

# R&S® ZVL

## Vector Network Analyzer

### Specifications



**75** Years of  
Driving  
Innovation

**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 stated otherwise, specifications apply to the two test ports and a nominal source power of -10 dBm.

"Typical values" are designated with the abbreviation "typ.". These values are verified during the final test but are not guaranteed by Rohde & Schwarz. "Nominal values" are design parameters that are not guaranteed by Rohde & Schwarz. These values are verified during product development but are not specifically tested during production.

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.

Data without tolerance limits is not binding.

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## Measurement range

Frequency range	R&S®ZVL3 and R&S®ZVL3-75 R&S®ZVL6	9 kHz to 3 GHz 9 kHz to 6 GHz
Static frequency accuracy	aging per year	$1 \times 10^{-6}$
	temperature drift 0 °C to +50 °C	$1 \times 10^{-6}$
	with optional R&S®FSL-B4 OCXO reference frequency	
	aging per year	$1 \times 10^{-7}$
	temperature drift 0 °C to +50 °C	$1 \times 10^{-7}$
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 1 MHz	>75 dB, typ. 85 dB
	1 MHz to 7 MHz	>85 dB, typ. 100 dB
	7 MHz to 20 MHz	>105 dB, typ. 120 dB
	20 MHz to 3 GHz (R&S®ZVL3 and R&S®ZVL6)	>115 dB, typ. 123 dB
	20 MHz to 3 GHz (R&S®ZVL3-75 only)	>110 dB, typ. 120 dB
	3 GHz to 5 GHz (R&S®ZVL6 only)	>115 dB, typ. 123 dB
	5 GHz to 6 GHz (R&S®ZVL6 only)	>110 dB, typ. 120 dB
<p>The dynamic range is measured as the difference between the -10 dBm source power and the rms value of the data trace of the transmission magnitude. This magnitude is produced by noise and crosstalk with the test ports short-circuited and the step attenuators set to 0 dB. This specification applies without system error correction and at 10 Hz measurement bandwidth (filter type normal) in the temperature range from +18 °C to +28 °C. The dynamic range is also affected by receiver inherent spurious at particular frequencies.</p>		

## Measurement speed

Measurement time	for S21 with 1.1 GHz center frequency, 200 MHz span, 201 measurements points, 100 kHz measurement bandwidth, and display switched on	
	with normalization calibration (R&S®ZVL3 and R&S®ZVL6)	<50 ms
	with normalization calibration (R&S®ZVL3-75 only)	<60 ms
	with full two-port calibration	<60 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

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## 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. This calibration kit is used to achieve the effective system data specified below. Frequency points, measurement bandwidth, and sweep time have to be identical for measurement and calibration (no interpolation allowed).

<b>Accuracy of transmission measurements</b>	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.		

<b>Accuracy of reflection measurements</b>	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.		

<b>Trace stability</b>		
Trace noise of S21 (rms) above 10 MHz	at –10 dBm source power, 0 dB transmission, 0 dB step attenuation, 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, typ. 50 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>40 dB, typ. 50 dB
Source match	9 kHz to 3 GHz	>40 dB, typ. 46 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>36 dB, typ. 40 dB
Reflection tracking	9 kHz to 3 GHz	<0.04 dB, typ. 0.01 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	<0.1 dB, typ. 0.01 dB
Load match	9 kHz to 3 GHz	>46 dB, typ. 50 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	>40 dB, typ. 46 dB
Transmission tracking	9 kHz to 3 GHz	<0.06 dB, typ. 0.01 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	<0.1 dB, typ. 0.05 dB

## Test port

Specifications apply to the two test ports, PORT 1 and PORT 2.

Impedance	R&S®ZVL3 and R&S®ZVL6	50 Ω
	R&S®ZVL3-75	75 Ω
Connector		type N, female

## Test port output

Specifications apply to the two test ports, PORT 1 and PORT 2.

