

Specifications

Unless otherwise stated, specifications apply to test ports PORT1 and PORT2, a nominal source power of -10 dBm at the test port and an IF bandwidth ≤ 10 kHz.

The arrow marks important data.

Frequency range, measurement speed, dynamic range

Frequency range

Without External Measurements option

ZVRL, ZVRE, ZVR	9 kHz to 4 GHz
with passive test set 50 Ω or 75 Ω	300 kHz to 4 GHz

ZVCE, ZVC	20 kHz to 8 GHz
with active test set 50 Ω	

With External Measurements option

ZVRL, ZVRE, ZVR	10 Hz to 4 GHz
ZVCE, ZVC	20 kHz to 8 GHz

Relative frequency deviation	$< 2 \times 10^{-6} + 1 \times 10^{-6}/\alpha$
Resolution	10 μ Hz

Measurement speed (above 2 MHz)

Number of points	1 to 2001 (selectable)		
Measurement time per point	IF bandwidth (IFBW)		
	3 kHz	10 kHz	26 kHz
with system error correction	<1050 μ s	<460 μ s	<330 μ s
normalized	<530 μ s	<230 μ s	<190 μ s
Fast Mode			
with system error correction	-	-	<240 μ s
normalized	-	-	<125 μ s

Dynamic range (without system error correction)

ZVRL, ZVRE, ZVR
(Models ZVRL and ZVRE: at IF bandwidth 10 Hz values are reduced by 5 dB)

	IF bandwidth		
	10 Hz	3 kHz	10 kHz
With passive test set, 50 Ω			
20 kHz to 200 kHz	>65 dB, typ. >110 dB	-	-
200 kHz to 20 MHz	>110 dB	>90 dB	>85 dB
20 MHz to 3 GHz	>120 dB	>100 dB	>95 dB
3 GHz to 4 GHz	>110 dB	>90 dB	>85 dB
With active test set, 50 Ω			
300 kHz to 1 MHz	>107 dB	>87 dB	>82 dB
1 MHz to 20 MHz	>110 dB	>90 dB	>85 dB
20 MHz to 3 GHz	>120 dB	>100 dB	>95 dB
3 GHz to 4 GHz	>110 dB	>90 dB	>85 dB
With passive test set, 75 Ω			
20 kHz to 200 kHz	>50 dB, typ. >95 dB	-	-
200 kHz to 20 MHz	>95 dB	>75 dB	>70 dB
20 MHz to 4 GHz	>105 dB	>85 dB	>80 dB
With active test set, 75 Ω			
300 kHz to 1 MHz	>95 dB	>75 dB	>70 dB
1 MHz to 20 MHz	>105 dB	>85 dB	>80 dB
20 MHz to 4 GHz	>102 dB	>80 dB	>75 dB
With External Measurements option			
50 Hz to 200 kHz	>75 dB	-	-
200 kHz to 20 MHz	>110 dB	>95 dB	>90 dB
20 MHz to 1 GHz	>130 dB	>110 dB	>105 dB
1 GHz to 3 GHz	>120 dB	>100 dB	>95 dB
3 GHz to 4 GHz	>110 dB	>95 dB	>90 dB

ZVCE, ZVC

(Model ZVCE: at IF bandwidth 10 Hz values are reduced by 5 dB)

With active test set, 50 Ω			
20 kHz to 200 kHz	>60 dB, typ. >90 dB	-	-
200 kHz to 20 MHz	>100 dB	>80 dB	>75 dB
20 MHz to 3 GHz	>120 dB	>100 dB	>95 dB
3 GHz to 4 GHz	>110 dB	>90 dB	>85 dB
4 GHz to 6 GHz	>105 dB	>85 dB	>80 dB
6 GHz to 8 GHz	>100 dB	>80 dB	>75 dB
With External Measurements option			
20 kHz to 200 kHz	>75 dB	-	-
200 kHz to 20 MHz	>110 dB	>95 dB	>90 dB
20 MHz to 1 GHz	>130 dB	>110 dB	>105 dB
1 GHz to 3 GHz	>120 dB	>100 dB	>95 dB
3 GHz to 4 GHz	>110 dB	>95 dB	>90 dB
4 GHz to 6 GHz	>105 dB	>90 dB	>85 dB
6 GHz to 8 GHz	>100 dB	>85 dB	>80 dB

Crosstalk between the two measurement channels (b_1 to b_2) with total reflection at test ports (values for 75 Ω models are 6 dB higher)

	ZVRL, ZVRE, ZVCE	ZVR, ZVC
20 kHz to 200 kHz	<-90 dB, typ. <-110 dB	
200 kHz to 5 MHz	<-120 dB	
5 MHz to 1 GHz	<-125 dB	<-130 dB
1 GHz to 3 GHz	<-115 dB	<-120 dB
3 GHz to 4 GHz	<-105 dB	<-110 dB
4 GHz to 6 GHz (ZVCE, ZVC)	<-100 dB	<-105 dB
6 GHz to 8 GHz (ZVCE, ZVC)	<-95 dB	<-100 dB

Stability of measurement trace

per degree temperature variation	
ZVRL, ZVRE, ZVR	<0.05 dB or 0.4°
ZVCE, ZVC	<0.1 dB or 1°

Measurement bandwidth

(IF bandwidth IFBW)	1 Hz to 10 kHz (half-decade steps) and 26 kHz (full)
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Measurement accuracy

The following data are valid between 20°C and 30°C provided the instrument has reached thermal equilibrium (about 1 h after switch-on) and the temperature has not varied by more than 1 degree after calibration.

