Version 02.00

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R&S®ZVL Vector Network Analyzer

Specifications

ROHDE&SCHWARZ

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Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal automatic adjustments performed. Unless otherwise stated, specifications apply to the two test ports and a nominal source power of –10 dBm. Data designated "nominal" applies to design parameters and is not tested. Data without tolerances: typical values only.

Rohde & Schwarz equipment is designed for reliable operation up to an altitude of 3000 m above sea level, and for transport up to an altitude of 4500 m above sea level.

Measurement range

Frequency range	R&S®ZVL3	9 kHz to 3 GHz
	R&S®ZVL6	9 kHz to 6 GHz
Static frequency accuracy	aging per year	1×10^{-6}
	temperature drift 0 °C to 50 °C	1×10^{-6}
	with optional R&S®FSL-B4 OCXO reference frequency	
	aging per year	1×10^{-7}
	temperature drift 0 °C to 50 °C	1×10^{-7}
Frequency resolution		1 Hz
Number of measurement points	default value	201
	user-selectable	2 to 4001
Measurement bandwidths	1/2/5 steps	10 Hz to 500 kHz
Dynamic range	9 kHz to 50 MHz	>75 dB, typical value 85 dB
	50 MHz to 100 MHz	>110 dB, typical value 115 dB
	100 MHz to 3 GHz	>115 dB, typical value 123 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>115 dB, typical value 123 dB
The dynamic range is defined as the difference between the actual available maximum source power and the rms value of the data trace of the transmission magnitude produced by noise and crosstalk with test ports short-circuited. This specification is valid without system error correction and at 10 Hz measurement bandwidth (filter type normal) in the temperature range from 18 °C to 28 °C.		

Measurement speed

Measurement time	for S21 with 1.1 GHz center frequency, 200 MHz span, 201 measurements points, and 100 kHz measurement bandwidth	
	with normalization calibration	<60 ms
	with full two-port calibration	<75 ms
Data transfer time	for 201 measurements points	
	via VX11 over 100 Mbit/s LAN	<2.1 ms
	via RSIB over 100 Mbit/s LAN	<1.5 ms
	via optional R&S®FSL-B10 GPIB interface	<4.7 ms

Measurement accuracy

This data is valid between 18 °C and 28 °C, provided the temperature has not varied by more than 1 K after calibration. Validity of the data is conditional on the use of a suitable calibration kit by which the effective system data specified below is achieved. Frequency points, measurement bandwidth, and sweep time have to be identical for measurement and calibration (no interpolation allowed).

Accuracy of transmission measurements		
9 kHz to 50 MHz	for 0 dB to –40 dB	<0.2 dB or <2°
50 MHz to 3 GHz	for 0 dB to –50 dB	<0.2 dB or <2°
	for –50 dB to –70 dB	<0.3 dB or <3°
3 GHz to 6 GHz (R&S®ZVL6 only)	for 0 dB to –50 dB	<0.2 dB or <2°
	for –50 dB to –70 dB	<0.3 dB or <3°
Specifications are based on a matched DUT, a measurement bandwidth of 10 Hz (filter type normal), a step attenuation of 10 dB (default value), and a nominal source power of 0 dBm.		

Accuracy of reflection measurements		
9 kHz to 3 GHz	for 0 dB to –15 dB	<0.4 dB or <3°
	for –15 dB to –25 dB	<1 dB or <6°
	for –25 dB to –35 dB	<3 dB or <20°
9 kHz to 6 GHz (R&S®ZVL6 only)	for 0 dB to –15 dB	<0.4 dB or <3°
	for –15 dB to –25 dB	<1 dB or <6°
	for –25 dB to –35 dB	<3 dB or <20°
Specifications are based on a matched DUT, a measurement bandwidth of 10 Hz (filter type normal), a step attenuation of 10 dB (default value), and a nominal source power of 0 dBm.		

