3.5 mm (m) to 3.5 mm (m)
Frequency	26.5 GHz
Skew error	< 5 ps
Matching	> 15 dB

OSCILLOSCOPE PORTFOLIO






	R&S®RTH1000	R&S®RTC1000	R&S®RTB 2	MXO 3
Vertical system				
Bandwidth [1]	60/100/200/350/500 MHz	50/70/100/200/300 MHz	70/100/200/300 MHz	100/200/350/500 MHz/1 GHz
Number of channels	2 plus DMM/4	2	2/4	4/8
Vertical resolution; system architecture	10 bit; 16 bit	8 bit; 16 bit	10 bit; 16 bit	12 bit; 18 bit
V/div, 1 MΩ	2 mV to 100 V	1 mV to 10 V	1 mV to 5 V	1 mV to 10 V
V/div, 50 Ω	–			1 mV to 1 V
Digital channels	8	8	16	16
Horizontal system				
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)
Maximum memory (per channel; 1 channel active)	125 kpoints (4-channel model); 250 kpoints (2-channel model); 500 kpoints	1 Mpoints; 2 Mpoints	10 Mpoints; 20 Mpoints	standard: 125 Mpoints; max. upgrade: 500 Mpoints [2]
Segmented memory	standard, 50 Mpoints	–	standard, 160 Mpoints	standard: 10 000 segments; option: 1 000 000 segments
Acquisition rate (in waveforms/s)	50 000	10 000	50 000 (300 000 in fast segmented memory mode)	> 4 500 000
Trigger				
Types	digital	analog	analog	advanced (includes zone trigger), digital trigger (15 trigger types)
Sensitivity	–	–	at 1 mV/div: > 2 div	0.0001 div, across full bandwidth, user controllable
Analysis				
Mask test	tolerance mask	tolerance mask	tolerance mask	user configurable, hardware based, tolerance mask
Mathematics	elementary	elementary	basic (math on math)	advanced (formula editor)
Serial protocols triggering and decoding [1]	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, CAN FD, SENT	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, CAN FD, CAN XL, LIN, ARINC 429, MIL-STD-1553, SPMI, 10BASE-T1S, QUAD-SPI, OCTO-SPI, SENT, RFFE I³C, NRZ, Manchester, SpaceWire, USB 1.1/2.0
Applications [1, 2]	high-resolution frequency counter, advanced spectrum analysis, harmonics analysis, user scripting	digital voltmeter (DVM), component tester, fast Fourier transform (FFT)	digital voltmeter (DVM), fast Fourier transform (FFT), frequency response analysis	power, digital voltmeter (DVM), frequency response analysis, basic jitter analysis, 3-phase analysis, impedance analysis
Compliance testing [1, 2]	–	–	–	–
Display and operation				
Size and resolution	7" touchscreen, 800 × 480 pixel	6.5", 640 × 480 pixel	10.1" touchscreen, 1280 × 800 pixel	11.6" touchscreen, 1920 × 1080 pixel (Full HD)
General data				
Dimensions in mm (W × H × D)	201 × 293 × 74	285 × 175 × 140	390 × 220 × 152	375 × 233 × 163
Weight in kg	2.4	1.7	2.5	4
Battery	lithium-ion, > 4 h	–	–	–