ZVRE and ZVR (bidirectional network analyzers)

Accuracy of transmission measurements

after Full Two-Port system error correction (TOSM)

Specifications are based on a matched DUT and refer to a nominal source power of -10 dBm at the test port.

Test set 50 Ω (active or passive test set available)

20 kHz to 300 kHz (passive test set only)	
at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 to -20 dB (typ. -55 dB)	<0.2 dB or 2°
for -20 to -30 dB (typ. -65 dB)	<0.5 dB or 4°
for -30 to -45 dB (typ. -80 dB)	<1 dB or 6°

300 kHz to 4 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -60 dB (passive)	<0.05 dB or 0.4°
for -5 dB to -60 dB (active)	<0.2 dB or 1°
for +3 dB to -40 dB	typ. <0.025 dB
for -60 dB to -70 dB	<0.2 dB or 1°
for -70 dB to -80 dB (ZVRE)	<1 dB or 6°
for -70 dB to -85 dB (ZVR)	<1 dB or 6°

at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -40 dB (passive)	<0.05 dB or 0.4°
for -5 dB to -40 dB (active)	<0.2 dB or 1°
for -40 dB to -50 dB	<0.2 dB or 1°
for -50 dB to -60 dB (ZVRE)	<1 dB or 6°
for -50 dB to -65 dB (ZVR)	<1 dB or 6°

at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -35 dB (passive)	<0.05 dB or 0.4°
for -5 dB to -35 dB (active)	<0.2 dB or 1°
for -35 dB to -45 dB	<0.2 dB or 1°
for -45 dB to -55 dB (ZVRE)	<1 dB or 6°
for -45 dB to -60 dB (ZVR)	<1 dB or 6°

Test set 75 Ω (active or passive test set available)

20 kHz to 300 kHz (passive test set only)	
at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 to -5 dB (typ. -40 dB)	<0.2 dB or 2°
for -5 to -15 dB (typ. -50 dB)	<0.5 dB or 4°
for -15 to -30 dB (typ. -65 dB)	<1 dB or 6°

300 kHz to 4 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -45 dB (passive)	<0.05 dB or 0.4°

for -5 dB to -45 dB (active)	<0.2 dB or 1°
for -45 dB to -55 dB	<0.2 dB or 1°
for -55 dB to -65 dB (ZVRE)	<1 dB or 6°
for -55 dB to -70 dB (ZVR)	<1 dB or 6°
at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -25 dB (passive)	<0.05 dB or 0.4°
for -5 dB to -25 dB (active)	<0.2 dB or 1°
for -25 dB to -35 dB	<0.2 dB or 1°
for -35 dB to -45 dB (ZVRE)	<1 dB or 6°
for -35 dB to -50 dB (ZVR)	<1 dB or 6°
at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -5 dB	<0.2 dB or 1°
for -5 dB to -20 dB (passive)	<0.05 dB or 0.4°
for -5 dB to -20 dB (active)	<0.2 dB or 1°
for -20 dB to -30 dB	<0.2 dB or 1°
for -30 dB to -40 dB (ZVRE)	<1 dB or 6°
for -30 dB to -45 dB (ZVR)	<1 dB or 6°

ZVRE and ZVR – Accuracy of reflection measurements

after system error correction (TOSM or Full One-Port)

Specifications are based on an isolating DUT and refer to a nominal source power of -10 dBm at the test port.

Test set 50 Ω (active or passive test set available)

It is assumed that the return loss of the match used for calibration is >46 dB (effective system data: directivity D_{eff} >46 dB, test port match S_{eff} >30 dB).

20 kHz to 4 GHz (passive test set),

300 kHz to 4 GHz (active test set)

for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -15 dB	<0.4 dB + 0.04 dB/GHz, <3° + 0.4°/GHz
for -15 dB to -25 dB	<1 dB or 6°
for -25 dB to -35 dB	<3 dB or 20°

Test set 75 Ω (active or passive test set available)

It is assumed that the return loss of the match used for calibration is >40 dB (effective system data: directivity D_{eff} >40 dB, test port match S_{eff} >26 dB).

20 kHz to 4 GHz (passive test set),

300 kHz to 4 GHz (active test set)

for +10 dB to +3 dB	<1.5 dB or 10°
for +3 dB to -10 dB	<0.7 dB + 0.04 dB/GHz, <5° + 0.4°/GHz
for -10 dB to -20 dB	<1 dB or 6°
for -20 dB to -30 dB	<3 dB or 20°

ZVCE and ZVC (bidirectional network analyzers)

Accuracy of transmission measurements

after Full Two-Port system error correction (TOSM)

Specifications are based on a matched DUT and refer to a nominal source power of -20 dBm at the test port.