Trace stability		
Trace noise of S21 (rms) at –10 dBm source power and above 10 MHz	at 0 dB transmission and 2 kHz measurement bandwidth (filter type normal)	<0.005 dB

Effective system data

This data is valid between 18 °C and 28 °C, provided the temperature has not varied by more than 1 K after calibration. The data is based on a measurement bandwidth of 10 Hz (filter type normal) and system error calibration by means of a suitable calibration kit. Frequency points, measurement bandwidth, and sweep time have to be identical for measurement and calibration (no interpolation allowed).

Directivity	9 kHz to 3 GHz	>46 dB, typical value 50 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>40 dB, typical value 50 dB
Source match	9 kHz to 3 GHz	>40 dB, typical value 46 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>36 dB, typical value 40 dB
Reflection tracking	9 kHz to 3 GHz	<0.04 dB, typical value 0.01 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	<0.1 dB, typical value 0.01 dB
Load match	9 kHz to 3 GHz	>46 dB, typical value 50 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>40 dB, typical value 46 dB
Transmission tracking	9 kHz to 3 GHz	<0.06 dB, typical value 0.01 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	<0.1 dB, typical value 0.05 dB

Test port

Specifications apply to both of the two test ports PORT 1 and PORT 2

Impedance		50 Ω
Connector		type N, female

Test port output

Specifications apply to both of the two test ports PORT 1 and PORT 2

Source match	9 kHz to 3 GHz	typical value >14 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	typical value >14 dB
Power range		–50 dBm to 0 dBm typical values –60 dBm to +10 dBm
Power accuracy	at –10 dBm source power above 10 MHz	<2 dB
	in temperature range 18 °C to 28 °C	<1 dB, typical value 0.3 dB
Power linearity	referenced to –10 dBm and above 10 MHz	<2 dB
	in temperature range 18 °C to 28 °C	<0.8 dB, typical value 0.3 dB
Power resolution		0.01 dB
Harmonics	at –10 dBm source power	typical value –35 dBc
Spurious	at –10 dBm source power	typical value –40 dBc

Test port input

Specifications apply to both of the two test ports PORT 1 and PORT 2

Load match	9 kHz to 3 GHz	typical value >14 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	typical value >14 dB
Attenuation	default value	10 dB
	user-selectable	0 dB to 30 dB
Attenuation steps		5 dB
Attenuation uncertainty		<0.3 dB
Maximum nominal input level	with attenuation set to 0 dB	–10 dBm
	with attenuation set to 30 dB	+20 dBm
1 dB compression point	above 200 MHz with attenuation set to 0 dB	 +5 dBm, nominal
Inherent spurious response	without input signal and with attenuation set to 0 dB	 <–90 dBm, nominal
Damage DC voltage		30 V
Damage CW RF power		+27 dBm
Damage pulse voltage	10 µs pulse length	150 V
Damage pulse energy	10 µs pulse length	10 mWs

Additional front panel connectors

AUX OUT		
Connector		3.5 mm mini jack (mono)
Output impedance		<100 Ω
Open-circuit voltage	adjustable	0 V to 1.5 V

PROBE POWER		
DC voltages		+15 V, –12.6 V, and ground
DC current		max. 150 mA

Rear panel connectors

LAN	local area network connector	RJ-45, 8 pins

EXT TRIGGER / GATE IN		
Connector type		BNC, female, 50 Ω
Input signal		TTL compatible

EXT REF	input for external frequency reference signal and, with optional R&S®FSL-B4 OCXO reference frequency, alternatively input or output for external frequency reference signal	
Connector type		BNC, female, 50 Ω
Input frequency		10 MHz
Maximum allowed deviation		1 kHz
Input power		0 dBm to +10 dBm
Input impedance		50 Ω
Output frequency	requires optional R&S®FSL-B4 OCXO reference frequency	10 MHz
Output frequency accuracy		50 Hz
Output power		0 dBm, nominal

Spectrum analysis option

The specifications of the R&S®ZVL-K1 spectrum analysis option apply to the RF INPUT connector (it is combined with PORT 2).