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






MXO 4	MXO 5/MXO 5C	R&S®RTO6	R&S®RTP
200/350/500 MHz/1/1.5 GHz	100/200/350/500 MHz/1/2 GHz	600 MHz/1/2/3/4/6 GHz	4/6/8/13/16 GHz
4	4/8	4	4
12 bit; 18 bit	12 bit; 18 bit	8 bit; 16 bit	8 bit; 16 bit
500 µV to 10 V	500 µV to 10 V	1 mV to 10 V (HD mode: 500 µV to 10 V)	
500 µV to 1 V	500 µV to 1 V	1 mV to 1 V (HD mode: 500 µV to 1 V)	2 mV to 1 V (HD mode: 1 mV to 1 V)
16	16	16	16
2.5; 5 (2 channels interleaved)	5 on 4 channels; 2.5 on 8 channels (2 channels interleaved)	10; 20 (2 channels interleaved in 4 GHz and 6 GHz model)	20; 40 (2 channels interleaved)
standard: 400 Mpoints; max. upgrade: 800 Mpoints [2)]	standard: 500 Mpoints max. upgrade: 1 Gpoints [2)]	standard: 200 Mpoints/800 Mpoints; max. upgrade: 1 Gpoints/2 Gpoints	standard: 100 Mpoints/400 Mpoints; max. upgrade: 3 Gpoints
standard: 10000 segments; option: 1000000 segments	standard: 10000 segments; option: 1000000 segments	standard	standard
> 4500000	> 4500000	1000000 (2500000 in ultra-segmented memory mode)	750000 (> 3000000 in ultra-segmented memory mode)
advanced (includes zone trigger), digital trigger (15 trigger types)	advanced (includes zone trigger), digital trigger (15 trigger types)	advanced (includes zone trigger), digital trigger (15 trigger types), high speed serial pattern trigger including 5 Gbit/s clock data recovery (CDR) [2)]	advanced (includes zone trigger), digital trigger (14 trigger types) with real-time deembedding [2)], high speed serial pattern trigger including 8/16 Gbit/s clock data recovery (CDR) [2)]
0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable
user configurable, hardware based, tolerance mask	user configurable, hardware based, tolerance mask	user configurable, hardware based	user configurable, hardware based
advanced (formula editor)	advanced (formula editor)	advanced (formula editor, Python interface)	advanced (formula editor, Python interface)
I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, CAN FD, CAN XL, LIN, ARINC 429, MIL-STD-1553, SPMI, 10BASE-T1S, QUAD-SPI, OCTO-SPI, SENT, RFFE, I³C, NRZ, Manchester, SpaceWire, USB 1.1/2.0	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, CAN FD, CAN XL, LIN, ARINC 429, MIL-STD-1553, SPMI, 10BASE-T1S, 100/1000BASE-T1, QUAD-SPI, OCTO-SPI, 8b10b, SENT, RFFE, I³C, NRZ, Manchester, SpaceWire, USB 1.1/2.0, MIPI D-PHY (CSI2/DSI)	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I²S, MIL-STD-1553, ARINC 429, FlexRay, CAN FD, CAN XL, MIPI RFFE, SPMI, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, SENT, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, CXPI, USB 3.1 Gen 1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, Automotive Ethernet 10BASE-T1S, 100/1000BASE-T1, I³C	I²C, SPI, UART/RS-232/RS-422/RS-485, SENT, CAN, LIN, CAN FD, CAN XL, MIL-STD-1553, ARINC 429, SpaceWire, USB 2.0/HSIC/PD, USB 3.1 Gen 1/Gen 2/SSIC, PCIe 1.1/2.0/3.0, 8b10b, MIPI RFFE, MIPI D/M-PHY/UniPro, SPMI, Automotive Ethernet 10BASE-T1S, 100/1000BASE-T1, Ethernet 10/100BASE-TX, MDIO, Manchester, NRZ, I³C
power, digital voltmeter (DVM), frequency response analysis, basic jitter analysis, 3-phase analysis, impedance analysis	power, digital voltmeter (DVM), frequency response analysis, basic jitter analysis, eye analysis, 3-phase analysis, impedance analysis	power, advanced spectrum analysis and spectrogram, jitter and noise decomposition, clock data recovery (CDR), I/Q data and RF analysis (R&S®VSE), deembedding, embedding, equalization, PAM-N, TDR/TDT analysis, advanced eye diagram, EMC/ESD test	advanced spectrum analysis and spectrogram, jitter and noise decomposition, real-time deembedding, embedding, equalization, PAM-N, TDR/TDT analysis, I/Q data and RF analysis (R&S®VSE), advanced eye diagram, EMC/ESD test
–	see specifications (PD 3683.8196.22, PD 3684.1472.22)	see specifications (PD 5216.1640.22)	see specifications (PD 3683.5616.22)
13.3" touchscreen, 1920 × 1080 pixel (Full HD)	for MXO 5 only: 15.6" touchscreen, 1920 × 1080 pixel (Full HD)	15.6" touchscreen, 1920 × 1080 pixel (Full HD)	13.3" touchscreen, 1920 × 1080 pixel (Full HD)
414 × 279 × 162	MXO 5: 445 × 314 × 154 MXO 5C: 445 × 105 × 405	450 × 315 × 204	441 × 285 × 316
6	MXO 5: 9 MXO 5C: 8.7	10.7	18
–	–	–	–

