R&S®RT-ZVCxx Multi-Channel Power Probe

Specifications

ROHDE&SCHWARZ

Data Sheet | Version 03.00

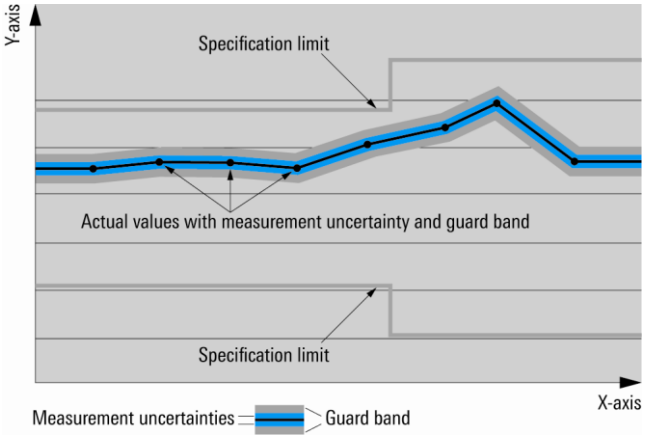
CONTENTS

Definitions

General
Product data applies under the following conditions:

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

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



Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

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

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

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

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

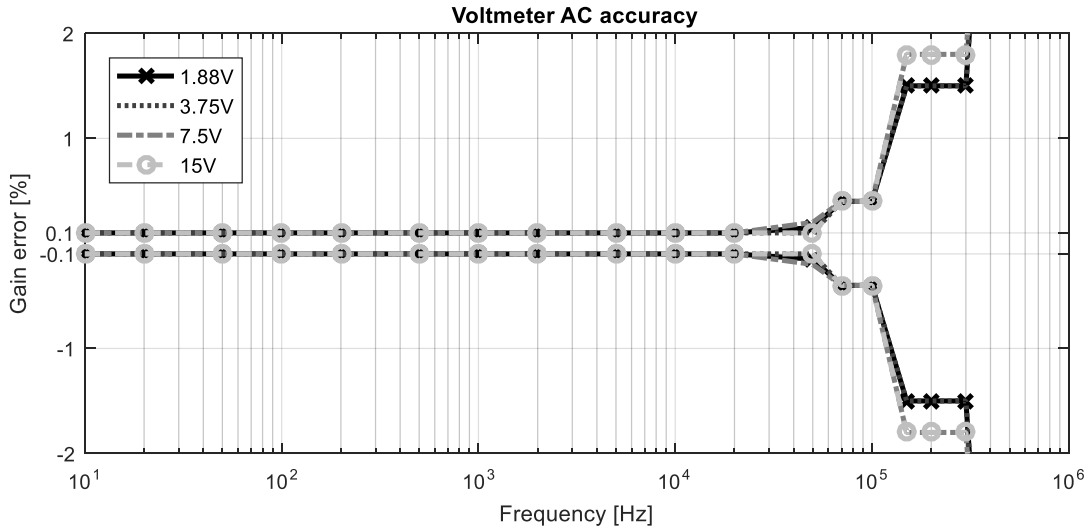
Device settings and GUI parameters are indicated as follows: “parameter: value”.

