

R&S® ZVA-Zxx Millimeter-Wave Converters

Network analysis up to 500 GHz



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

Millimeter-wave measurements in the V, E, W, F, D, G, J and Y band – network analysis in 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-Z90E)
 - 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)using an R&S®ZVA24, R&S®ZVA40, R&S®ZVA50, R&S®ZVA67 or R&S®ZVT20 network analyzer
- Wide dynamic range:
 - R&S®ZVA-Z75: > 90 dB, typ. 110 dB
 - R&S®ZVA-Z90E: > 90 dB, typ. 110 dB
 - R&S®ZVA-Z110/Z110E: > 95 dB, typ. > 110 dB
 - R&S®ZVA-Z140: > 85 dB, typ. > 100 dB
 - R&S®ZVA-Z170: > 75 dB, typ. > 90 dB
 - R&S®ZVA-Z220: > 75 dB, typ. > 90 dB
 - R&S®ZVA-Z325: > 60 dB, typ. > 70 dB
 - R&S®ZVA-Z500: > 50 dB, typ. > 65 dB
- Variable output power
- Automatic parameter setting
- Easy handling

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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Applications

- ▮ On-wafer measurements
- ▮ True differential measurements

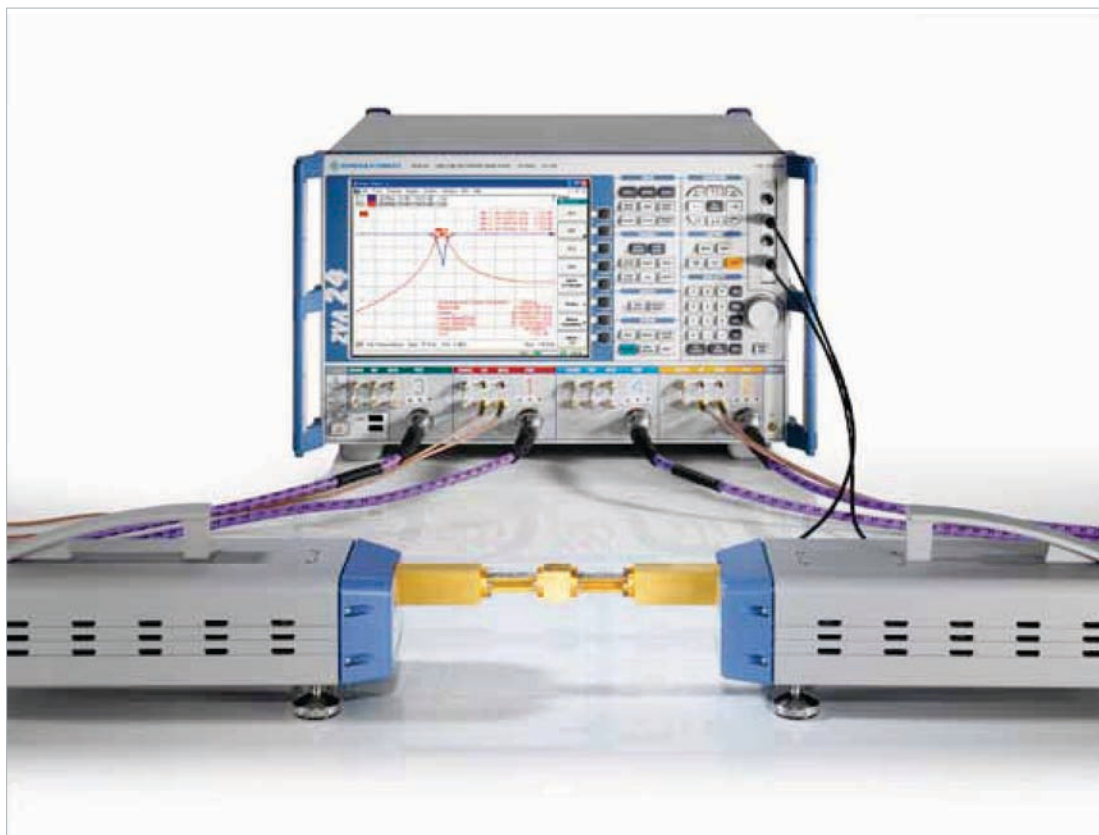
▷ [page 7](#)