20 kHz to 10 MHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 to -20 dB (typ. -55 dB)	<0.2 dB or 2°
for -20 to -30 dB (typ. -65 dB)	<0.5 dB or 4°
for -30 to -45 dB (typ. -80 dB)	<1 dB or 6°

10 MHz to 4 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -50 dB	<0.2 dB or 1°
for +3 dB to -40 dB	typ. <0.025 dB
for -50 dB to -60 dB	<0.5 dB or 4°
for -60 dB to -70 dB (ZVCE)	<1 dB or 6°
for -60 dB to -75 dB (ZVC)	<1 dB or 6°
at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -30 dB	<0.2 dB or 1°
for -30 dB to -40 dB	<0.5 dB or 4°
for -40 dB to -45 dB (ZVCE)	<1 dB or 6°
for -40 dB to -50 dB (ZVC)	<1 dB or 6°
at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -25 dB	<0.2 dB or 1°
for -25 dB to -35 dB	<0.5 dB or 4°
for -35 dB to -45 dB (ZVCE)	<1 dB or 6°
for -35 dB to -50 dB (ZVC)	<1 dB or 6°

4 GHz to 8 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -45 dB	<0.2 dB or 2°
for +3 dB to -40 dB	typ. <0.025 dB
for -45 dB to -55 dB (ZVCE)	<1 dB or 6°
for -45 dB to -60 dB (ZVC)	<1 dB or 6°
at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -25 dB	<0.2 dB or 2°
for -25 dB to -30 dB (ZVCE)	<1 dB or 6°
for -25 dB to -35 dB (ZVC)	<1 dB or 6°
at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -20 dB	<0.2 dB or 2°
for -20 dB to -25 dB (ZVCE)	<1 dB or 6°
for -20 dB to -30 dB (ZVC)	<1 dB or 6°

ZVCE and ZVC – Accuracy of reflection measurements

after system error correction (TOSM or Full One-Port)

Specifications are based on an isolating DUT and refer to a nominal source power of -20 dBm at the test port.

It is assumed that the return loss of the match used for calibration is >40 dB (effective system data: directivity D_{eff} >40 dB, test port match S_{eff} >30 dB).

20 kHz to 8 GHz

for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -10 dB	<0.4 dB + 0.04 dB/GHz, <3° + 0.4°/GHz
for -10 dB to -20 dB	<1 dB or 6°
for -20 dB to -30 dB	<3 dB or 20°

ZVRL (multidirectional network analyzer)

Accuracy of transmission measurements

after system error correction (One-Port Two-Port)

Specifications are based on a matched DUT and refer to a nominal source power of -10 dBm at the test port.

Test set 50 Ω (only passive test set available)

20 kHz to 300 kHz

at IF bandwidth 10 Hz	
for +10 to -45 dB (typ. -80 dB)	<1 dB or 6°

300 kHz to 4 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -75 dB	<0.2 dB or 1°
at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -55 dB	<0.2 dB or 1°
at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -50 dB	<0.2 dB or 1°

Test set 75 Ω (only passive test set available)

20 kHz to 300 kHz

at IF bandwidth 10 Hz	
for +10 to -30 dB (typ. -65 dB)	<1 dB or 6°

300 kHz to 4 GHz

at IF bandwidth 10 Hz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -60 dB	<0.2 dB or 1°
at IF bandwidth 3 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -40 dB	<0.2 dB or 1°
at IF bandwidth 10 kHz	
for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to -35 dB	<0.2 dB or 1°

ZVRL – Accuracy of reflection measurements

after system error correction (Full One-Port or One-Path Two-Port)

Specifications are based on an isolating DUT and refer to a nominal source power of –10 dBm at the test port.

Test set 50 Ω (only passive test set available)

It is assumed that the return loss of the match used for calibration is >46 dB (effective system data: directivity D_{eff} >46 dB, test port match S_{eff} >30 dB).

20 kHz to 4 GHz

for +10 dB to +3 dB	<1 dB or 6°
for +3 dB to –15 dB	<0.4 dB + 0.04 dB/GHz, < 3° + 0.4°/GHz
for –15 dB to –25 dB	<1 dB or 6°
for –25 dB to –35 dB	<3 dB or 20°

Test set 75 Ω (only passive test set available)

It is assumed that the return loss of the match used for calibration is >40 dB (effective system data: directivity D_{eff} >40 dB, test port match S_{eff} >26 dB).

20 kHz to 4 GHz

for +10 dB to +3 dB	<1.5 dB or 10°
for +3 dB to –10 dB	<0.7 dB + 0.04 dB/GHz, < 5° + 0.4°/GHz
for –10 dB to –20 dB	<1 dB or 6°
for –20 dB to –30 dB	<3 dB or 20°

Effective system characteristics (above 200 kHz)

These data are valid between 20°C and 30°C provided the instrument has reached thermal equilibrium (about 1 h after switch-on) and the temperature variation is not more than 1 degree after calibration.