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

Probe characteristics

Voltmeter

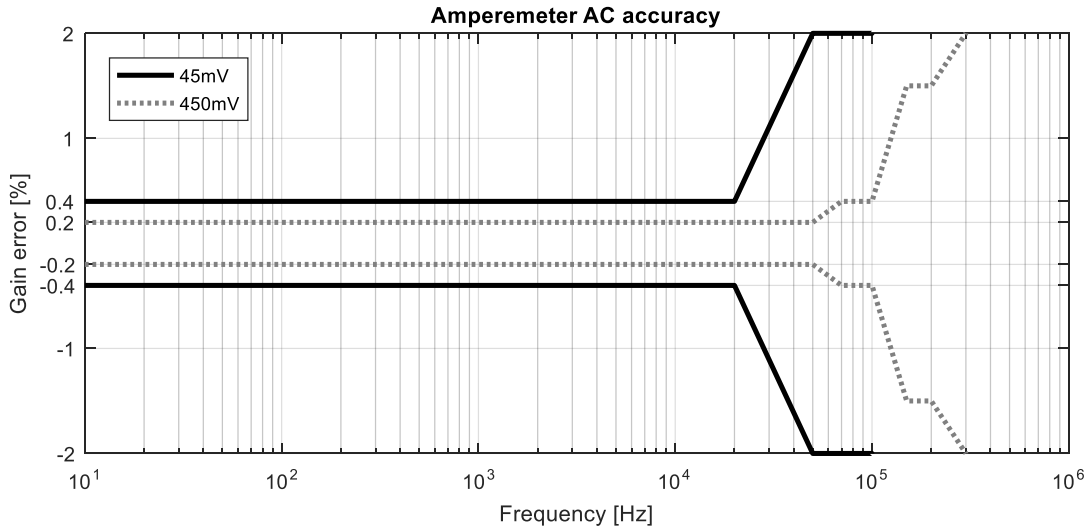
Number of signals		2/4
DC characteristics		
Voltage ranges		1.88 V, 3.75 V, 7.5 V, 15 V
DC accuracy	system	± (0.1 % of reading + 0.01 % of range)
Specified accuracy temperature range	rated accuracy applies after 30 min stabilization	+23 °C ± 5 °C
Temperature coefficient	from 0 °C to +18 °C or +28 °C to +50 °C	0.15 × specified accuracy/°C
Dynamic range		
Overall range	referred to LSB	102 dB (nom.)
Differential input	single socket	±7.5 V
Single-ended input	single socket	±15 V
Maximum rated input voltage		
Continuous voltage		±18 V (CAT I)
ESD tolerance	human body model	8 kV
Input impedance		
DC input resistance	between signal sockets	10 MΩ (nom.)
Input capacitance		48 pF (meas.)
Sensitivity		
Noise	AC RMS value computed with 5 Msample/s	
	1.88 V	< 50 µV (meas.)
	3.75 V	< 100 µV (meas.)
	7.5 V	< 200 µV (meas.)
	15 V	< 400 µV (meas.)
Frequency response		
Bandwidth	system, –1 dB (10.9 % error), starting at DC	
	1.88 V, 3.75 V, 7.5 V, 15 V	≤ 1 MHz
AC accuracy	1.88 V	
	10 Hz to 20 kHz	± (0.1 % of reading + 0.01 % of range)
	20 kHz to 50 kHz	± (0.15 % of reading + 0.01 % of range)
	50 kHz to 100 kHz	± (0.4 % of reading + 0.01 % of range)
	100 kHz to 300 kHz	± (1.5 % of reading + 0.01 % of range)
	300 kHz to 400 kHz	± (5 % of reading + 0.01 % of range)
	400 kHz to 1 MHz	± (10.9 % of reading + 0.01 % of range)
	3.75 V	
	10 Hz to 50 kHz	± (0.1 % of reading + 0.01 % of range)
	50 kHz to 100 kHz	± (0.4 % of reading + 0.01 % of range)
	100 kHz to 300 kHz	± (1.5 % of reading + 0.01 % of range)
	300 kHz to 600 kHz	± (5 % of reading + 0.01 % of range)
	600 kHz to 1 MHz	± (10.9 % of reading + 0.01 % of range)
	7.5 V	
	10 Hz to 20 kHz	± (0.1 % of reading + 0.01 % of range)
	20 kHz to 50 kHz	± (0.2 % of reading + 0.01 % of range)
	50 kHz to 100 kHz	± (0.4 % of reading + 0.01 % of range)
	100 kHz to 300 kHz	± (1.8 % of reading + 0.01 % of range)
	300 kHz to 500 kHz	± (5 % of reading + 0.01 % of range)
	500 kHz to 1 MHz	± (10.9 % of reading + 0.01 % of range)
	15 V	
	10 Hz to 50 kHz	± (0.1 % of reading + 0.01 % of range)
	50 kHz to 100 kHz	± (0.4 % of reading + 0.01 % of range)
	100 kHz to 300 kHz	± (1.8 % of reading + 0.01 % of range)
	300 kHz to 400 kHz	± (5 % of reading + 0.01 % of range)
	400 kHz to 800 kHz	± (10.9 % of reading + 0.01 % of range)
Specified accuracy temperature range	rated accuracy applies after 30 min stabilization	+23 °C ± 5 °C
Temperature coefficient	from 0 °C to +18 °C or +28 °C to +50 °C	0.15 × specified accuracy/°C



