

R&S® ZVA-Zxx

Millimeter-Wave Converters

Network analysis up to 500 GHz

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R&S®ZVA-Zxx Millimeter-Wave Converters At a glance

The R&S®ZVA-Zxx millimeter-wave converters allow millimeter-wave measurements in the V, E, W, F, D, G, J and Y band as well as network analysis in the frequency ranges from 50 GHz to 500 GHz depending on the converter model.

Featuring a wide dynamic range, the Rohde&Schwarz converters offer high operating convenience and allow fast measurements. Two-port measurements can be performed using a four-port network analyzer and two converters; no external generator is required. When using a two-port network analyzer, an external generator is needed to supply the LO signals.

Key facts

- Wide frequency range
 - 50 GHz to 75 GHz (R&S®ZVA-Z75)
 - 60 GHz to 90 GHz (R&S®ZVA-Z90)
 - 75 GHz to 110 GHz (R&S®ZVA-Z110/-Z110E)
 - 90 GHz to 140 GHz (R&S®ZVA-Z140)
 - 110 GHz to 170 GHz (R&S®ZVA-Z170)
 - 140 GHz to 220 GHz (R&S®ZVA-Z220)
 - 220 GHz to 325 GHz (R&S®ZVA-Z325)
 - 325 GHz to 500 GHz (R&S®ZVA-Z500)
- Wide dynamic range
 - R&S®ZVA-Z75: > 90 dB, 110 dB (typ.)
 - R&S®ZVA-Z90: > 100 dB, 115 dB (typ.)
 - R&S®ZVA-Z110: > 100 dB, 110 dB (typ.)
 - R&S®ZVA-Z110E: > 95 dB, 110 dB (typ.)
 - R&S®ZVA-Z140: > 85 dB, 105 dB (typ.)
 - R&S®ZVA-Z170: > 85 dB, 105 dB (typ.)
 - R&S®ZVA-Z220: > 85 dB, 105 dB (typ.)
 - R&S®ZVA-Z325: > 80 dB, 100 dB (typ.)
 - R&S®ZVA-Z500: > 70 dB, 90 dB (typ.)
- Variable output power
- Automatic parameter setting
- Easy handling
- Highly stable measurements

The wide dynamic range is particularly important for high-blocking filters, for example, but it also speeds up measurements in general, as it enables the use of wider bandwidths while maintaining the same excellent performance.



R&S® ZVA-Zxx Millimeter-Wave Converters

Benefits and key features

Maximum performance made easy

- ▮ Variable output power
- ▮ Electronic power control
- ▮ Automatic parameter setting
- ▮ Convenient handling
- ▮ Multiport and true differential measurements
- ▮ Pulsed measurements
- ▮ Calibration

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Versatile amplifier characterization

- ▮ On-wafer device characterization
- ▮ True differential stimulus for accurate gain measurements

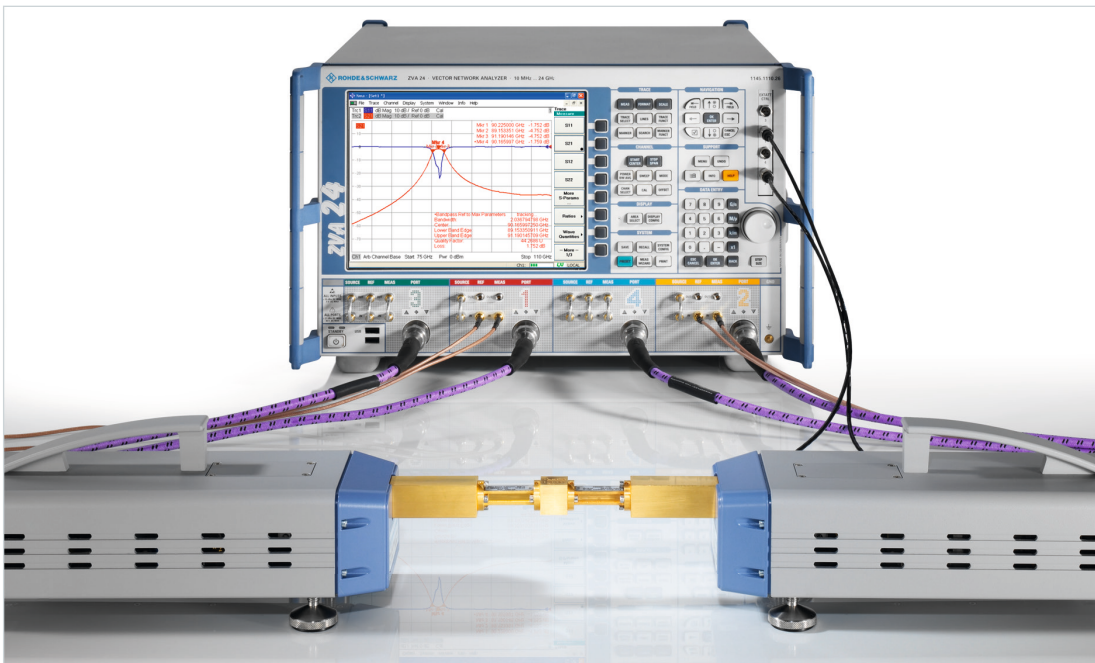
▷ [page 7](#)

Easy and modular configuration

- ▮ Possible configurations with the R&S® ZVA and R&S® ZVT

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Setup for a two-port measurement showing a filter measurement. A four-port network analyzer eliminates the need for controlling an external generator that supplies the LO signals.