Configuration examples

- ▮ 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 +4 dBm (R&S®ZVA-Z75), +2 dBm (R&S®ZVA-Z90E), +3 dBm (R&S®ZVA-Z110), typ. +2 dBm (R&S®ZVA-Z140), typ. -5 dBm (R&S®ZVA-Z170), typ. -12 dBm (R&S®ZVA-Z220), typ. -17 dBm (R&S®ZVA-Z325) and typ. -24 dBm (R&S®ZVA-Z500). A control screw on top of the converters allows the power to be reduced manually by 25 dB with the R&S®ZVA-Z75/-Z110/-Z170 and by 20 dB with the R&S®ZVA-Z140/-Z220/-Z325. This is a useful feature that can help to avoid overloading the device under test – when performing measurements on low-noise amplifiers, for example.

Electronic power control

The R&S®ZVA allows the output power of the R&S®ZVA-Z90E converter to be reduced by 20 dB and the output power of the R&S®ZVA-Z110E converter to be reduced by 25 dB. This allows power sweeps for compression measurements on amplifiers as well as power calibration.

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

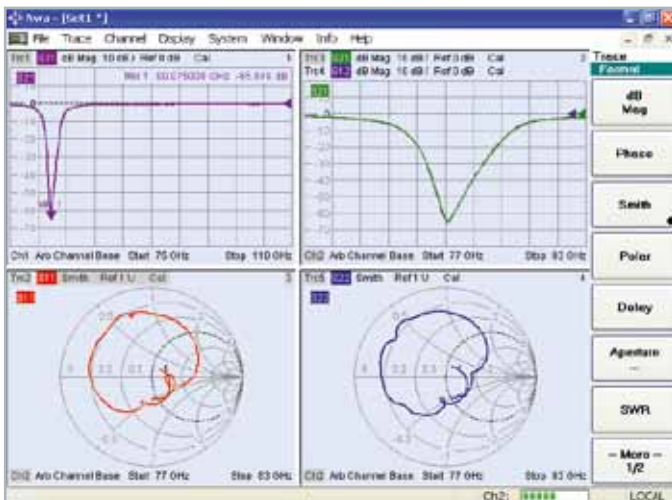
For ease of use, the converters' waveguide connectors are arranged on a bar extending from the converter. The screwed flange joints are easily accessible to facilitate calibration and connection of the DUT. The converters can be set up on three or four height-adjustable feet. Using three feet makes aligning 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.

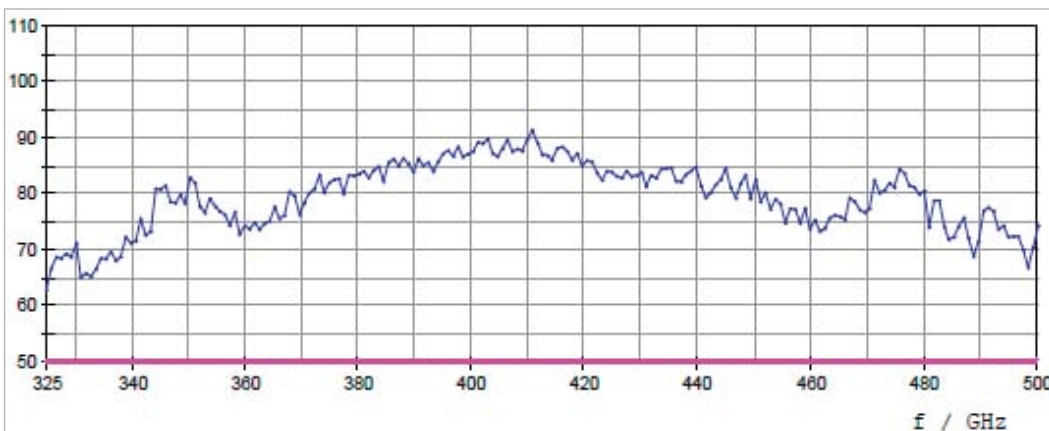
Power sweep on an amplifier with 1 dB compression point analysis using the R&S®ZVA-Z110E with electronic power control.



Measurement of an 80 GHz notch filter.



Dynamic range of the R&S®ZVA-Z500.



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 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.

A three- or four-port test setup allows differential devices under test to be analyzed. The converters with electronic power control in particular 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.