Frequency		
Frequency range	R&S®ZVL3	9 kHz to 3 GHz
	R&S®ZVL6	9 kHz to 6 GHz
Static reference frequency uncertainty	aging per year	$<1\times10^{-6}$
	temperature drift 0 °C to 50 °C	$<1\times10^{-6}$
	with optional R&S®FSL-B4 OCXO reference frequency	
	aging per year	$<1\times10^{-7}$
	temperature drift 0 °C to 50 °C	$<1\times10^{-7}$
Attenuation	default value	10 dB
	user-selectable	0 dB to 30 dB
Attenuation steps		5 dB

R&S®FSL-B22 RF preamplifier option		
Gain	switchable	0 dB or 20 dB, nominal

Frequency readout	with marker or frequency counter	
Marker resolution		span/501
Uncertainty		<marker frequency × reference uncertainty + 2 % × span + 10 % × resolution bandwidth + ½ × last digit
Frequency counter resolution		1 Hz
Counter uncertainty	S/N > 25 dB	<frequency × reference uncertainty + ½ × last digit
Frequency span	R&S®ZVL3	0 Hz (zero span) and 10 Hz to 3 GHz
	R&S®ZVL6	0 Hz (zero span) and 10 Hz to 6 GHz
Frequency span uncertainty		3 %

Spectral purity		
Single sideband (SSB) phase noise at 500 MHz	at carrier offset of 1 kHz	typical value –95 dBc (1 Hz)
	at carrier offset of 10 kHz	<–96 dBc (1 Hz), typical value –100 dBc (1 Hz)
	at carrier offset of 100 kHz	<–96 dBc (1 Hz), typical value –100 dBc (1 Hz)
	at carrier offset of 1 MHz	<–113 dBc (1 Hz), typical value –116 dBc (1 Hz)

Sweep time		
Sweep times	10 Hz ≤ span ≤ 3.2 kHz	2.5 ms to 5 × span
	3.2 kHz < span ≤ 1.5 GHz	2.5 ms to 16,000 s
	1.5 GHz < span ≤ 3 GHz	5 ms to 16,000 s
	3 GHz < span ≤ 6 GHz	10 ms to 16,000 s
Sweep times for zero span		1 µs to 5 µs in steps of 125 ns
		5 µs to 16,000 s in steps of 5 %
Sweep time uncertainty	for finite span	<3 %, nominal
	for zero span	<0.1 %, nominal

Sweep filters		
Resolution bandwidths		300 Hz to 10 MHz (–3 dB) in 1/3/10 steps
	with optional R&S®FSL-B7 narrow resolution filters	10 Hz to 10 MHz (–3 dB) in 1/3/10 steps
	zero span	additionally 20 MHz (–3 dB)
Resolution bandwidth uncertainty		<3 %, nominal
Resolution filter shape factor 60 dB : 3 dB		<5, nominal (Gaussian filters)

EMI filters		
6 dB bandwidths		9 kHz, 120 kHz, and 1 MHz
	with optional R&S®FSL-B7 narrow resolution filters	200 Hz, 9 kHz, 120 kHz, and 1 MHz
Bandwidth uncertainty		<3 %, nominal
Shape factor 60 dB : 3 dB		<6, nominal

Channel filters		
Bandwidths	300 Hz, 500 Hz, 1 kHz, 1.5 kHz, 2 kHz, 2.4 kHz, 2.7 kHz, 3 kHz, 3.4 kHz, 4 kHz, 4.5 kHz, 5 kHz, 6 kHz, 8.5 kHz, 9 kHz, 10 kHz, 12.5 kHz, 14 kHz, 15 kHz, 16 kHz, 18 kHz (RRC), 20 kHz, 21 kHz, 24.3 kHz (RRC), 25 kHz, 30 kHz, 50 kHz, 100 kHz, 150 kHz, 192 kHz, 200 kHz, 300 kHz, 500 kHz, 1 MHz, 1.228 MHz, 1.28 MHz (RRC), 1.5 MHz, 2 MHz, 3 MHz, 3.84 MHz (RRC), 4.096 MHz (RRC), and 5 MHz (RRC means root raised cosine)	
	with optional R&S®FSL-B7 narrow resolution filters	100 Hz, additionally 200 Hz
Video bandwidths	One-pole low pass filters	1 Hz to 10 MHz in 1/3/10 steps
Demodulation bandwidth		20 MHz, nominal