ZVRE, ZVR, ZVCE, ZVC

(bidirectional network analyzers)

after Full Two-Port system error correction (TOSM)

	ZVRE, ZVR 50 Ω	75 Ω	ZVCE, ZVC 50 Ω
	(active or passive test sets)		
Directivity	>46 dB ¹⁾	>40 dB ²⁾	>40 dB ²⁾
Source match	>40 dB ³⁾	>36 dB ⁴⁾	>36 dB ⁴⁾
Load match	>46 dB ¹⁾	>40 dB ²⁾	>40 dB ²⁾
Transmission tracking	<0.04 dB	<0.06 dB	<0.06 dB
Reflection tracking	<0.04 dB	<0.06 dB	<0.06 dB

ZVRL (unidirectional network analyzer)

after system error correction (One-Path Two-Port)

	Test set 50 Ω (only passive test sets available)	Test set 75 Ω
Directivity	>46 dB ¹⁾	>40 dB ²⁾
Source match (PORT 1)	>30 dB	>26 dB
Load match (PORT 2)	>18 dB	>18 dB
Transmission tracking	<0.2 dB	<0.25 dB
Reflection tracking	<0.06 dB	<0.06 dB

1) Return loss of matched load >46 dB.

2) Return loss of matched load >40 dB.

3) Phase deviation of open standard <1°.

4) Phase deviation of open standard <1.6°.

Output power

Power range (without options)

These data are valid between 20°C and 30°C.

ZVRL, ZVRE, ZVR with test set, 50 Ω	–25 dBm to 0 dBm
ZVRL, ZVRE, ZVR with test set, 75 Ω	–27 dBm to –6 dBm
ZVCE, ZVC	
20 kHz to 6 GHz	–25 dBm to 0 dBm
6 GHz to 8 GHz	–25 dBm to –3 dBm

Deviation (at –10 dBm)

up to 2 MHz	<1 dB
above 2 MHz	<0.5 dB

Linearity (referred to –10 dBm)

0 dBm to –25 dBm (up to 20 kHz)	<0.8 dB
0 dBm to –15 dBm (above 20 kHz)	<0.4 dB
–15 dBm to –25 dBm	<0.6 dB

Resolution

0.1 dB

Spectral purity

Harmonics

	ZVRL, ZVRE, ZVR	ZVCE, ZVC
At maximum source power		
up to 400 MHz	<–25 dBc	<–25 dBc
above 400 MHz	<–30 dBc	<–25 dBc
At –10 dBm source power		
up to 600 MHz	<–35 dBc	<–35 dBc
above 600 MHz	<–40 dBc	<–35 dBc

Spurious

<–40 dBc

SSB phase noise

1 Hz bandwidth, 10 kHz from carrier

up to 10 MHz	<–110 dBc
10 MHz to 150 MHz	<–100 dBc
150 MHz to 1 GHz	<–90 dBc
above 1 GHz	<–90 dBc + 20·log(f/GHz) [<–78 dBc at 4 GHz, <–72 dBc at 8 GHz]

Residual FM

RMS weighting from 10 Hz to 3 kHz

up to 10 MHz	<1 Hz
10 MHz to 150 MHz	<2 Hz
150 MHz to 1 GHz	<5 Hz
1 GHz to 2 GHz	<10 Hz
2 GHz to 4 GHz	<20 Hz
above 4 GHz	<40 Hz

Input level

Maximum nominal input level

	Receiver step attenuator	0 dB	≥30 dB
Without options	0 dBm	–	–
With Receiver Step Attenuator option	0 dBm	–	+27 dBm

Damage level

Without options	+27 dBm	–
With Receiver Step Attenuator option	+27 dBm	+30 dBm

Damage DC current/voltage

With passive test set (internal DC short R_{int} <0.1 Ω)	0.5 A
With active test set	0.5 A or 30 V

RMS noise level (50 Ω, without options)

With 75-Ω models the noise level is higher by 6 dB

Frequency range	IF bandwidth	Noise level
9 kHz to 50 kHz	1 kHz	<–75 dBm
50 kHz to 200 kHz	3 kHz	<–70 dBm
200 kHz to 20 MHz	3 kHz	<–90 dBm
20 MHz to 3 GHz	3 kHz	<–100 dBm
3 GHz to 4 GHz	3 kHz	<–90 dBm
4 GHz to 8 GHz	3 kHz	<–80 dBm

TEST SETS

In contrast to passive test sets, active test sets allow a direct DC bias of an (active) DUT via the inner conductor of the test ports.