SPECIFICATIONS IN BRIEF

Specifications in brief		
Vertical system		
Number of channels		4
Analog bandwidth (–3 dB)	R&S®RTP044B	4 GHz
	R&S®RTP064B	6 GHz
	R&S®RTP084B	8 GHz
	R&S®RTP134B	13 GHz (2 channels interleaved)
	R&S®RTP164B	16 GHz (2 channels interleaved)
Impedance		50 Ω
Input sensitivity	max. bandwidth in all ranges	50 Ω: 2 mV/div to 1 V/div
Offset range	> 100 mV/div	±5 V
	≤ 100 mV/div	±(1.5 V – input sensitivity × 5 div)
Resolution		8 bit, up to 16 bit in HD mode
Acquisition system		
Real-time sampling rate	R&S®RTP044B/064B/084B/134B/164B	40 Gsample/s (2 channels interleaved); 20 Gsample/s on each channel
Acquisition memory	standard configuration	100 Mpoints on 4 channels; 400 Mpoints on 1 channel
	max. upgrade (R&S®RTP-B130 option)	3 Gpoints on 4 channels
Maximum acquisition rate	continuous acquisition and display, 40 Gsample/s, 1 ksample	> 750 000 waveforms/s
Real-time processing	differential signal math	real-time calculation of differential and common mode signals from two input channels; can be used as trigger source
	deembedding (optional)	real-time deembedding of signal path characteristic based on S-parameters
Horizontal system		
Timebase range		20 ps/div to 10 000 s/div
Accuracy	OCXO as standard, after delivery/calibration	±0.01 ppm
	during calibration interval	±0.1 ppm
Trigger system		
Trigger types	all trigger types up to full bandwidth; based on real-time deembedding (optional)	edge, glitch, width, runt, window, timeout, interval, slew rate, data2clock, pattern, state, TV/video, serial protocol triggers (optional), zone trigger (optional), high speed serial pattern (optional), 16 Gbit/s CDR (optional)
Zone trigger (optional)		logical combination of max. 8 polygons; intersect or not intersect
	source	measurement channels, spectrum, math functions
Sensitivity	definition of trigger hysteresis	automatic or manually adjustable from 0 div to 5 div
General data		
Dimensions	W × H × D	441 mm × 285 mm × 316 mm (17.36 in × 11.22 in × 12.44 in)
Weight		18 kg (39.68 lb)
Screen		13.3" LC TFT color display with capacitive touchscreen, 1920 × 1080 pixel (Full HD)
Option slots	2 slots on front side, 2 slots on rear side for upgrading with various hardware options	MSO (16 channels, 400 MHz), R&S®RT-ZVC (multiple high-precision voltage and current channels), arbitrary waveform generator, 16 GHz differential pulse source
Interfaces		1 Gbit/s LAN, type A: 4 × USB 3.1, type B: 1 × USB 3.1, GPIB (standard), HDMI 2.0 and DP++ 1.3 for external monitor, external trigger with active probe interface, trigger output, ref in: 1 MHz to 20 MHz, ref out: 10 MHz

ORDERING INFORMATION

Step 1: choose needed bandwidth and channels	
	4 channels
4 GHz	R&S®RTP044B
6 GHz	R&S®RTP064B
8 GHz	R&S®RTP084B
13 GHz	R&S®RTP134B
16 GHz	R&S®RTP164B