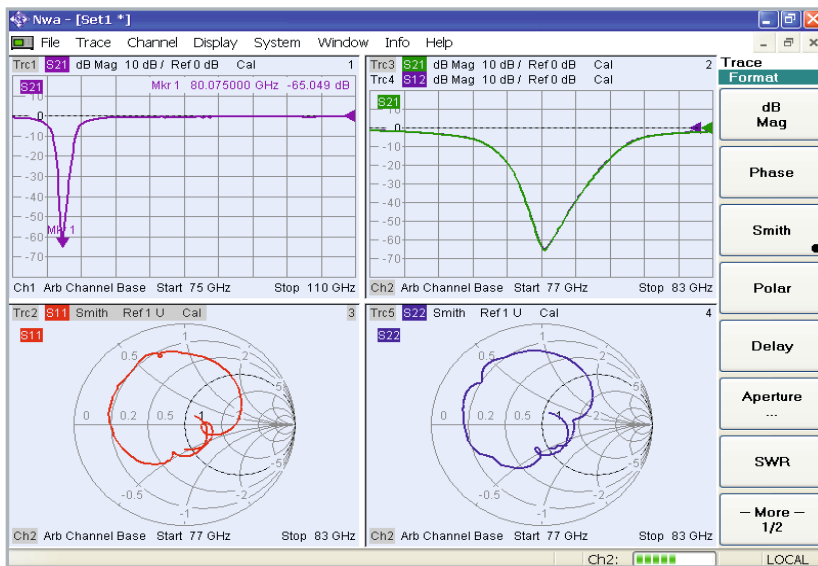
Maximum performance made easy

Variable output power

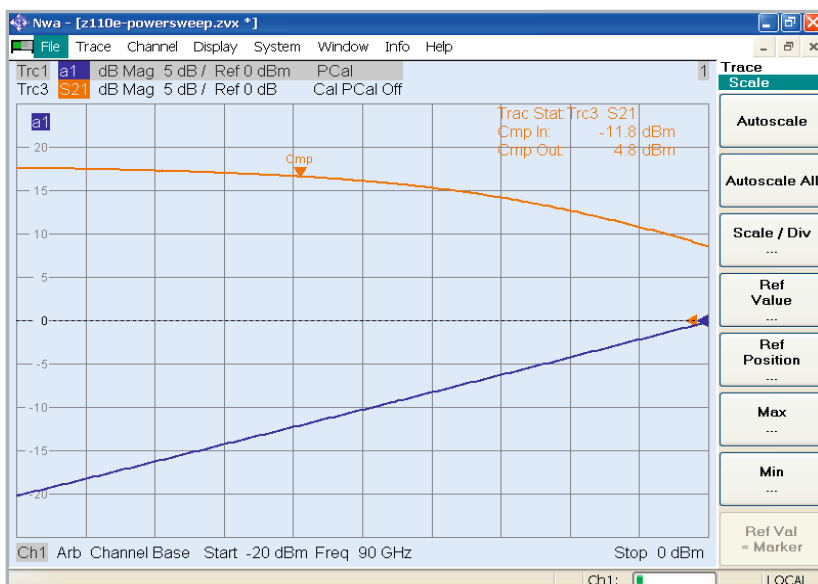
The Rohde & Schwarz converters provide an output power of typically

- +4 dBm (R&S®ZVA-Z75)
- +10 dBm (R&S®ZVA-Z90)
- +10 dBm (R&S®ZVA-Z110)
- +3 dBm (R&S®ZVA-Z140)
- -4 dBm (R&S®ZVA-Z170)
- -12 dBm (R&S®ZVA-Z220)
- -20 dBm (R&S®ZVA-Z325)
- -22 dBm (R&S®ZVA-Z500)

A control screw on top of the converters allows the power to be reduced manually by 40 dB with the R&S®ZVA-Z75/-Z110/-Z170/-Z140/-Z220/-Z325/-Z500. This is a useful feature that can help to avoid overloading the device under test – when performing measurements on low-noise amplifiers, for example.



Measurement of an 80 GHz notch filter.



Power sweep on an amplifier with 1 dB compression point analysis using the R&S®ZVA-Z110E with electronic power control.

Electronic power control

The R&S®ZVA allows the output power of the R&S®ZVA-Z110E converter to be reduced electronically by 25 dB. The output power of the R&S®ZVA-Z90 and R&S®ZVA-Z110 can be reduced by 70 dB via the RF input power reduction. This allows power sweeps for compression measurements on amplifiers as well as power calibration. The converter leveling tool, available at www.rohde-schwarz.com, is recommended for precise power leveling versus frequency.

Automatic parameter setting

The R&S®ZVA and R&S®ZVT firmware incorporates the ability to operate the Rohde&Schwarz converters using the R&S®ZVA-K8 converter control option. The network analyzer will automatically set the frequency limits to the correct frequency band and set the requisite parameters, based on the selected converter type. For calibration, the analyzer automatically offers the calibration kit appropriate for the selected frequency band. Moreover, the network analyzer protects the converters by limiting its output power to the converters' coaxial inputs.

Convenient handling

For ease of use, the converters' waveguide connectors are arranged on a bar extending from the converter. The screwed flange joints are easily accessible to facilitate calibration and connection of the DUT. The converters can be set up on three or four height-adjustable feet. Using three feet makes aligning the test port flange significantly easier. The converters contain no fans – an advantage in particle-sensitive environments in particular.

The converters are supplied with test port adapters that allow them to be used with other manufacturers' calibration kits and effectively protect the converters' waveguide connectors against wear.