Impedance	ZVRL, ZVRE, ZVR ZVCE, ZVC	50 Ω or 75 Ω 50 Ω
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Match ZVRE, ZVR

(without system error correction)

Passive test set, 50 Ω		
40 kHz to 100 kHz		>10 dB
100 kHz to 100 MHz		>16 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>16 dB
Active test set, 50 Ω		
300 kHz to 1 MHz		>6 dB
1 MHz to 100 MHz		>16 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>16 dB
Passive test set, 75 Ω		
40 kHz to 100 kHz		>6 dB
100 kHz to 100 MHz		>12 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>15 dB
Active test set, 75 Ω		
300 kHz to 1 MHz		>4 dB
1 MHz to 100 MHz		>12 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>10 dB

Match ZVCE, ZVC

(without system error correction)

Active test set, 50 Ω		
20 kHz to 1 GHz		>6 dB
1 GHz to 8 GHz		>10 dB

Match ZVRL

PORT 1 (without system error correction)

Passive test set, 50 Ω		
40 kHz to 100 kHz		>10 dB
100 kHz to 100 MHz		>16 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>16 dB
Passive test set, 75 Ω		
40 kHz to 100 kHz		>6 dB
100 kHz to 100 MHz		>12 dB
100 MHz to 3 GHz		>18 dB
3 GHz to 4 GHz		>15 dB

PORT 2 (without system error correction) >18 dB

System error correction techniques

All analyzer models offer simple normalizations for reflection and transmission measurements, One-Port Two-Port calibration and a Full One-Port calibration (3-term). Full Two-Port calibration TOSM (12-term) can be carried out with models ZVRE and ZVCE. ZVR and ZVC offer the greatest variety of modern system error correction methods. Apart from the techniques already mentioned, the following Full Two-Port procedures are available: TOM, TRM, TRL, TNA, TOM-X (15-term). The names indicate the standards used for calibration.

T = Through
O = Open
S = Short
M = Match
R = Reflect
L = Line
N = Network
A = Attenuator

TOM-X (X = crosstalk) is an extension of the TOM method. It considers all possible crosstalk between the four receiver channels (full model). Since an exact model and no approximations are used, the result is a perfect elimination of crosstalk and thus the effective dynamic range of the system is dramatically increased. On the other hand, this method needs a higher effort. The lowest possible effort offers the new automatic calibration procedure *AutoKal* that is available as an option for ZVRE, ZVR, ZVCE and ZVC.

Display

Screen	26 cm colour LCD
Number of pixels	640 x 480 (SVGA)
Sweep modes	frequency, power and time
Parameter formats (examples)	S-parameters and derived quantities like SWR, impedance, admittance, group delay, etc, as well as nonlinear parameters (optional) like n dB compression point, SOI and TOI. Complex parameters are displayed either in a complex form or formatted to magnitude, phase, real or imaginary part.
Diagrams (examples)	Cartesian: linear, simple or double logarithmic, segmented. Polar: linear or logarithmic or segmented. Smith (any zoom), inverted Smith, Charter
Scale (examples)	0.001 dB/50 dB/ 10 m ² /to 200 k ² / 1 pU/to 10 kU/ automatically variable number of grid lines
MAX/MIN scale	
Multichannel display	up to 4 independent display channels (CH1 to CH4)
Screen formats (examples)	overlay, dual or quad-channel split
Markers	8 normal markers, 8 delta markers
Marker resolution	4 significant figures
Marker formatting	selectable independent of trace formatting
Automatic marker functions	marker tracking, marker search, marker target, bandfilter functions (Q, shape factor, etc)
Trace mathematics	all four arithmetical operations with up to three operands
Display lines	horizontal lines, circles or radial lines
Limit lines	pairs of curves formed from line segments in Cartesian diagrams, any circles in polar diagrams

Inputs/outputs (basic unit)

Probe power connector (PROBE 1 and PROBE 2)

Operating voltages	+15 V ±0.3 V (<300 mA) -12 V ±0.6 V (<300 mA)
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EXT TRIGGER

(input for external trigger signal)	edge-triggered TTL signal
Polarity	positive or negative, selectable
Minimum pulse width	1 μs

LEVEL (input for external level control)

Frequency range	0 to 100 kHz
Voltage range	0 to 10 V
Input impedance	>10 kΩ

REF IN (input for external reference frequency)

Frequency	1 MHz to 15 MHz in 1 MHz steps
Max. deviation	6 × 10 ⁻⁶
Input level (V _{rms})	0.1 V to 3 V
Input impedance	1 kΩ

REF OUT (output for internal reference frequency)

Frequency	10 MHz
Relative deviation	<2 × 10 ⁻⁶ + 1 × 10 ⁻⁶ / α
Level (sine)	12 dBm ±3 dB into 50 Ω

ANALYZER MONITOR

IBM-PC-compatible VGA connector
IBM-PC-compatible PS/2 connector

KEYBOARD

IBM-PC-compatible 5-contact DIN connector

USER (input/output)
16 bit, TTL, user-programmable, sub-D, 25 contacts

COM 1/COM 2
IBM-compatible serial interfaces

RS-232-C, sub-D, 9 contacts
remote-control interfaces, IEEE 488,
IEC-625-1, 24 contacts