Calibration

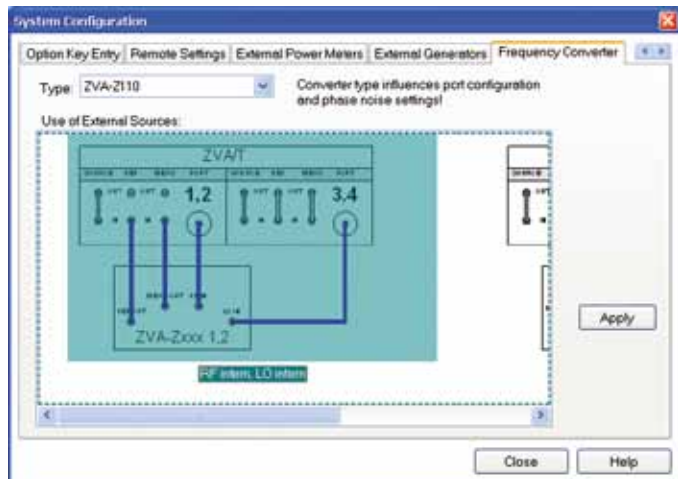
Calibration can be performed using the R&S®ZV-WR15/-WR12/-WR10/-WR08/-WR06/-WR05/WR03 or -WR02 waveguide calibration kits. The calibration data is stored in the analyzer firmware and is loaded automatically. The calibration kits contain the following standards:

- ▮ 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.

Selection of converter type and display of required cabling.