Multiport and true differential measurements

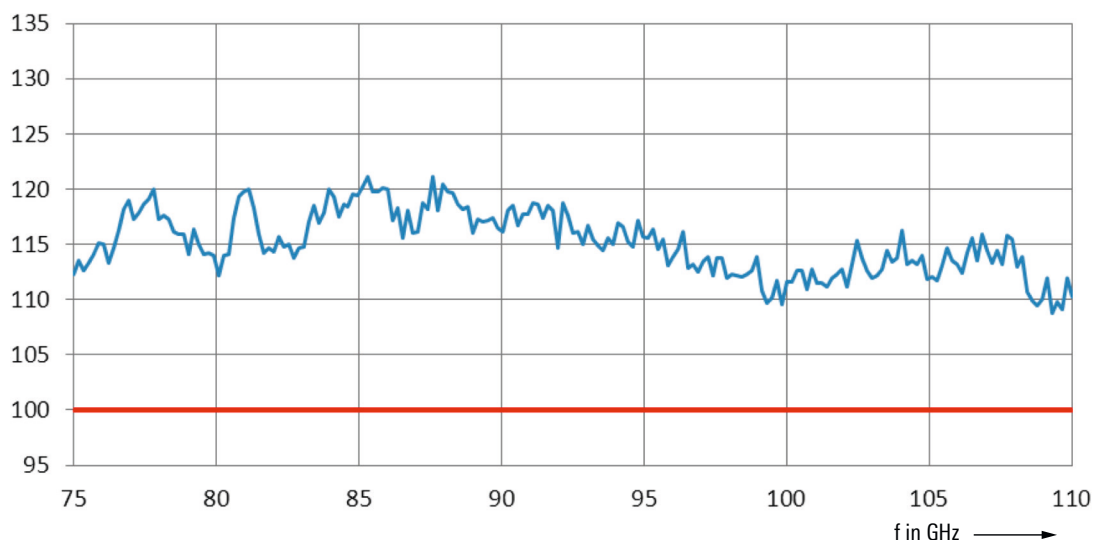
Multiport devices such as couplers can be analyzed by using three or four converters. The setup can be based on an R&S®ZVA24, R&S®ZVA40, R&S®ZVA50 or R&S®ZVA67 plus an external R&S®SMF100A microwave generator and one converter per test port. As an alternative, it is possible to use an R&S®ZVT20. The R&S®ZVT20 (six-port configuration) with its three internal signal sources allows up to four converters to be connected without requiring an external signal generator.

The R&S®ZVA-Z90/-Z110 and the R&S®ZVA-Z110E are ideal for generating true differential signals (true differential mode).

Pulsed measurements

The converters are also suitable for pulsed mode operation to characterize pulsed amplifiers, for example. This applies to both measurements versus frequency (average pulse and point-in-pulse) and pulse profile measurements.

Dynamic range of the R&S®ZVA-Z110



Calibration

Calibration can be performed using the R&S®ZV-WR15/-WR12/-WR10/-WR08/-WR06/-WR05/WR03 or -WR02 waveguide calibration kits. The calibration data is stored in the analyzer firmware and is loaded automatically. The calibration kits contain the following standards:

- Short
- Shim
- Shim 2 (R&S®ZV-WR05/-WR03/-WR02)
- Fixed match
- Sliding match (optional)

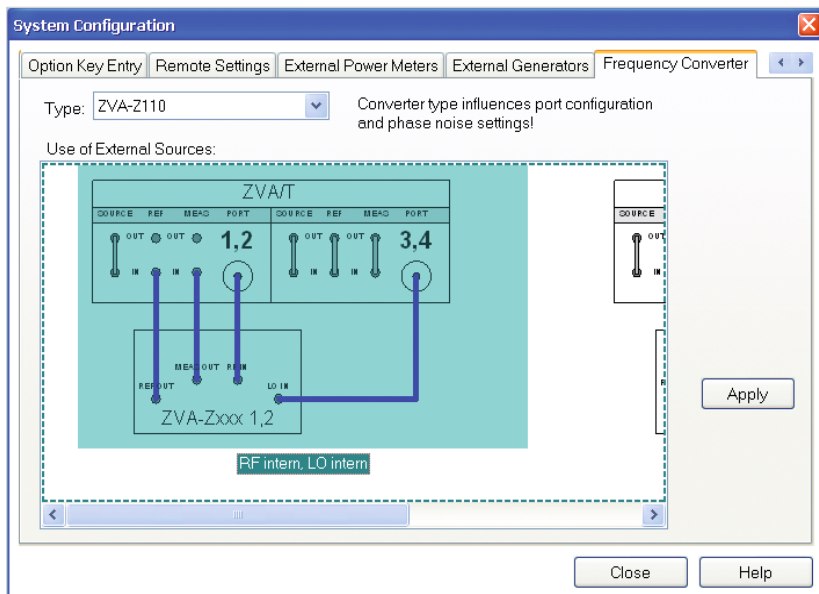
When connected together, the shim and short calibration standards form an offset short. The through standard is implemented by connecting the two waveguide outputs of the converters directly with each other.

A sliding match can be used instead of the fixed match. Rohde&Schwarz therefore offers two versions of the calibration kits with and without a sliding match.

R&S®ZV-WR10 calibration kit with sliding match.



Selection of converter type and display of required cabling.