Step 2: choose additional test resources	
16, 400 MHz digital channels (MSO)	R&S®RTP-B1
2 channels 100 MHz arbitrary waveform generator	R&S®RTP-B6
16 GHz differential pulse source	R&S®RTP-B7
Multichannel power probe (4 + 4 channels V/I)	R&S®RTP-ZVC04

Step 3: choose software options			
Triggering and decode technology packages or bundles			
Bus analysis	R&S®RTP-K500		
Low speed serial buses	R&S®RTP-K510	I²C/SPI/RS-232/UART	
Automotive protocols	R&S®RTP-K520	CAN/LIN/CAN FD/CAN XL incl. CAN-dbc file import	
Aerospace protocols	R&S®RTP-K530	MIL-STD-1553/ARINC 429/SpaceWire	
Ethernet protocols	R&S®RTP-K540	10BASE-T/100BASE-T/MDIO	
MIPI low speed	R&S®RTP-K550	MIPI RFFE/SPMI/I³C	
Automotive Ethernet	R&S®RTP-K560	IEEE 10BASE-T1S/100BASE-T1/IEEE 1000BASE-T1	
USB protocols	R&S®RTP-K570	USB 1.0/1.1/USB 2.0/HSIC/USB 3.2 Gen 1/Gen 2/USB power delivery (USB-PD)/USB SSIC	
MIPI high speed	R&S®RTP-K580	MIPI D-PHY v.1.2, DSI v.1.3 and CSI-2 v.1.2/MIPI M-PHY 4.0 and UniPro 1.6	
PCI Express	R&S®RTP-K590	8b10b/PCI Express 1.1/2.0/3.0	
Generic decode	R&S®RTP-K600	8b10b/Manchester/Manchester II/NRZ unclocked/clocked	
Low speed trigger and decode bundle	R&S®RTP-TDBDL1	R&S®RTP-K500/-K510/-K520/-K530/-K540/-K550/-K600	
High speed trigger and decode bundle	R&S®RTP-TDBDL2	R&S®RTP-K560/-K570/-K580/-K590/-K600	
Trigger and decode bundle ALL	R&S®RTP-ALLTD	R&S®RTP-K500/-K510/-K520/-K530/-K540/-K550/-K560/-K570/-K580/-K590/-K600	
Technology	**Triggering and decoding**	**Compliance**	**Test fixture set**
Embedded			
I²C/SPI	R&S®RTP-K1		
UART/RS-232/422/485	R&S®RTP-K2		
10/100 Mbit Ethernet	R&S®RTP-K8	R&S®RTP-K22	R&S®RT-ZF2
1 Gbit Ethernet		R&S®RTP-K22	R&S®RT-ZF2, R&S®RT-ZF2C
2.5G/5GBASE-T Ethernet		R&S®RTP-K25	R&S®RT-ZF2
10 Gbit Ethernet		R&S®RTP-K23	R&S®RT-ZF2
10M/100M/1GBASE-T Energy Efficient Ethernet		R&S®RTP-K86	R&S®RT-ZF4, R&S®RT-ZF5
10BASE-T1L Ethernet		R&S®RTP-K89	R&S®RT-ZF7P, R&S®RT-ZF7A, R&S®RT-ZF8
8b10b	R&S®RTP-K52		
MDIO	R&S®RTP-K55		
USB 1.0/1.1/2.0/HSIC	R&S®RTP-K60	R&S®SPLUS-K400	R&S®RT-ZF1
USB-PD	R&S®RTP-K63		
USB-SSIC	R&S®RTP-K64		
USB 3.1 Gen 1 TX	R&S®RTP-K61	R&S®RTP-K101	[1]
USB 3.1 Gen 2 TX	R&S®RTP-K62	R&S®RTP-K101 [2]	[1]
USB 3.1 Gen 1/Gen 2 RX		R&S®RTP-K102	[3]
PCIe Express 1.1/2.0/3.0	R&S®RTP-K73	R&S®SPLUS-K440 [2]	[4]
DDR3/LPDDR3		R&S®RTP-K91	[4]
DDR4/LPDDR4		R&S®RTP-K93	[5]
DDR5		R&S®RTP-K94	[5]