IEC BUS (I)/IEC SYSTEM BUS (II)
IBM-compatible printer interface,
Centronics, sub-D, 25 contacts

LPT

Optional inputs/outputs (rear panel)

PORT BIAS 1/2 (inputs) DC bias for PORT1/2 (for active test sets only)	<200 mA or <30 V
Controller option	
PC MONITOR	IBM-compatible VGA connector

Mixer Measurements option

EXTERNAL GENERATOR

Connectors for high-speed control of an external generator from the R & S family SME/SMP. The external generator indicates the sweep start with the MARKER signal. The BLANK signal is low at each frequency point of the sweep and high during the transition from one point to the next. The analyzer controls the external generator by means of the TRIGGER signal. To set the generator to the next frequency point, the TRIGGER signal goes high.

MARKER (input)	TTL signal
BLANK (input)	TTL signal
TRIGGER (output)	TTL signal

Reference Channel Ports option

EXTERNAL REF MIXER

SMA connector pair to connect an external reference mixer for measurements on frequency-converting DUTs.

Other optional interfaces

(eg LAN Ethernet and MULTIPORT ADAPTER) are available and will be specified on request.

Specifications of options

External Measurements option

This option adds three additional front-panel connectors, OUTPUT a1, INPUT b1 and INPUT b2, to the basic unit (ZVRL; PORT 2 is used as INPUT b2) to provide direct access to the generator output and the two receiver inputs. Internal SWR bridges are bypassed. As a result, frequency range (with ZVRL, ZVRE and ZVR towards the lower end), output power and sensitivity of the network analyzer are increased. Specifications of the output power are valid for the temperature range 20°C to 30°C.

	ZVRL, ZVRE, ZVR	ZVCE, ZVC
Frequency range	10 Hz to 4 GHz	20 kHz to 8 GHz
Impedance	50 Ω	50 Ω
Output power at OUTPUT a1	-85 to +7 dBm	-90 to +3 dBm
Power deviation (at -10 dBm)		
up to 2 MHz	<1 dB	<1 dB
above 2 MHz	<0.5 dB	<0.5 dB
Power linearity (referred to -10 dBm)		
+7 dBm to 0 dBm	<0.4 dB	-
0 dBm to -7 dBm	<0.4 dB	<0.4 dB
-7 dBm to -15 dBm	<0.6 dB	<0.4 dB
-15 dBm to -20 dBm	-	<0.6 dB
Equivalent match of OUTPUT a1		
up to 2 MHz	>10 dB (SWR <2)	>8 dB
2 MHz to 4 GHz	>12 dB (SWR <1.7)	>8 dB
4 GHz to 8 GHz	-	>8 dB
Parasitic DC at OUTPUT a1		
up to 10 MHz	<100 mV	
above 10 MHz	<20 mV	
Match of		
INPUT b1 and INPUT b2	>8 dB	

Receiver step attenuator

	0 dB	≥30 dB
Maximum nominal input level at INPUT b1 and INPUT b2	-3 dBm	+27 dBm
Damage level at INPUT b1 and INPUT b2	+20 dBm	+30 dBm
Max. nominal DC	5 V	
Damage DC	5 V	

RMS noise level (with step attenuators set to 0 dB)
(For models ZVCE and ZVC values are reduced by 5 dB.)

Frequency range	IF bandwidth	Noise level
10 Hz to 50 Hz (ZVRL, ZVRE, ZVR)	1 Hz	<-115 dBm
50 Hz to 500 Hz (ZVRL, ZVRE, ZVR)	10 Hz	<-105 dBm
500 Hz to 20 kHz (ZVRL, ZVRE, ZVR)	100 Hz	<-95 dBm
20 kHz to 50 kHz	1 kHz	<-85 dBm
50 kHz to 200 kHz	3 kHz	<-80 dBm
200 kHz to 20 MHz	3 kHz	<-100 dBm
20 MHz to 3 GHz	3 kHz	<-110 dBm
3 GHz to 4 GHz	3 kHz	<-100 dBm
4 GHz to 8 GHz (ZVCE, ZVC)	3 kHz	<-90 dBm

Dynamic range see table on page 10

Generator/Receiver Step Attenuator options PORT1/2

These options permit the level of the output/input signals at PORT1/2 to be attenuated in 10 dB steps between 0 dB and 70 dB.

Frequency range	same as analyzer
Attenuation	0 dB to 70 dB
Attenuation steps	10 dB
Attenuation deviation	up to 30 dB <0.5 dB above 40 dB <1.5 dB

Power Calibration option

With this firmware option the analyzer power can be calibrated precisely. The source power (additional power meter eg NRD, NRV5 or NRV from Rohde & Schwarz required) as well as the absolute power measurement of the receiver input signals (including IF REF) can be calibrated.