Versatile amplifier characterization

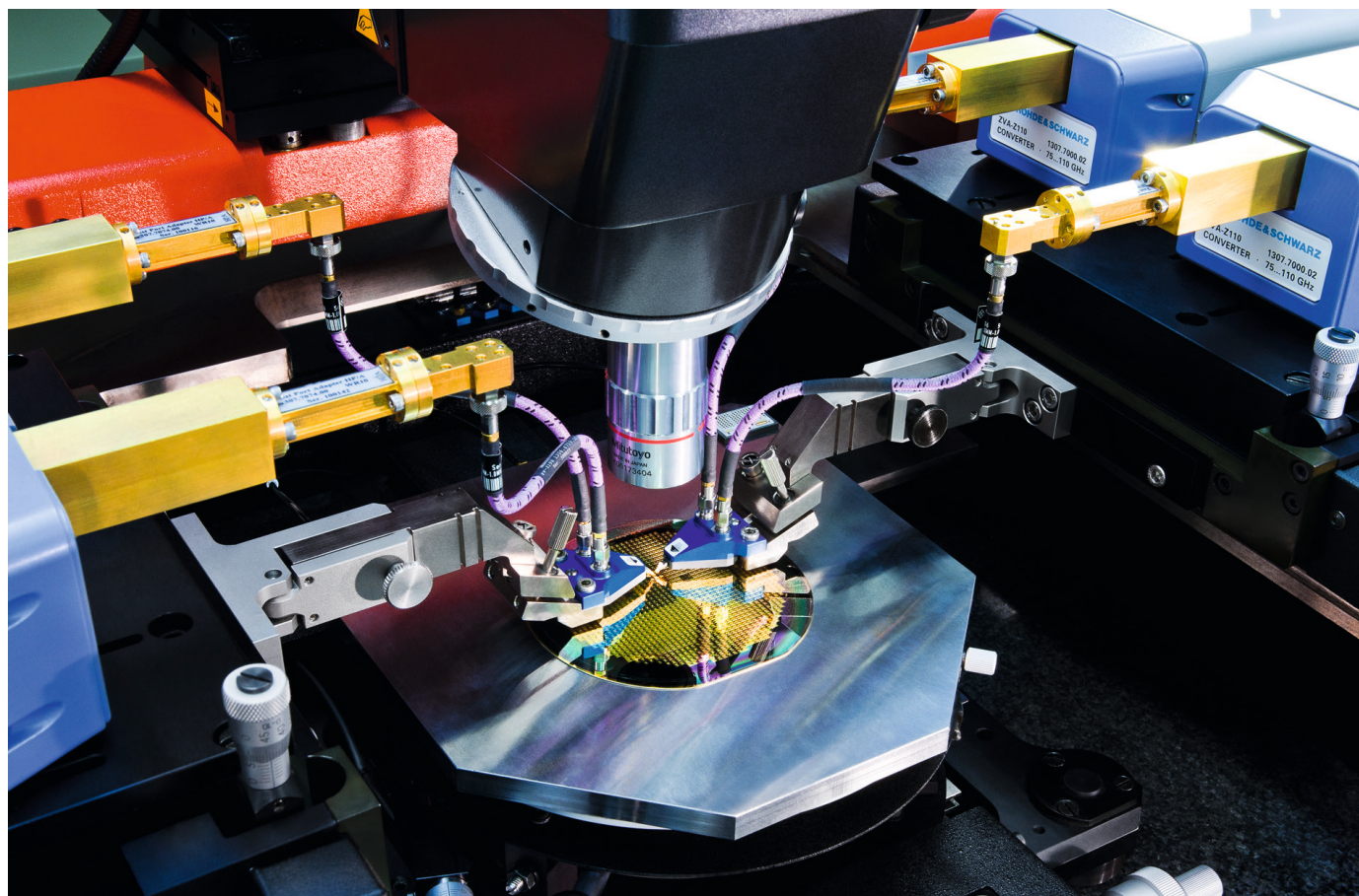
On-wafer device characterization

The Rohde & Schwarz millimeter-wave converters can be combined with wafer probes to perform on-wafer measurements. The converters are mechanically prepared for installation on Cascade Microtech wafer probes. The R&S®ZVA vector network analyzer and the R&S®ZVA-Zxx millimeter-wave converters are supported by the WinCal XE software.