Amperemeter

Number of signals		2/4
DC characteristics		
Current ranges		4.5 µA
		45 µA
		4.5 mA
		45 mA
		4.5 A
	limited by internal overload protection and 15 A fuse, continuous current only for 1 channel at room temperature +23 °C ± 5 °C	10 A
	external shunt on DUT, recommended for currents > 3 A	45 mV
		450 mV
Shunt resistors	4.5 µA, 45 µA	10 kΩ ± 0.1 %
	4.5 mA, 45 mA	10 Ω ± 0.1 %
	4.5 A, 10 A	10 mΩ ± 0.1 %
Voltage burden	including total (round trip) input resistance	
	10 kΩ shunt (4.5 µA, 45 µA)	10 mV/µA, max. 500 mV
	10 Ω shunt (4.5 mA, 45 mA)	10.7 mV/mA, max. 535 mV
	10 mΩ shunt (4.5 A, 10 A)	128 mV/A, max. 1.28 V
DC accuracy	system, all ranges except 4.5 A and 10 A	± (0.2 % of reading + 0.02 % of range)
	system, 4.5 A range	± (0.3 % of reading + 0.02 % of range)
	system, 10 A range	± (0.2 % of reading + 0.09 % of range)
Specified accuracy temperature range	rated accuracy applies after 30 min stabilization	+23 °C ± 5 °C
Temperature coefficient	from 0 °C to +18 °C or +28 °C to +50 °C	0.15 × specified accuracy/°C
Dynamic range		
Overall range	including range switching	202 dB
Differential input	single socket	±250 mV
Single-ended input	single socket	±500 mV
Common mode range	single socket	±15 V
Maximum rated input voltage		
Continuous voltage	external shunt	±18 V (CAT I)
ESD tolerance	human body model	8 kV