AutoKal option

The AutoKal module is used for automatic analyzer calibration and employs a patented calibration method. It is connected to PORT1 and PORT2 of the network analyzer and remains connected during all calibrations and measurements. It is, therefore, an integral part of the analyzer system and its two type N jacks are used as PORT1 and PORT2. The DUT can be connected to these ports directly or via a test cable.

Frequency range	0 to 8 GHz
Impedance	50 Ω
Operating temperature range	+5 °C to +40 °C

3-Port Adapter option

This module adds a third port (PORT3) to the two ports (PORT1 and PORT2) of the network analyzer. The option contains an electronic switch for connecting PORT1 of the analyzer alternatively to PORT1 or PORT3 of the 3-Port Adapter. PORT2 of the analyzer is directly connected to the PORT2 of the option and not switched. The 3-Port Adapter is controlled via an interface at the rear.

4-Port Adapter option

This module adds two ports (PORT3 and PORT4) to the two ports (PORT1 and PORT2) of the network analyzer. It comes in two models (02 and 03), which provide different switching functions and are thus particularly suitable for other 4-port DUTs.

Model 02: comprises two separate switches (SPDT). The first connects PORT1 of the analyzer alternatively to PORT1 or PORT3 of the 4-Port Adapter. The second connects PORT2 of the network analyzer alternatively to PORT2 or PORT4 of the 4-Port Adapter.

Model 03: connects PORT1 of the network analyzer directly to PORT1 of the 4-Port Adapter while PORT2 of the analyzer can be switched to one of the remaining three ports of the 4-Port Adapter.

Both 4-Port Adapters are controlled via an interface at the rear.

Mixer Measurements option

With this option, network analysis can also be carried out for frequency-converting DUTs, particularly mixers, and for harmonics measurements.

Reference Channel Ports option

Extends the Mixer Measurements option and can be used to generate a reference signal when an additional external mixer is connected to the RF REF and IF REF connectors on the rear panel.

Controller option

With this option the network analyzer is able to function like an IBM-compatible computer. Additional VGA connector for PC monitor, a keyboard, a mouse, DOS™ and Windows™ are part of the package.

Ethernet option

With this option the analyzer can be networked (LAN).

IEC/IEEE-Bus Interface option

This option provides a third IEC/IEEE-bus interface for use with the Controller option.

Ordering information

Order designation	Type	Frequency range	Order No.
Vector Network Analyzers (test sets included) *			
3-channel, unidirectional, 50 Ω, passive	ZVRL	9 kHz to 4 GHz	1043.0009.41
3-channel, bidirectional, 50 Ω, passive	ZVRE	9 kHz to 4 GHz	1043.0009.51
3-channel, bidirectional, 50 Ω, active	ZVRE	300 kHz to 4 GHz	1043.0009.52
4-channel, bidirectional, 50 Ω, passive	ZVR	9 kHz to 4 GHz	1043.0009.61
4-channel, bidirectional, 50 Ω, active	ZVR	300 kHz to 4 GHz	1043.0009.62
3-channel, bidirectional, 50 Ω, active	ZVCE	20 kHz to 8 GHz	1106.9020.50
4-channel, bidirectional, 50 Ω, active	ZVC	20 kHz to 8 GHz	1106.9020.60
Alternative test sets *			
75 Ω SWR Bridge for ZVRL (instead of SWR bridge, 50 Ω, passive) ¹⁾			
75 Ω, passive	ZVR-A71	9 kHz to 4 GHz	1043.7690.18
75 Ω Bridge Pairs for ZVRE and ZVR (instead of bridge pairs, 50 Ω) ¹⁾			
75 Ω, passive	ZVR-A75	9 kHz to 4 GHz	1043.7755.28
75 Ω, active	ZVR-A76	300 kHz to 4 GHz	1043.7755.29
Options			
AutoKal	ZVR-B1	0 to 8 GHz	1044.0625.02
Mixer Measurements ²⁾	ZVR-B4	same as analyzer	1044.1215.02
Reference Channel Ports	ZVR-B6	same as analyzer	1044.1415.02
Power Calibration ³⁾	ZVR-B7	same as analyzer	1044.1544.02
3-Port Adapter	ZVR-B8	0 to 4 GHz	1086.0000.02
Virtual Embedding Networks ⁴⁾	ZVR-K9	-	1106.8830.02
4-Port Adapter (2 x SPDT)	ZVR-B14	0 to 4 GHz	1106.7510.02
4-Port Adapter (SP3T)	ZVR-B14	0 to 4 GHz	1106.7510.03
Controller (German) ⁵⁾	ZVR-B15	-	1044.0290.02
Controller (English) ⁵⁾	ZVR-B15	-	1044.0290.03
Ethernet BNC for ZVR-B15	FSE-B16	-	1073.5973.02
Ethernet AUI for ZVR-B15	FSE-B16	-	1073.5973.03
IEC/IEEE-Bus Interface for ZVR-B15	FSE-B17	-	1066.4017.02
Generator Step Attenuator PORT 1	ZVR-B21	same as analyzer	1044.0025.11
Generator Step Attenuator PORT 2 ⁶⁾	ZVR-B22	same as analyzer	1044.0025.21
Receiver Step Attenuator PORT 1	ZVR-B23	same as analyzer	1044.0025.12
Receiver Step Attenuator PORT 2	ZVR-B24	same as analyzer	1044.0025.22
External Measurements, 50 Ω ⁷⁾	ZVR-B25	10 Hz to 4 GHz (ZVR/E/I) 20 kHz to 8 GHz (ZVC/E)	1044.0460.02
Upgrade Kit ZVRL → ZVRE ⁸⁾	ZVR-U1	-	1085.6005.02
Upgrade Kit ZVRE → ZVR ⁸⁾	ZVR-U2	-	1085.6092.02
Upgrade Kit ZVRL → ZVR ⁸⁾	ZVR-U3	-	1085.6170.02
Service Kit ⁸⁾	ZVR-Z1	-	1044.1650.02