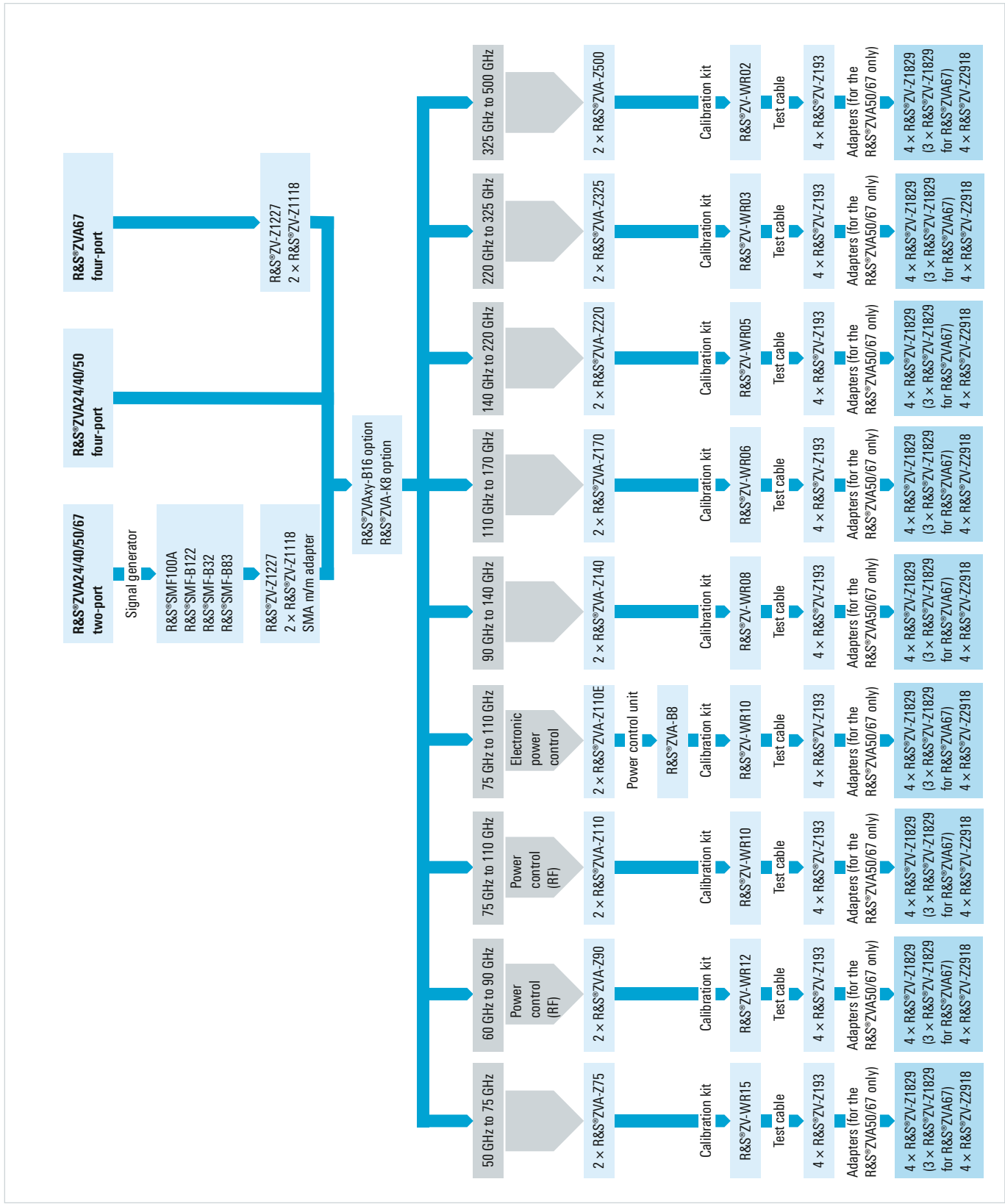
True differential stimulus for accurate gain measurements

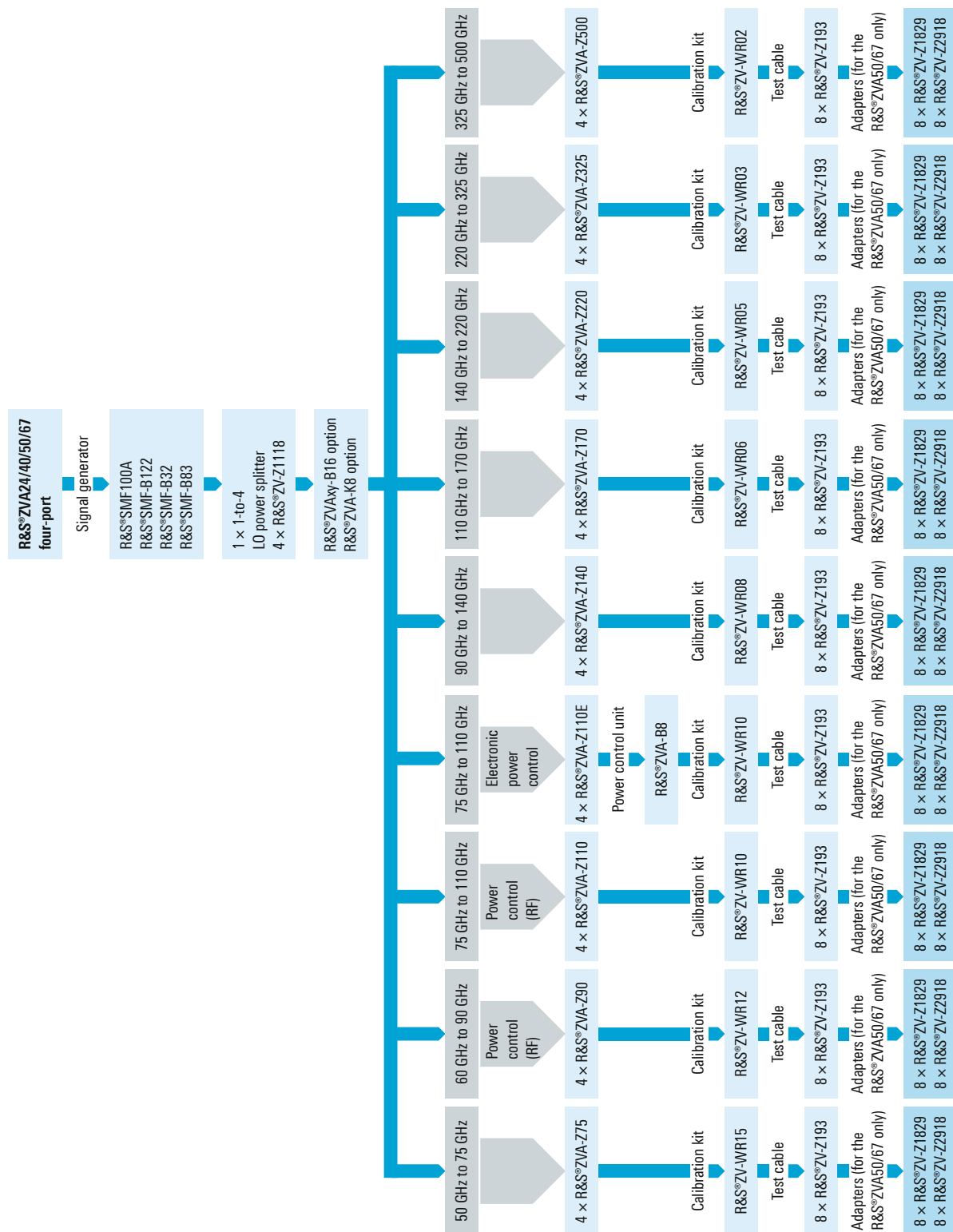
The R&S®ZVA-Z90, R&S®ZVA-Z110 and R&S®ZVA-Z110E millimeter-wave converters are especially suitable for generating true differential signals because the frequency response of the output power can be eliminated by power calibration. The two output signals can then be set to exactly the same amplitude and a phase difference of 0° for common mode and 180° for differential mode.