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



Applications

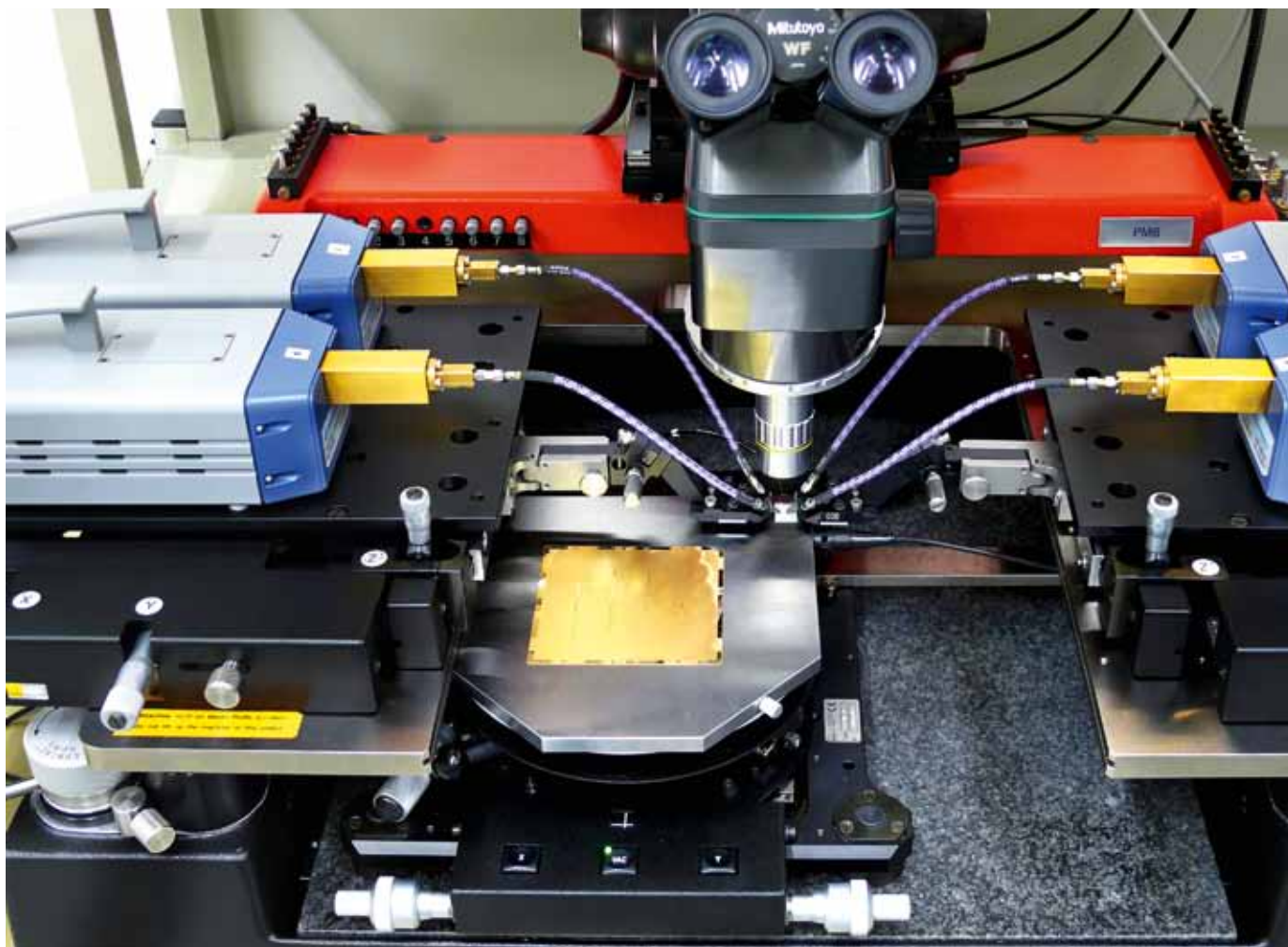
On-wafer measurements

The Rohde & Schwarz millimeter-wave converters can be combined with wafer probers to perform on-wafer measurements. They are mechanically prepared for installation on the wafer probers of all notable manufacturers and are also included in their software packages.

True differential measurements