Input impedance		
DC input resistance	resistance between signal sockets	
	external shunt	1 MΩ (nom.)
	10 kΩ shunt (4.5 µA, 45 µA)	1 MΩ || 10 kΩ = 9.89 kΩ (nom.)
	10 Ω shunt (4.5 mA, 45 mA)	10.6 Ω (nom.)
	10 mΩ shunt (4.5 A, 10 A)	21.2 mΩ (nom.)
	additional resistance caused by cabling and connectors	
	AWG24 cable (standard shipping)	2*(41 + 0.77/cm) mΩ (nom.)
	AWG20 cable (used in accessory sets)	2*(41 + 0.33/cm) mΩ (nom.)
	total (round trip) resistance including connectors and standard cabling (16 cm length), causes total voltage burden seen at the lead ends	
	10 kΩ shunt (4.5 µA, 45 µA)	9.89 kΩ (nom.)
	10 Ω shunt (4.5 mA, 45 mA)	10.7 Ω (nom.)
	10 mΩ shunt (4.5 A, 10 A)	128 mΩ (nom.)
Input capacitance	between signal sockets	
	external shunt	< 1.4 nF (meas.)
Sensitivity		
Noise	AC RMS value computed with 5 Msample/s	
	4.5 µA	< 2 nA (meas.)
	45 µA	< 6 nA (meas.)
	4.5 mA	< 2 µA (meas.)
	45 mA	< 6 µA (meas.)
	4.5 A	< 2 mA (meas.)
	10 A	< 6 mA (meas.)
	45 mV	< 30 µV (meas.)
	450 mV	< 60 µV (meas.)
Frequency response		
Bandwidth	system, –1 dB (10.9 % error), starting at DC, only characterized in external shunt mode (worst case condition in terms of input capacitance, comparable specification for current ranges using internal shunts are given in brackets)	
	45 mV (4.5 µA, 4.5 mA, 4.5 A)	300 kHz
	450 mV (45 µA, 45 mA, 10 A)	1 MHz
AC accuracy	45 mV (4.5 µA, 4.5 mA, 4.5 A)	
	10 Hz to 40 kHz	± (0.4 % of reading + 0.02 % of range)
	40 kHz to 100 kHz	± (2 % of reading + 0.02 % of range)
	100 kHz to 270 kHz	± (10.9 % of reading + 0.02 % of range)
	450 mV (45 µA, 45 mA, 10 A)	
	10 Hz to 50 kHz	± (0.2 % of reading + 0.02 % of range)
	50 kHz to 100 kHz	± (0.4 % of reading + 0.02 % of range)
	100 kHz to 200 kHz	± (1.5 % of reading + 0.02 % of range)
	200 kHz to 300 kHz	± (2 % of reading + 0.02 % of range)
	300 kHz to 800 kHz	± (5 % of reading + 0.02 % of range)
	800 kHz to 1 MHz	± (10.9 % of reading + 0.02 % of range)
Specified accuracy temperature range	rated accuracy applies after 30 min stabilization	+23 °C ± 5 °C
Temperature coefficient	from 0 °C to +18 °C or +28 °C to +50 °C	0.15 × specified accuracy/°C
Vx-to-Ix channel isolation	input frequency < analog bandwidth, from voltmeter to amperemeter channel of same channel number (not relevant between voltmeter and amperemeter of different channel numbers)	
	4.5 µA	> 67 dB (meas.)
	45 µA	> 54 dB (meas.)
	4.5 mA	> 65 dB (meas.)
	45 mA	> 54 dB (meas.)
	4.5 A	> 87 dB (meas.)
	10 A	> 114 dB (meas.)
	45 mV	> 64 dB (meas.)
	450 mV	> 64 dB (meas.)



Digital backend

A/D conversion		
Number of channels	1 per input signal	4/8
Readings per second (speed)		5 Msample/s
Resolution		18 bit
Resolution voltmeter (LSB)	1.88 V	14 µV
	3.75 V	28 µV
	7.5 V	57 µV
	15 V	114 µV
Resolution amperemeter (LSB)	4.5 µA	0.038 nA
	45 µA	0.38 nA
	4.5 mA	38 nA
	45 mA	381 nA
	4.5 A	38 µA
	10 A	381 µA
	45 mV	381 nV
	450 mV	3.81 µV
Scope interface		
Use with		R&S®RTO2000, R&S®RTE
Connector	as shipped with article 1326.0259.02/04 or accessory 1333.1770.02	HDMR-29
USB interface		
Connector		USB 3.0 Micro B
Max. cable length	as shipped with article 1326.0259.22/24	1.5 m

R&S®CMWrun interface

Use with	R&S®CMWrun software option R&S®CMW-KT051 plus dedicated signaling extension for control and evaluation of power consumption monitoring and battery life measurements	R&S®CMW500
PC prerequisites		
Operating system		Windows PC, Windows version ⩾ 7
CPU	minimum	Intel™Core i3 or similar processor performance
RAM		⩾ 8 Gbyte
HDD		high performance HDD or SDD for storing sample data
Peripherals		USB 3.0 interface
Graphical user interface for results		
Number of supported power measurement groups in parallel	Each power measurement group consists of a voltmeter and amperemeter with internal multiplier for instantaneous power calculation.	
	R&S®RT-ZVC02	1 group out of 2
	R&S®RT-ZVC04	1 group out of 4
Displayed measurements in the R&S®CMWrun report/power consumption monitor		parallel monitoring of voltage and current samples with calculation and display of the instantaneous power in R&S®CMWrun software
Monitoring sample rate displayed in the R&S®CMWrun report/power consumption monitor	available sample rate per measured channel (voltage, current and instantaneous power)	continuous monitoring: 10/100/1 ksample/s; after events, auto zoom function up to 50 ksample/s (for short time intervals)
USB transfer data rate	sample transfer via USB interface to the PC	up to 50 ksample/s depending on the selected monitoring sample rate
Decimation methods		peak or average
Output formats		PDF, XML, CSV, TXT
Trigger events		signaling events in red lines
		IP analysis triggers in blue lines