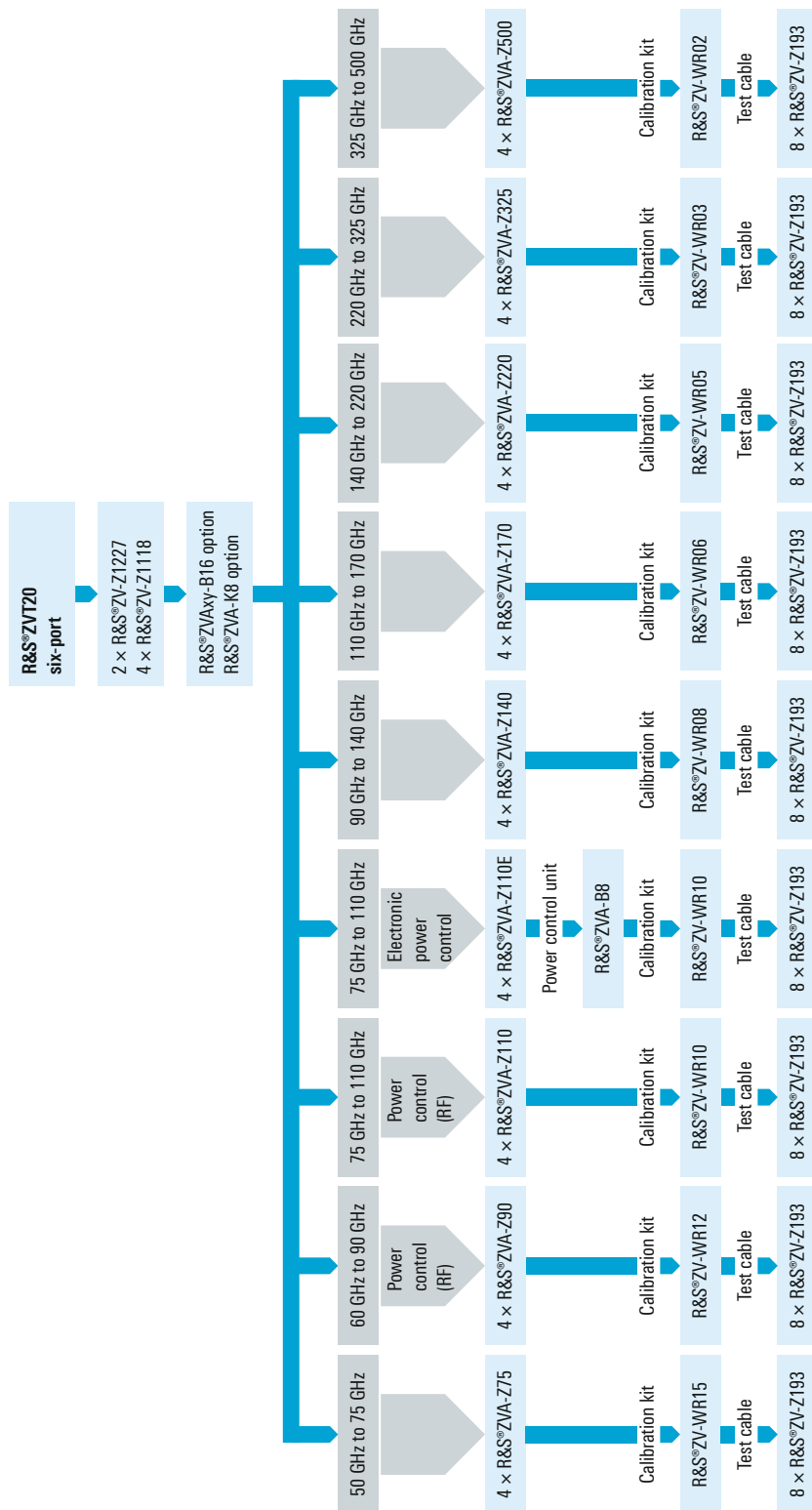
On-wafer measurement with four test ports at 110 GHz.



Configuration examples







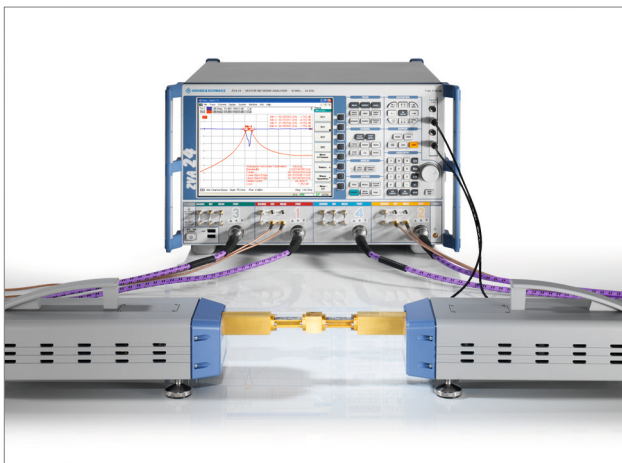
- The following accessories are supplied with each R&S®ZVA-Zxx millimeter-wave converter as standard:
- 1 × test port adapter (2 × test port adapter with the R&S®ZVA-Z110/-Z110E)
 - Hex ball driver
 - DC power supply
 - 2 × IF cable for MEAS and REF converter output signals



R&S®ZVA-Z500: 325 GHz to 500 GHz.