[1] USB.org test fixtures: order from www.usb.org/estore
[2] Lower standards are supported.
[3] USB-IF certified test fixtures: order from www.wilder-tech.com/en/products/usb31
[4] DDR3/DDR4/DDR5 interposer: order from http://www.nexustechnology.com or https://www.eyeknowhow.de/en/

Step 3: choose software options			
LPDDR5		R&S®RTP-K95	
eMMC (HS200/HS400)		R&S®RTP-K92	
HDMI 1.4/2.0/2.1		R&S®RTP-K110	[5]
DisplayPort (DP) 1.4a		R&S®RTP-K114	[6]
Embedded DisplayPort (eDP) 1.4b/1.5		R&S®RTP-K115	[7]
Automotive			
CAN/LIN	R&S®RTP-K3		
CAN FD	R&S®RTP-K9		
CAN XL	R&S®RTP-K77		
10BASE-T1S Ethernet	R&S®RTP-K56	R&S®RTP-K89	R&S®RT-ZF7A, R&S®RT-ZF7P
100BASE-T1/BroadR-Reach Ethernet	R&S®RTP-K57	R&S®RTP-K24	R&S®RT-ZF3, R&S®RT-ZF7, R&S®RT-ZF7A, R&S®RT-ZF8
1000BASE-T1 Ethernet	R&S®RTP-K58	R&S®RTP-K87	R&S®RT-ZF6, R&S®RT-ZF7A, R&S®RT-ZF8
MultiGBASE-T1 Ethernet (2.5G/5G/10G)		R&S®RTP-K88	R&S®RT-ZF7A, R&S®RT-ZF8
ASA-ML		R&S®SPLUS-K105	
GMSL2		R&S®SPLUS-K107	
Aerospace			
MIL-STD-1553	R&S®RTP-K6		
ARINC 429	R&S®RTP-K7		
SpaceWire	R&S®RTP-K65		
Mobile communications			
MIPI RFFE	R&S®RTP-K40		
MIPI I^3C	R&S®RTP-K45		
MIPI D-PHY v.1.2	R&S®RTP-K42	R&S®RTP-K26	
MIPI D-PHY v.2.5		R&S®RTP-K27	
MIPI C-PHY v.2.1		R&S®RTP-K28	
MIPI M-PHY	R&S®RTP-K44		
Configurable			
Manchester, NRZ	R&S®RTP-K50		
Analysis			
Signal integrity bundle 1	R&S®RTP-SIBDL1 (incl. R&S®RTP-K12/-K19/-K121/-K122/-K141)		
Signal integrity bundle 2	R&S®RTP-SIBDL2 (incl. R&S®RTP-K126/-K134/-K135/-K137)		
Signal integrity bundle ALL	R&S®RTP-ALLSI (incl. R&S®RTP-K19/-K121/-K122-K126/-K134/-K135/-K137/-K14)		
Jitter analysis	R&S®RTP-K12		
Zone trigger	R&S®RTP-K19		
Spectrogram	R&S®RTP-K37		
User-defined math with Python	R&S®RTP-K39		
Deembedding	R&S®RTP-K121		
Deembedding, real-time extension	R&S®RTP-K122		
Embedding and equalization	R&S®RTP-K126		
Video raster analysis	R&S®RTP-K129		
TDR/TDT analysis	R&S®RTP-K130		
Jitter decomposition	R&S®RTP-K133		
Jitter and noise decomposition	R&S®RTP-K134		
PAM-N analysis	R&S®RTP-K135		
Advanced eye analysis (8 Gbit/s CDR)	R&S®RTP-K136		
Advanced eye analysis (16 Gbit/s CDR)	R&S®RTP-K137		
High-speed serial pattern trigger (8 Gbit/s CDR)	R&S®RTP-K140		
High-speed serial pattern trigger (16 Gbit/s CDR)	R&S®RTP-K141		
EMC/ESD test	R&S®RTP-K155		
Health and utilization monitoring service (HUMS)	R&S®RTP-K980		