Source match	9 kHz to 3 GHz	typ. >14 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	typ. >14 dB
Power range		-50 dBm to 0 dBm typ. -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, typ. 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, typ. 0.3 dB
Power resolution		0.01 dB
Harmonics	at -10 dBm source power	typ. -35 dBc
Spurious	at -10 dBm source power	typ. -40 dBc

## Test port input

Specifications apply to the two test ports, PORT 1 and PORT 2.

Load match	9 kHz to 3 GHz	typ. >14 dB
	3 GHz to 6 GHz (R&S®ZVL6 only)	typ. >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

<b>LAN</b>	local area network connector	RJ-45, 8 pins
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<b>DVI</b>	connector for external monitor	DVI-D
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<b>EXT TRIGGER/GATE IN</b>		
Connector type		BNC, female, 50 Ω
Input signal		TTL compatible

<b>EXT REF</b>	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 (combined with PORT 2).

<b>Frequency</b>		
Frequency range	R&S®ZVL3 and R&S®ZVL3-75 R&S®ZVL6	9 kHz to 3 GHz 9 kHz to 6 GHz
Static reference frequency uncertainty	aging per year	$<1 \times 10^{-6}$
	temperature drift 0 °C to +50 °C with optional R&S®FSL-B4 OCXO reference frequency	$<1 \times 10^{-6}$
	aging per year	$<1 \times 10^{-7}$
	temperature drift 0 °C to +50 °C	$<1 \times 10^{-7}$
Attenuation	default value	10 dB
	user-selectable	0 dB to 30 dB
Attenuation steps		5 dB

<b>R&amp;S®FSL-B22 RF preamplifier option</b>		
Gain	switchable	0 dB or 20 dB, nominal

<b>Frequency readout</b>		
Marker resolution	with marker or frequency counter	
Uncertainty		span/501 $< \text{marker frequency} \times \text{reference uncertainty} + 2\% \times \text{span} + 10\% \times \text{resolution bandwidth} + \frac{1}{2} \times \text{last digit}$
Frequency counter resolution		1 Hz
Counter uncertainty	S/N > 25 dB	$< \text{frequency} \times \text{reference uncertainty} + \frac{1}{2} \times \text{last digit}$
Frequency span	R&S®ZVL3 and R&S®ZVL3-75	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 %

<b>Spectral purity</b>		
Single sideband (SSB) phase noise at 500 MHz	at a carrier offset of 1 kHz	typ. -95 dBc (1 Hz)
	at a carrier offset of 10 kHz	$< -96$ dBc (1 Hz), typ. -100 dBc (1 Hz)
	at a carrier offset of 100 kHz	$< -96$ dBc (1 Hz), typ. -100 dBc (1 Hz)
	at a carrier offset of 1 MHz	$< -113$ dBc (1 Hz), typ. -116 dBc (1 Hz)

<b>Sweep time</b>		
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 16000 s
	1.5 GHz < span ≤ 3 GHz	5 ms to 16000 s
	3 GHz < span ≤ 6 GHz	10 ms to 16000 s
Sweep times for zero span		1 μs to 5 μs in steps of 125 ns 5 μs to 16000 s in steps of 5 %
Sweep time uncertainty	for finite span	<3 %, nominal
	for zero span	<0.1 %, nominal

<b>Sweep filters</b>		
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)

<b>EMI filters</b>		
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

<b>Channel filters</b>		
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 = root raised cosine)	
	with optional R&S®FSL-B7 narrow resolution filters	100 Hz, additionally 200 Hz
Video bandwidths	one-pole lowpass filters	1 Hz to 10 MHz in 1/3/10 steps
Demodulation bandwidth		20 MHz, nominal

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

<b>Intermodulation</b>		
Third-order intermodulation (TOI)	intermodulation-free dynamic range, level 2 × –20 dBm, reference level –10 dBm	>50 dBc (TOI +5 dBm, typ. +12 dBm)
Second harmonic intercept (SHI)	20 MHz to 3 GHz	typ. +30 dBm