R&S®ZVA-Z110E: 75 GHz to 110 GHz (W band) with electronic power control.



Setup for a two-port measurement on a W-band filter using R&S®ZVA-Z110E converters with electronic power control.

Specifications in brief

R&S®ZVA-Z75

Waveguide designation	Electronic Industries Alliance (EIA)	WR15
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		50 GHz to 75 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	+4 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 90 dB, > 110 dB (typ.)

R&S®ZVA-Z90

Waveguide designation	Electronic Industries Alliance (EIA)	WR12
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		60 GHz to 90 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	+10 dBm (typ.)
Output power attenuation	adjustable by RF input power reduction	0 dB to 70 dB
Dynamic range		> 100 dB, > 115 dB (typ.)

R&S®ZVA-Z110

Waveguide designation	Electronic Industries Alliance (EIA)	WR10
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		75 GHz to 110 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	+10 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator adjustable by RF input power reduction	0 dB to 40 dB 0 dB to 70 dB
Dynamic range		> 100 dB, > 110 dB (typ.)

R&S®ZVA-Z110E

Waveguide designation	Electronic Industries Alliance (EIA)	WR10
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		75 GHz to 110 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	0 dBm (typ.)
Output power attenuation	electronic power control	0 dB to 25 dB
Dynamic range		> 95 dB, > 110 dB (typ.)

R&S®ZVA-Z140

Waveguide designation	Electronic Industries Alliance (EIA)	WR08
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		90 GHz to 140 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	+3 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 85 dB, > 105 dB (typ.)

R&S®ZVA-Z170

Waveguide designation	Electronic Industries Alliance (EIA)	WR06
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		110 GHz to 170 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	–4 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 85 dB, > 105 dB (typ.)

R&S®ZVA-Z220

Waveguide designation	Electronic Industries Alliance (EIA)	WR05
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		140 GHz to 220 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	–12 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 85 dB, > 105 dB (typ.)

R&S®ZVA-Z325

Waveguide designation	Electronic Industries Alliance (EIA)	WR03
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		220 GHz to 325 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	–20 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 80 dB, > 100 dB (typ.)

R&S®ZVA-Z500

Waveguide designation	Electronic Industries Alliance (EIA)	WR02
Connector type	anti-cocking flange	precision waveguide flange compatible with UG387/U-M
Frequency range		325 GHz to 500 GHz
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT	–22 dBm (typ.)
Output power attenuation	manually adjustable by variable attenuator	0 dB to 40 dB
Dynamic range		> 70 dB, > 90 dB (typ.)

Application notes

1EZ55	Millimeter-wave measurements with the converters of the R&S®ZVA family
1EZ56	Multiport millimeter-wave measurements with the converters of the R&S®ZVA family
1EZ57	Testing millimeter-wave mixers using converters of the R&S®ZVA family