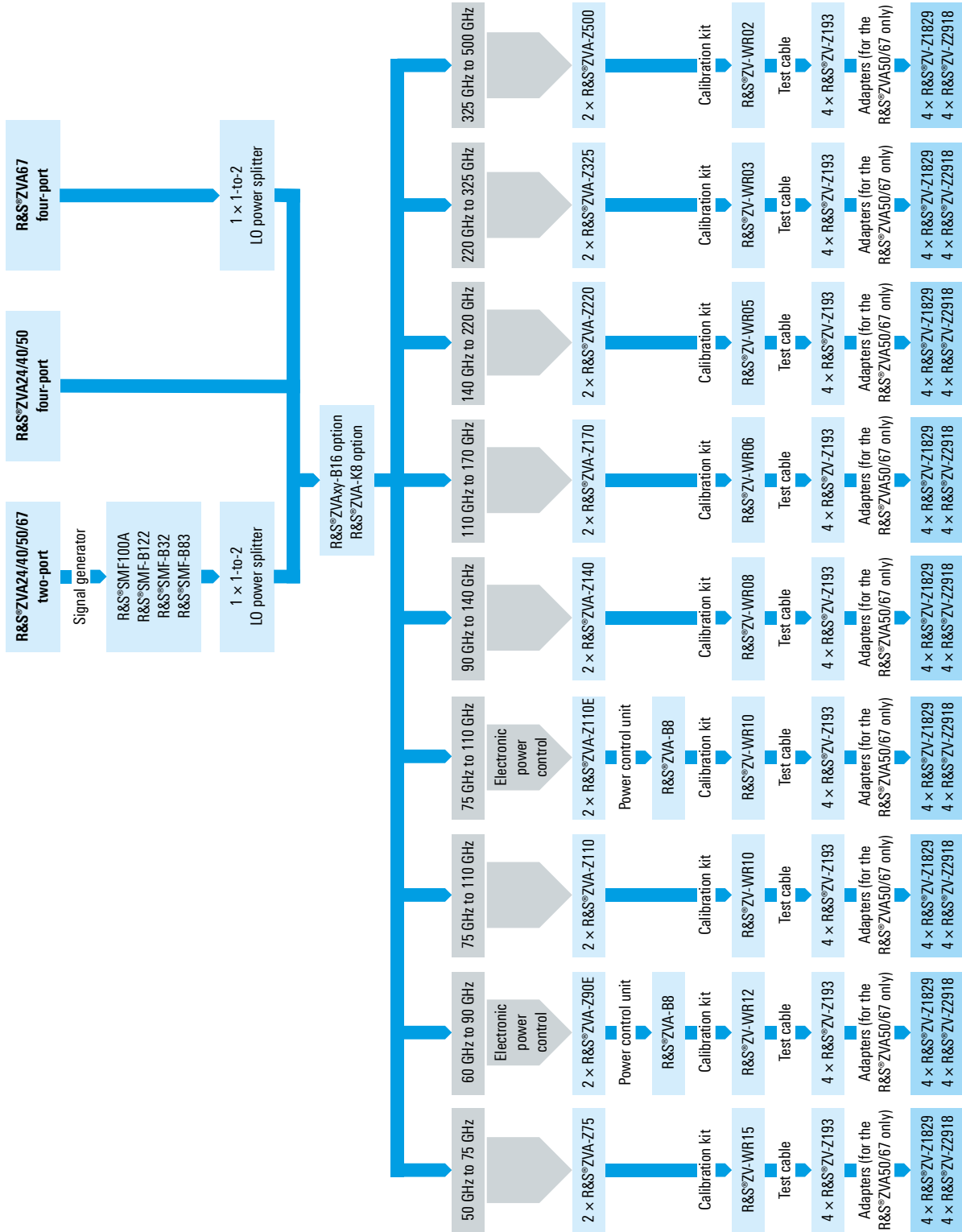
The millimeter-wave converters with electronic power control (R&S®ZVA-Z90E and R&S®ZVA-Z110E) are especially suitable for generating true differential signals because the frequency response of the output power can be eliminated by power calibration. The two output signals can then be set to exactly the 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.