Level		
Display range		displayed noise floor to +20 dBm
1 dB compression point	above 200 MHz and at 0 dB attenuation	+5 dBm, nominal

Intermodulation		
Third-order intermodulation (TOI)	intermodulation-free dynamic range, level 2 × –20 dBm, reference level –10 dBm	>50 dBc (TOI +5 dBm, typical value +12 dBm)
Second harmonic intercept (SHI)	20 MHz to 3 GHz	typical value +40 dBm

Displayed average noise level		
at 0 dB attenuation, with resolution bandwidth (RBW) 1 kHz, and video bandwidth (VBW) 10 Hz normalized to 1 Hz		
9 kHz to 1 MHz	with preamplifier off	<–100 dBm (1 Hz)
1 MHz to 10 MHz		<–115 dBm (1 Hz)
10 MHz to 50 MHz		<–130 dBm (1 Hz)
50 MHz to 6 GHz		<–140 dBm (1 Hz)
9 kHz to 1 MHz	with preamplifier on (needs optional R&S®FSL-B22 RF preamplifier)	<–115 dBm (1 Hz)
1 MHz to 10 MHz		<–130 dBm (1 Hz)
10 MHz to 50 MHz		<–150 dBm (1 Hz)
50 MHz to 6 GHz		<–156 dBm (1 Hz)
500 MHz		typical value –163 dBm (1 Hz)
1 GHz		typical value –163 dBm (1 Hz)
3 GHz		typical value –162 dBm (1 Hz)
6 GHz		typical value –161 dBm (1 Hz)

Immunity to interference		
Image frequency response	f + 2 × 48.375 MHz	<–60 dBc, typical value –80 dBc
	f + 2 × 838.375 MHz	<–60 dB, typical value –80 dBc
	f + 2 × 7158.375 MHz	typical value –60 dBc
Intermediate frequency response	at 48.375 MHz, 838.375 MHz, and 7158.375 MHz	<–60 dBc, typical value –80 dBc
Inherent spurious response	above 30 MHz, without input signal, at 0 dB attenuation and RBW < 1 MHz	<–90 dBm
Spurious responses	related to local oscillators	<–60 dBc
	related to A/D conversion	typical value –70 dBc
	related to subharmonic of first LO (spur at 7158.375 MHz – 2 × f_{in})	typical value –60 dBc
Spurious response at mixer level <–10 dBm	related to harmonic of first LO (spur at f_{in} – 3579.1875 MHz)	typical value –60 dBc

Level display		
Logarithmic level axis		10 dB to 100 dB
Linear axis		0 % to 100 % with 10 divisions
Number of traces		4
Trace detectors		max peak, min peak, auto peak, sample, rms, quasi peak, and average
Number of measurement points	default value	501
	user-selectable	125 to 32001
Trace functions		clear/write, max hold, average, min hold, or view
Setting range of reference level	logarithmic display	–80 dBm to 20 dBm in steps of 2 dB, 5 dB, or 10 dB
	linear display	–80 dBm to 20 dBm or 0 % to 100 %
Units of axis	logarithmic display	dBm, dBmV, dBµV, dBµA, or dBpW
	linear display	V, mV, µV, A, mA, µA, W, mW, µW, nW, or pW

Level measurement uncertainty		
95 % confidence level, 20 °C to 30 °C, S/N > 16 dB, 0 dB to –50 dB from reference level	10 MHz to 3 GHz	<0.5 dB
	3 GHz to 6 GHz	<0.8 dB
Absolute uncertainty	at internal calibration frequency (65.833 MHz)	<0.3 dB
Frequency response, 20 °C to 30 °C, at –10 dBm input level and 10 dB attenuation	up to 10 MHz	<0.8 dB, nominal
	10 MHz to 3 GHz	<0.5 dB, typical value 0.3 dB
	3 GHz to 6 GHz	<0.8 dB, typical value 0.3 dB
Attenuation uncertainty		<0.3 dB
Uncertainty of reference level setting		<0.1 dB, nominal