R&S®RTO2000, R&S®RTE interface

Vertical system

Input channels	depending on number (up to 2) and type of connected probes (2 × 2 or 2 × 4 voltage/current channel version)	
	1 × R&S®RT-ZVC02	2 voltage, 2 current channels
	2 × R&S®RT-ZVC02	4 voltage, 4 current channels
	1 × R&S®RT-ZVC04	4 voltage, 4 current channels
	1 × R&S®RT-ZVC02, 1 × R&S®RT-ZVC04	6 voltage, 6 current channels
	2 × R&S®RT-ZVC04	8 voltage, 8 current channels
Arrangement of input channels	arranged in two probes Z1 and Z2 with up to 4 voltage/current channels each, assignment of the power probe to the port at the back of the scope is indicated on the probe (probe Z1, probe Z2)	Z1V1 to Z1V4, Z1I1 to Z1I4 Z2V1 to Z2V4, Z2I1 to Z2I4

Horizontal system

Channel deskew	for each channel	
	min.	–6 µs
	max.	+6 µs
	step	200 ns
Oscilloscope to R&S®RT-ZVC channel skew (CH1 to CH4 to V1 to V4, I1 to I4)	R&S®RT-ZVC bandwidth set to 1 MHz, oscilloscope channels not filtered	
	amperemeter channels: 45 µA, 45 mA, 10 A, 450 mV; voltmeter channels: 1.88 V, 3.75 V, 7.5 V, 15 V	≤ ±200 ns (meas.)
	amperemeter channels: 4.5 µA, 4.5 mA, 4.5 A, 45 mV	≤ +400 ns (meas.)

Acquisition system

Acquisition mode		realtime and interpolated time
Acquisition history		supported
Sampling rate	max.	5 Msample/s
Realtime waveform acquisition rate	max.	500 waveform/s
Memory depth	1 active power probe (R&S®RT-ZVC02/-ZVC04)	16 Msample for every channel
	2 active power probes (R&S®RT-ZVC02/-ZVC04)	8 Msample for every channel
	acquisition and post-processing settings can reduce the memory depth	
Decimation	modes	sample, peak, highres
	min. sample rate	25 ksample/s
Bandwidth	reduction performed by first order digital low-pass filtering	
	min.	5 kHz
	max.	1 MHz
	step	5 kHz

Trigger system

Edge trigger on R&S®RT-ZVC channels	triggers on specified slope (positive, negative or either) in the source signal	
	sources	any channel from V1 to V4, I1 to I4
Other trigger features		all trigger features of the base unit on oscilloscope channels

Prerequisites

Hardware option	R&S®RTO2000	R&S®RTO-B1 mixed signal option (latest version with included R&S®RTO-B1E) or R&S®RTO-B1E digital extension port
	R&S®RTE	R&S®RTE-B1 mixed signal option (latest version with included R&S®RTE-B1E) or R&S®RTE-B1E digital extension port
	for details see ordering information in the R&S®RTO2000 and R&S®RTE data sheets	
R&S®RTx software version	R&S®RT-ZVC02/-ZVC04 support	with 3.60.1.0 onwards

Features

General features	waveform measurements, mask testing, waveform math, search and mark function, display characteristics	all features of base unit as well as R&S®RTO-K18 and R&S®RTO-K19 options are supported
	sources	all channels from V1 to V4, I1 to I4
Mixed operation	R&S®RT-ZL04 logic probe and R&S®RT-ZVC02/04 power probe	simultaneous connection, but no parallel operation on screen
	R&S®RT-ZL04 logic probe or R&S®RT-ZVC02/04 power probe together with analog input channels	supported, running on same horizontal scale