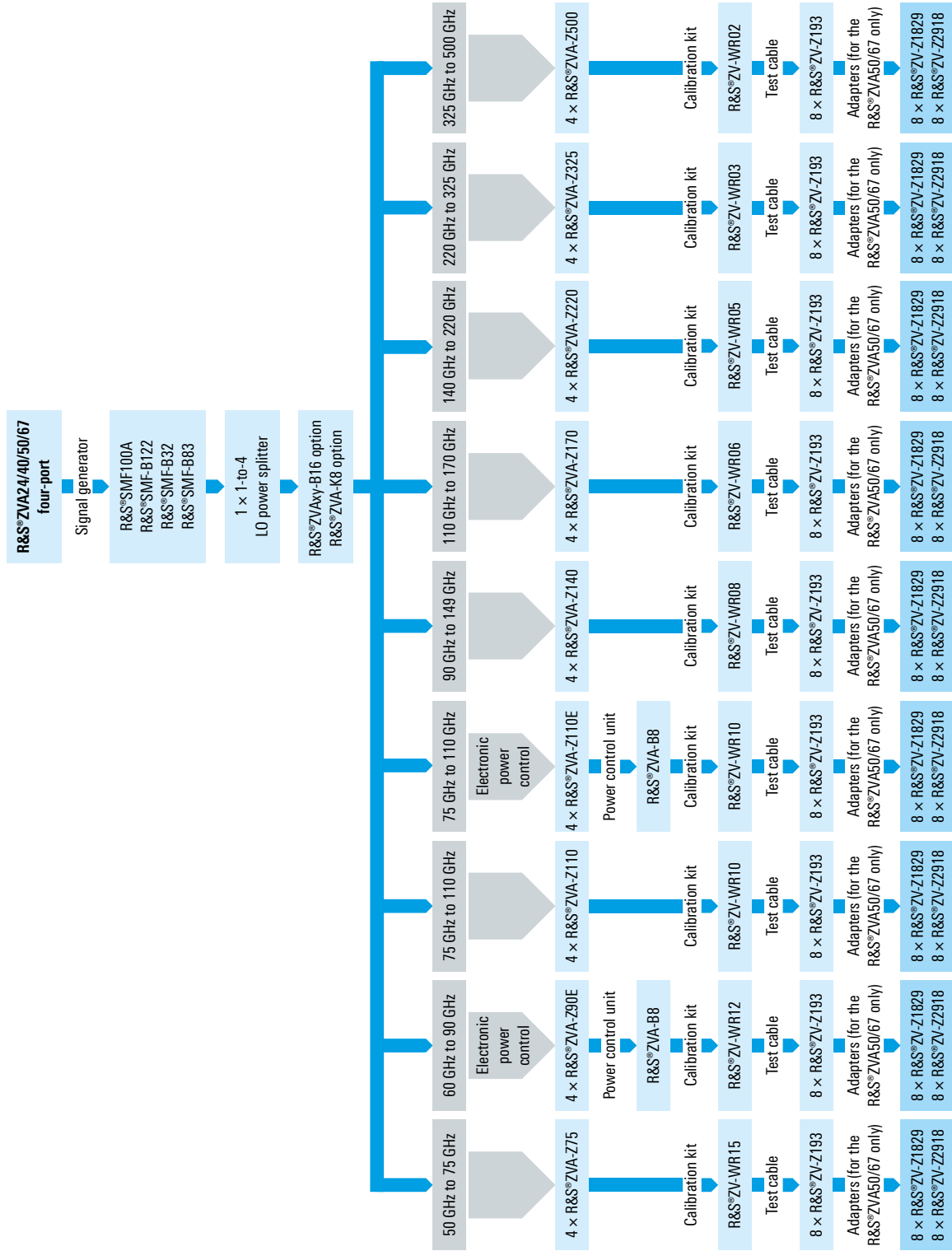


Configuration examples

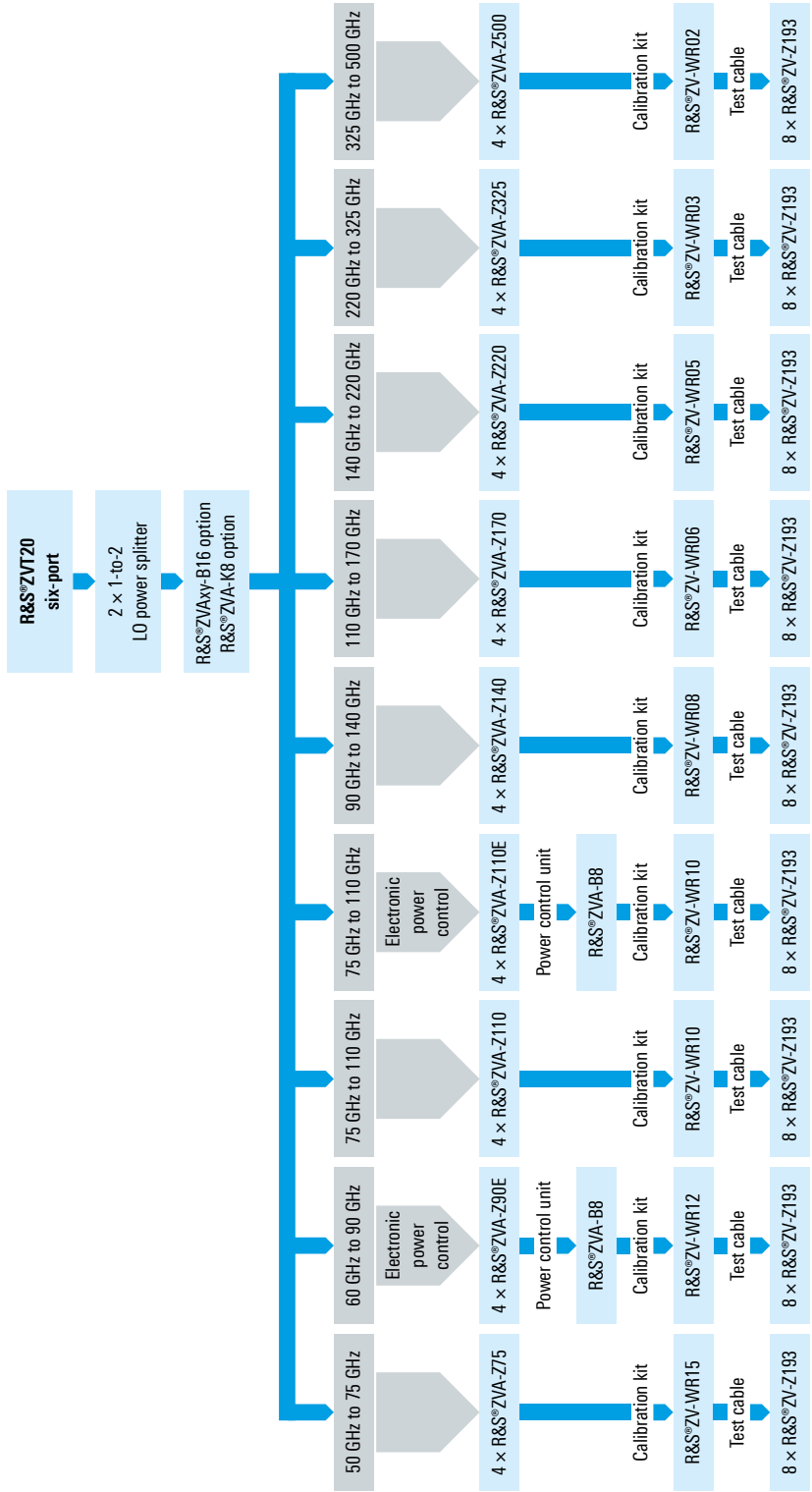
Configuration chart for the R&S® ZVA-Zxx millimeter-wave converters, two-port setup, R&S® ZVA-based