Ordering information

Designation	Type	Order No.
Vector Network Analyzer, two ports, 10 MHz to 24 GHz	R&S®ZVA24	1145.1110.24
Vector Network Analyzer, four ports, 10 MHz to 24 GHz	R&S®ZVA24	1145.1110.26
Vector Network Analyzer, four ports, four sources, 10 MHz to 24 GHz	R&S®ZVA24	1145.1110.28
Vector Network Analyzer, two ports, 10 MHz to 40 GHz	R&S®ZVA40	1145.1110.40/43
Vector Network Analyzer, four ports, 10 MHz to 40 GHz	R&S®ZVA40	1145.1110.42/45
Vector Network Analyzer, four ports, , four sources, 10 MHz to 40 GHz	R&S®ZVA40	1145.1110.48
Vector Network Analyzer, two ports, 10 MHz to 50 GHz	R&S®ZVA50	1145.1110.50
Vector Network Analyzer, four ports, 10 MHz to 50 GHz	R&S®ZVA50	1145.1110.52
Vector Network Analyzer, two ports, 10 MHz to 67 GHz	R&S®ZVA67	1305.7002.02
Vector Network Analyzer, four ports, 10 MHz to 67 GHz	R&S®ZVA67	1305.7002.04
Direct Generator/Receiver Access (for the R&S®ZVA24 two-port model), 10 MHz to 24 GHz	R&S®ZVA24-B16	1164.0209.24
Direct Generator/Receiver Access (for the R&S®ZVA24 four-port model), 10 MHz to 24 GHz	R&S®ZVA24-B16	1164.0209.26
Direct Generator/Receiver Access (for the R&S®ZVA40 two-port model), 10 MHz to 40 GHz	R&S®ZVA40-B16	1164.0209.40
Direct Generator/Receiver Access (for the R&S®ZVA40 four-port model), 10 MHz to 40 GHz	R&S®ZVA40-B16	1164.0209.42
Direct Generator/Receiver Access (for the R&S®ZVA50 two-port model), 10 MHz to 50 GHz	R&S®ZVA50-B16	1164.0209.50
Direct Generator/Receiver Access (for the R&S®ZVA50 four-port model), 10 MHz to 50 GHz	R&S®ZVA50-B16	1164.0209.52
Direct Generator/Receiver Access (for the R&S®ZVA67 two-port model), 10 MHz to 67 GHz	R&S®ZVA67-B16	1164.0209.67
Direct Generator/Receiver Access (for the R&S®ZVA67 four-port model), 10 MHz to 67 GHz	R&S®ZVA67-B16	1164.0209.69
Vector Network Analyzer, two ports, 10 MHz to 20 GHz	R&S®ZVT20	1300.0000.20
Additional Port 3 (R&S®ZVT20), 10 MHz to 20 GHz	R&S®ZVT20-B63	1300.1606.03
Additional Port 4 (R&S®ZVT20), 10 MHz to 20 GHz	R&S®ZVT20-B64	1300.1606.04
Additional Port 5 (R&S®ZVT20), 10 MHz to 20 GHz	R&S®ZVT20-B65	1300.1606.05
Additional Port 6 (R&S®ZVT20), 10 MHz to 20 GHz	R&S®ZVT20-B66	1300.1606.06
Direct Generator/Receiver Access (for ports 1/2/3/4/5/6 of the R&S®ZVT20), 10 MHz to 20 GHz	R&S®ZVT20-B16	1300.1635.11/ 12/13/14/15/16
USB-to-IEC/IEEE Adapter	R&S®ZVAB-B44	1302.5544.02
Converter WR15, 50 GHz to 75 GHz	R&S®ZVA-Z75	1307.7400.02
Converter WR12, 60 GHz to 90 GHz	R&S®ZVA-Z90	1322.3024.02
Converter WR10, 75 GHz to 110 GHz	R&S®ZVA-Z110	1307.7000.03
Converter WR10, 75 GHz to 110 GHz, with electronic power control	R&S®ZVA-Z110E	1307.7000.40
Converter WR08, 90 GHz to 140 GHz	R&S®ZVA-Z140	1307.7800.02
Converter WR06, 110 GHz to 170 GHz	R&S®ZVA-Z170	1311.8707.02
Converter WR05, 140 GHz to 220 GHz	R&S®ZVA-Z220	1307.8006.02
Converter WR03, 220 GHz to 325 GHz	R&S®ZVA-Z325	1317.0514.02
Converter WR02, 325 GHz to 500 GHz	R&S®ZVA-Z500	1317.0520.02
Converter Control Software	R&S®ZVA-K8	1307.7022.02
Control Unit for External Electronic Attenuators, required for the R&S®ZVA-Z110E	R&S®ZVA-B8	1307.6026.02
Waveguide Calibration Kit WR15 (without sliding match), 50 GHz to 75 GHz	R&S®ZV-WR15	1307.7500.30
Waveguide Calibration Kit WR15 (with sliding match), 50 GHz to 75 GHz	R&S®ZV-WR15	1307.7500.31
Waveguide Calibration Kit WR12 (without sliding match), 60 GHz to 90 GHz	R&S®ZV-WR12	1307.7700.10
Waveguide Calibration Kit WR12 (with sliding match), 60 GHz to 90 GHz	R&S®ZV-WR12	1307.7700.11
Waveguide Calibration Kit WR10 (without sliding match), 75 GHz to 110 GHz	R&S®ZV-WR10	1307.7100.10
Waveguide Calibration Kit WR10 (with sliding match), 75 GHz to 110 GHz	R&S®ZV-WR10	1307.7100.11

Designation	Type	Order No.
Waveguide Calibration Kit WR08 (without sliding match), 90 GHz to 140 GHz	R&S®ZV-WR08	1307.7900.10
Waveguide Calibration Kit WR08 (with sliding match), 90 GHz to 140 GHz	R&S®ZV-WR08	1307.7900.11
Waveguide Calibration Kit WR06 (without sliding match), 110 GHz to 170 GHz	R&S®ZV-WR06	1311.8807.10
Waveguide Calibration Kit WR06 (with sliding match), 110 GHz to 170 GHz	R&S®ZV-WR06	1311.8807.11
Waveguide Calibration Kit WR05 (without sliding match), 140 GHz to 220 GHz	R&S®ZV-WR05	1307.8106.10
Waveguide Calibration Kit WR05 (with sliding match), 140 GHz to 220 GHz	R&S®ZV-WR05	1307.8106.11
Waveguide Calibration Kit WR03 (without sliding match), 220 GHz to 325 GHz	R&S®ZV-WR03	1307.7300.30
Waveguide Calibration Kit WR03 (with sliding match), 220 GHz to 325 GHz	R&S®ZV-WR03	1307.7300.31
Waveguide Calibration Kit WR02 (without sliding match), 325 GHz to 500 GHz	R&S®ZV-WR02	1314.5550.10
Test Cable, 3.5 mm (f)/3.5 mm (m), 0 Hz to 26.5 GHz	R&S®ZV-Z193	1306.4520.36
Test Cable, 3.5 mm (f)/3.5 mm (m), 0 Hz to 26.5 GHz, length: 1.5 m (60 in)	R&S®ZV-Z193	1306.4520.60
Adapter, 1.85 mm (f)/2.92 mm (m)	R&S®ZV-Z1829	1307.8212.00
Adapter, 2.92 mm (f)/1.85 mm (m)	R&S®ZV-Z2918	1307.8229.00

Service 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, three years	R&S®WE3	
Extended Warranty, four years	R&S®WE4	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	
Extended Warranty with Calibration Coverage, three years	R&S®CW3	
Extended Warranty with Calibration Coverage, four years	R&S®CW4	