[5] HDMI test fixture: order from www.wilder-tech.com/en/products/hdmi
[6] DP test fixture: order from www.wilder-tech.com/en/products/displayport

Step 3: choose software options		
RF signal analysis		
I/Q software interface	R&S®RTP-K11	
Wideband modulated load-pull	R&S®RTP-K98	
External frontend control	R&S®RTP-K553	
Vector signal explorer software	**Flexible installation [7]**	**Oscilloscope-only [8]**
License dongle	R&S®FSPC	–
Pulse measurements	R&S®VSE-K6	R&S®VSE-KT6
Multichannel pulse analysis	R&S®VSE-K6A	R&S®VSE-KT6A
Bluetooth® BR/EDR/LE measurements	R&S®VSE-K8	R&S®VSE-KT8
Bluetooth® 6.0 Low Energy Channel Sounding measurements	R&S®VSE-K8E	R&S®VSE-KT8E
Transient measurements	R&S®VSE-K60	R&S®VSE-KT60
Vector signal analysis	R&S®VSE-K70	R&S®VSE-KT70
3GPP WCDMA uplink and downlink signal analysis, including HSDPA, HSUPA and HSPA+	R&S®VSE-K72	R&S®VSE-KT72
WLAN signal analysis, in line with the WLAN IEEE 802.11a/ac/ax/b/be/bn/g/n/p standard	R&S®VSE-K91	R&S®VSE-KT91
WLAN OFDM cross-correlation	R&S®VSE-K91X	R&S®VSE-KT91X
Analysis of user-defined OFDM and OFDMA signals	R&S®VSE-K96	R&S®VSE-KT96
LTE and LTE-Advanced signal analysis	R&S®VSE-K100/-K102/-K104	R&S®VSE-KT100/-K102/-K104
LTE narrowband IoT analysis	R&S®VSE-K106	R&S®VSE-KT106
3GPP 5G NR downlink and uplink measurement application	R&S®VSE-K144	R&S®VSE-KT144
3GPP 5G NR cross-correlation	R&S®VSE-K144X	R&S®VSE-KT144X
3GPP 5G NR downlink MIMO measurements	R&S®VSE-K146	R&S®VSE-KT146
3GPP 5G NR Release 16 extension for uplink/downlink	R&S®VSE-K148	R&S®VSE-KT148
HRP UWB measurements	R&S®VSE-K149	R&S®VSE-KT149
3GPP 5G NR Release 17 extension for uplink/downlink	R&S®VSE-K171	R&S®VSE-KT171
O-RAN measurements	R&S®VSE-K175	R&S®VSE-KT175
Beyond 5G measurements	R&S®VSE-K184	R&S®VSE-KT184
OneWeb reverse link	R&S®VSE-K201	R&S®VSE-KT201
User-defined frequency correction by SnP file	R&S®VSE-K544	R&S®VSE-KT544
Software maintenance	R&S®VSE-SWM	

Step 4: choose hardware options	
Replacement SSD	R&S®RTP-B19B
Front handles	R&S®RTP-B20B
Adapter, rear option slot	R&S®RTP-B21B
Memory upgrade	
200 Mpoints per channel	R&S®RTP-B102
500 Mpoints per channel	R&S®RTP-B105
1 Gpoint per channel	R&S®RTP-B110
2 Gpoints per channel	R&S®RTP-B120
3 Gpoints per channel	R&S®RTP-B130

[7] Can be installed and run either on an oscilloscope or on an external PC.
[8] Can only be installed and run on the oscilloscope it was purchased for.

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Step 5: choose accessories	
High-impedance buffer amplifier, incl. 500 MHz passive probe	R&S®RT-Z1M
Front cover	R&S®RTP-Z1
Hard case	R&S®RTP-Z4
Precision BNC to SMA adapter	R&S®RT-ZA16
High-precision and low-loss matched cable pair, length: 1 m	R&S®RT-ZA17
Rackmount kit	R&S®ZZA-KN6B

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[1] For extended periods, contact your Rohde&Schwarz sales office.

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