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<b>Displayed average noise level</b>	at 0 dB attenuation, with resolution bandwidth (RBW) 1 kHz, and video bandwidth (VBW) 10 Hz, normalized to 1 Hz	
	with preamplifier OFF	
	9 kHz to 1 MHz	<-100 dBm (1 Hz)
	1 MHz to 10 MHz	<-110 dBm (1 Hz)
	10 MHz to 50 MHz	<-130 dBm (1 Hz)
	50 MHz to 6 GHz	<-140 dBm (1 Hz)
	with preamplifier ON (requires optional R&S® FSL-B22 RF preamplifier)	
	9 kHz to 1 MHz	<-115 dBm (1 Hz)
	1 MHz to 10 MHz	<-125 dBm (1 Hz)
	10 MHz to 50 MHz	<-150 dBm (1 Hz)
	50 MHz to 6 GHz	<-156 dBm (1 Hz)
	500 MHz	typ. -163 dBm (1 Hz)
	1 GHz	typ. -163 dBm (1 Hz)
	3 GHz	typ. -162 dBm (1 Hz)
6 GHz	typ. -161 dBm (1 Hz)	

<b>Immunity to interference</b>		
Image frequency response	f + 2 × 48.375 MHz	<-60 dBc, typ. -80 dBc
	f + 2 × 838.375 MHz	<-60 dB, typ. -80 dBc
	f + 2 × 7158.375 MHz	typ. -60 dBc
Intermediate frequency response	at 48.375 MHz, 838.375 MHz, and 7158.375 MHz	<-60 dBc, typ. -80 dBc
Inherent spurious response	above 30 MHz, without input signal, at 0 dB attenuation and RBW < 1 MHz	<-90 dBm
Spurious response	referenced to local oscillators	<-50 dBc, typ. -60 dBc
	referenced to A/D conversion	typ. -70 dBc
	referenced to subharmonic of first LO (spur at 7158.375 MHz - 2 × f <sub>in</sub> )	typ. -60 dBc
	Spurious response at mixer level <-10 dBm	referenced to harmonic of first LO (spur at f <sub>in</sub> - 3579.1875 MHz)

<b>Level display</b>		
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



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<b>Level measurement uncertainty</b>	95 % confidence level, +20 °C to +30 °C, S/N > 16 dB, 0 dB to –50 dB from reference level	
	R&S® ZVL3 and R&S® ZVL6	
	10 MHz to 3 GHz	<0.5 dB
	R&S® ZVL6	
	3 GHz to 6 GHz	<0.8 dB
	R&S® ZVL3-75	
	10 MHz to 3 GHz	<0.7 dB
Absolute uncertainty	at internal calibration frequency of 65.833 MHz	
	R&S® ZVL3 and R&S® ZVL6	<0.3 dB
	R&S® ZVL3-75	<0.5 dB
Frequency response	+20 °C to +30 °C, at –10 dBm input level and 10 dB attenuation	
	R&S® ZVL3 and R&S® ZVL6	
	up to 10 MHz	<0.8 dB, nominal
	10 MHz to 3 GHz	<0.5 dB, typ. 0.3 dB
	R&S® ZVL6	
	3 GHz to 6 GHz	<0.8 dB, typ. 0.3 dB
	R&S® ZVL3-75	
	up to 10 MHz	<1 dB, nominal
	10 MHz to 3 GHz	<0.7 dB
Attenuation uncertainty		<0.3 dB
Uncertainty of reference level setting		<0.1 dB, nominal

<b>Display nonlinearity</b>		
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

<b>Trigger functions</b>		
Trigger source		free run, video, external, IF power
External trigger signal		TTL

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

<b>Weight and Dimensions</b>		
Dimensions ( W × H × D )	with handle	408.8 mm × 158.1 mm × 465.3 mm (16.1 in × 6.2 in × 18.3 in)
	without handle	342.3 mm × 158.1 mm × 367.0 mm (13.5 in × 6.2 in × 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)

<b>Recommended calibration interval</b>		12 months
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