General data

Environmental conditions		
Temperature	operating temperature range, for probe and for operation via USB and power adapter	0 °C to +50 °C
	operating temperature range, with scope	0 °C to +45 °C
	storage temperature range	–10 °C to +60 °C
Damp heat		+25 °C/+40 °C, 95 % rel. humidity, cyclic, in line with EN 60068-2-30
Altitude	operating	up to 2000 m
	transport	up to 4500 m

Mechanical resistance		
Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I
Power rating		
Probe	all channels enabled, all sampling	6 V DC, 2 A
Power adapter	input	100 V to 240 V at 47 Hz to 63 Hz, 0.4 A
	output	+5.9 V DC, 1.5 A
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU	applied harmonized standards: • EN 61326-1 (industrial environment) • EN 61326-2-1, • EN 55011 (class A), • EN 61000-3-2, • EN 61000-3-3
Electrical safety	EU: in line with Low Voltage Directive 2014/35/EU	applied harmonized standard: EN 61010-1
	USA	UL 61010-1
	Canada	CAN/CSA-C22.2 No. 61010-1
Certifications		VDE, $_{c}$CSA$_{US,}$ KC
Calibration interval	recommended for highest accuracy	1 year
	for general test and measurement applications	2 years
Dimensions	probe head (L × W × H)	approx. 150 mm × 103 mm × 40 mm (5.9 in × 4.1 in × 1.6 in)
	cable lengths of shipped test leads	approx. 16 cm (6.3 in)
	current cable size	AWG24
	voltage cable size	AWG28
Weight	probe only	approx. 500 g (1.1 lb)

Ordering information

Designation	Type	Order No.
Multi-Channel Power Probe, 2 × 4 voltage/current channels, for R&S®RTO2000/R&S®RTE	R&S®RT-ZVC04	1326.0259.04
Multi-Channel Power Probe, 2 × 4 voltage/current channels, for R&S®CMWrun	R&S®RT-ZVC04	1326.0259.24
Multi-Channel Power Probe, 2 × 2 voltage/current channels, for R&S®RTO2000/R&S®RTE	R&S®RT-ZVC02	1326.0259.02
Multi-Channel Power Probe, 2 × 2 voltage/current channels, for R&S®CMWrun	R&S®RT-ZVC02	1326.0259.22
Accessories		
Extended Cable Set for R&S®RT-ZVC, PCB probing, 1 current and voltage lead, length: 32 cm	R&S®RT-ZA30	1333.1686.02
Extended Cable Set for R&S®RT-ZVC, 4 mm probing, 1 current and voltage lead, length: 32 cm	R&S®RT-ZA31	1333.1692.02
Power Adapter for R&S®RT-ZVC02/04 (only for operation with R&S®CMWrun)	R&S®RT-ZA32	1333.1705.02
Oscilloscope Interface Cable for R&S®RT-ZVC (included in R&S®RT-ZVC02/-ZVC04, 1326.0259.02/.04)	R&S®RT-ZA33	1333.1770.02
Extended Cable Set for R&S®RT-ZVC, 4 mm probing, 1 current and voltage lead, length: 1 m	R&S®RT-ZA34	1333.1892.02
Extended Cable Set for R&S®RT-ZVC, PCB probing, 1 current and voltage lead, length: 1 m	R&S®RT-ZA35	1333.1905.02
Solder-in Cable Set for R&S®RT-ZVC, 4 current and voltage solder-in cables, solder-in pins	R&S®RT-ZA36	1333.1911.02
Extended Cable Set for R&S®RT-ZVC, BNC connector, 1 current and voltage lead, length: 16 cm	R&S®RT-ZA37	1337.9130.02
Graphical user interface based on R&S®CMWrun (USB connection to the PC with R&S®CMWrun environment)		
R&S®CMWrun General-Purpose (adds battery life, GUI and features such as audio and E2E applications)	R&S®CMW-KT051	1203.4157.02

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

Extended warranty with a term of one and two years (WE1 and WE2)
Repairs carried out during the contract term are free of charge [2]. 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 [2] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

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

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

Service that adds value

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

Rohde&Schwarz

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

Sustainable product design

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

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Data without tolerance limits is not binding | Subject to change

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