Display nonlinearity		
Logarithmic level display	S/N >16 dB 0 dB to –50 dB	 <0.2 dB
Bandwidth switching uncertainty	reference: RBW = 10 kHz	<0.1 dB, nominal

Trigger functions		
Trigger source		free run, video, external, IF power
External trigger signal		TTL

I/Q data		
Interface		LAN
	with optional R&S®FSL-B10 GPIB interface	 LAN or IEC/IEEE bus (GPIB)
Memory length		max. 512 k samples I and Q
Sample rate		10 kHz to 65.8 MHz
Signal bandwidth	sample rate 65.8 MHz	20 MHz

General specifications

Remote control		
LAN interface		10/100 base T
IEC/IEEE bus (GPIB)	with optional R&S®FSL-B10 GPIB interface	 SCPI 1997.0

Display		
Type		Color TFT
Resolution		640 x 480 pixels

Temperature	operating temperature range	0 °C to 50 °C
	permissible temperature range	0 °C to 55 °C
	storage temperature range	–40 °C to 70 °C
		in line with IEC 60068-2-1 and IEC 60068-2-2
Damp heat		40 °C at 85 % rel. humidity, in line with IEC 60068-2-30

Mechanical resistance	sinusoidal vibration	5 Hz to 150 Hz, in line with IEC 60068-2-6
	random vibration	10 Hz to 300 Hz, in line with IEC 60068-2-64
	shock	40 g shock response spectrum, in line with IEC/EN 60068-2-27, MIL-STD-810

EMC		in line with with European EMC Directive 89/336/EEC and EMC Directive 2004/108/EC including: − IEC/EN 61326 Class A (Emission) − CISPR 11/EN 55011/ Group 1 Class A (Emission) – IEC/EN 61326 Table A.1 (Immunity, Industrial)

Safety		IEC 61010-1, EN 61010-1, UL 61010B-1, CSA C22.2 No. 1010-1

Power supply		
AC input voltage		100 V to 240 V (AC) with tolerance ±10 %, safety class I to VDE 411
AC supply frequency	for AC input voltages 100 V to 120 V 120 V to 240 V	 50 Hz to 400 Hz with tolerance ±5 % 50 Hz to 60 Hz with tolerance ±5 %
AC input current		0.4 A to 1.2 A
DC power supply	requires R&S®FSL-B30 DC power supply option	10 V to 28 V (DC)
DC input current	requires R&S®FSL-B30 DC power supply option	2.2 A to 8 A
Power consumption		80 W, typical value 60 W, max. 80 W with all options

Weights and dimensions		
Dimensions (W × H × D)	with handle	408.8 mm x 158.1 mm x 465.3 mm
		(16.1 in x 6.2 in x 18.3 in)
	without handle	342.3 mm x 158.1 mm x 367.0 mm
		(13.5 in x 6.2 in x 14.5 in)
Weight	without options	7 kg (16 lb)
	with battery pack and all other options	8.4 kg (18.5 lb)
Shipping weight		14 kg (31 lb)

Recommended calibration interval		12 months

Ordering information

Designation	Type	Order No.
Vector Network Analyzer, 3 GHz, 2 ports	R&S®ZVL3	1303.6509.03
Vector Network Analyzer, 6 GHz, 2 ports	R&S®ZVL6	1303.6509.06
Options		
OCXO Reference Frequency	R&S®FSL-B4	1300.6008.02
Additional Interfaces[1]	R&S®FSL-B5	1300.6108.02
Narrow Resolution Filters[1]	R&S®FSL-B7	1300.5601.02
GPIB Interface	R&S®FSL-B10	1300.6208.02
RF Preamplifier[1]	R&S®FSL-B22	1300.5953.02
DC Power Supply	R&S®FSL-B30	1300.6308.02
NiMH Battery Pack[2]	R&S®FSL-B31	1300.6408.02
Spectrum Analysis	R&S®ZVL-K1	1306.0301.02

[1] Requires R&S®ZVL-K1 spectrum analysis option.

[2] Requires R&S®FSL-B30 DC power supply option.

For data sheet, see PD 52138150.32
and www.rohde-schwarz.com
(search term: ZVL)

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