* Note:

Active test sets, in contrast to passive test sets, comprise internal bias networks, eg to supply DUTs.

Order designation	Type	Frequency range	Order No.
Extras			
Test Cables (pairs)			
N, 50 Ω, male	ZV-Z11	0 to 18 GHz	1085.6505.02
N, 75 Ω, male	ZV-Z12	0 to 18 GHz	1085.6570.02
Calibration Kits			
N, 50 Ω	ZV-Z21	0 to 18 GHz	1085.7099.02
N, 50 Ω	ZCAN	0 to 3 GHz	0800.8515.52
N, 75 Ω	ZCAN	0 to 3 GHz	0800.8115.72
PC 3.5	ZV-Z23	0 to 26.5 GHz	1085.7247.02
F, male	ZV-Z24	0 to 3 GHz	1085.7001.02
TRL Suppl. Kit, N, 50 Ω	ZV-Z26	0.4 GHz to 18 GHz	1085.7318.02
TRL Suppl. Kit, PC 3.5	ZV-Z27	0.4 to 26.5 GHz	1085.7401.02
TOM-X Suppl. Kit, N, 50 Ω	ZV-Z28	0 to 18 GHz	1085.7499.02
TOM-X Suppl. Kit, PC 3.5	ZV-Z29	0 to 26.5 GHz	1085.7647.02
Sliding Loads			
N, 50 Ω, male	ZV-Z41	1.7 GHz to 18 GHz	1085.8095.02
N, 50 Ω, female	ZV-Z41	1.7 GHz to 18 GHz	1085.8095.03
PC 3.5, male	ZV-Z43	1.7 to 26.5 GHz	1085.8195.02
PC 3.5, female	ZV-Z43	1.7 to 26.5 GHz	1085.8195.03
Adapters for Test Cable ZV-Z11			
N, 50 Ω, male	ZV-Z51	0 to 18 GHz	1085.8295.02
N, 50 Ω, female	ZV-Z51	0 to 18 GHz	1085.8295.03
PC 3.5, male	ZV-Z53	0 to 26.5 GHz	1085.8408.02
PC 3.5, female	ZV-Z53	0 to 26.5 GHz	1085.8408.03
Adapters for Test Cable ZV-Z12			
F, male	ZV-Z54	0 to 3 GHz	1085.8514.02
F, female	ZV-Z54	0 to 3 GHz	1085.8514.03
Attenuators, N 50 Ω			
1 W	DNF	0 to 12.4 GHz	0272.4X10.50
50 W ⁸⁾	RBU50	0 to 2 GHz	1073.8695.XX
100 W ⁸⁾	RBU100	0 to 2 GHz	1073.8495.XX
Matching Pads, 50 Ω → 75 Ω			
Series resistor	RAZ	0 to 2.7 GHz	0358.5714.02
L-section	RAM	0 to 2.7 GHz	0358.5414.02
Bias Network/DC Block			
Bias Network	ZV-Z61	2 MHz to 4 GHz	1106.8130.02
DC Block	FSE-Z3	5 MHz to 7 GHz	4010.3895.00
Power Splitter			
2 x 50 Ω	RVZ	0 to 2.7 GHz	0800.6612.52
External SWR Bridges			
50 Ω	ZRA	40 kHz to 150 MHz	1052.3607.52
50 Ω	ZRB 2	5 MHz to 3 GHz	0373.9017.52
75 Ω	ZRB 2	5 MHz to 2 GHz	0802.1018.73
50 Ω	ZRC	40 kHz to 4 GHz	1039.9492.52
75 Ω	ZRC	40 kHz to 2.5 GHz	1039.9492.72
Miscellaneous			
Transit Case	ZZK-965	-	1013.9437.00
19" Rack Adapter with front handles	ZZA-96	-	396.4928.00

1) To be ordered together with the analyzer.

2) Harmonics measurements included.

3) Power meter and sensor required.

4) Only for ZVR or ZVC with ZVR-B15.

5) DOS, Windows 3.11, keyboard and mouse included.

6) For ZVR or ZVC only (see page 8).

7) Attenuators required (page 8).

8) On request.