Configuration chart for the R&S®ZVA-Zxx millimeter-wave converters, four-port setup, R&S®ZVA-based



Configuration chart for the R&S® ZVA-Zxx millimeter-wave converters, four-port setup, R&S® ZVT20-based



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

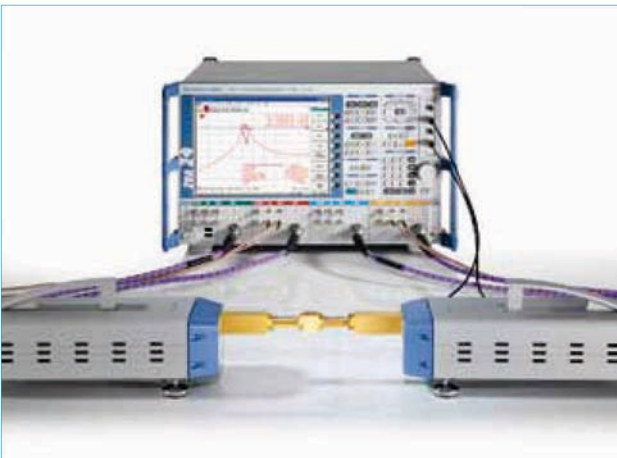
R&S®ZVA-Z325: 220 GHz to 325 GHz (J band).



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
Output power attenuation	manually adjustable by variable attenuator	0 dB to 25 dB
Dynamic range		> 90 dB, typ. > 110 dB

R&S®ZVA-Z90E		
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	+2 dBm
Output power attenuation	electronic power control	0 dB to 20 dB
Dynamic range		> 90 dB, typ. > 110 dB

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	+3 dBm
Output power attenuation	manually adjustable by variable attenuator	0 dB to 25 dB
Dynamic range		> 95 dB, typ. > 110 dB

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	+1 dBm
Output power attenuation	electronic power control	0 dB to 25 dB
Dynamic range		> 95 dB, typ. > 110 dB

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	typ. +2 dBm
Output power attenuation	manually adjustable by variable attenuator	0 dB to 20 dB
Dynamic range		> 85 dB, typ. > 100 dB

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	typ. -5 dBm
Output power attenuation	manually adjustable by variable attenuator	0 dB to 25 dB
Dynamic range		> 75 dB, typ. > 90 dB

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	typ. -12 dBm
Output power attenuation	manually adjustable by variable attenuator	0 dB to 20 dB
Dynamic range		> 75 dB, typ. > 90 dB

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	typ. -17 dBm
Output power attenuation	manually adjustable by variable attenuator	typ. 0 dB to 20 dB
Dynamic range		> 60 dB, typ. > 70 dB

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	typ. -24 dBm
Output power attenuation		N/A
Dynamic range		> 50 dB, typ. > 65 dB

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, 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, 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-Z90E	1307.7600.02
Converter WR10 75 GHz to 110 GHz	R&S®ZVA-Z110	1307.7000.02
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

Designation	Type	Order No.
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	1307.7200.02
Converter WR02 325 GHz to 500 GHz	R&S®ZVA-Z500	1314.5509.02
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
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	1311.8707.10
Waveguide Calibration Kit WR06 (with sliding match) 110 GHz to 170 GHz	R&S®ZV-WR06	1311.8707.11
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	1307.8106.10
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, 60 in/1.5 m	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

For data sheet, see PD 5214.2033.22 and www.rohde-schwarz.com.

Service you can rely on

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

About Rohde & Schwarz

Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Environmental commitment

- | Energy-efficient products
- | Continuous improvement in environmental sustainability
- | ISO 14001-certified environmental management system

Certified Quality System
ISO 9001

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