

R&S® ZCxxx

# Millimeter-Wave Converters

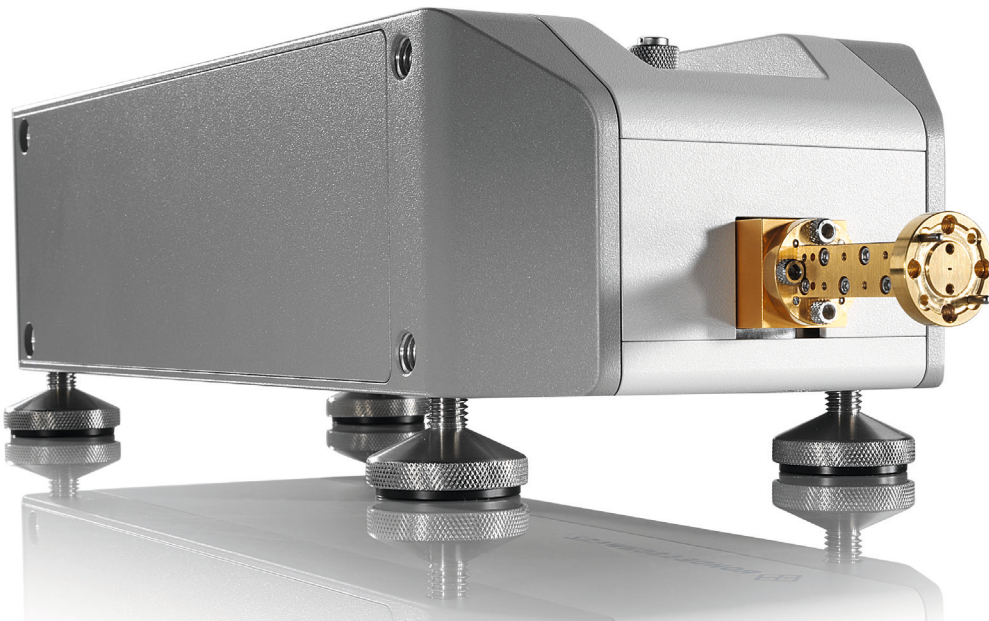
Network analysis  
up to 500 GHz



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**ROHDE & SCHWARZ**

# R&S®ZCxxx Millimeter-Wave Converters At a glance

The R&S®ZCxxx millimeter-wave converters allow millimeter-wave measurements in the frequency range from 75 GHz to 500 GHz (WM-2540/-2032/-1651/-1295/-864 and -570). They feature a wide dynamic range and high output power. Plus, they offer high operating convenience and allow highly stable measurements.

The converters' wide dynamic range is particularly beneficial for measurements on high-blocking filters, for antenna measurements and on-wafer amplifier measurements. It also speeds up measurements in general, as it enables the use of wider bandwidths while maintaining the same excellent performance.

## Key facts

- Wide frequency range
  - 75 GHz to 110 GHz (R&S®ZC110)
  - 90 GHz to 140 GHz (R&S®ZC140)
  - 110 GHz to 170 GHz (R&S®ZC170)
  - 140 GHz to 220 GHz (R&S®ZC220)
  - 220 GHz to 330 GHz (R&S®ZC330)
  - 330 GHz to 500 GHz (R&S®ZC500)
- For use with an R&S®ZVA24, R&S®ZVA40, R&S®ZVA50, R&S®ZVA67 or R&S®ZVT20 network analyzer <sup>1)</sup>
- High output power
  - typ. +14 dBm (R&S®ZC110)
  - typ. +7 dBm to +9 dBm (R&S®ZC140)
  - typ. +9 dBm (R&S®ZC170)
  - typ. 0 dBm to +2 dBm (R&S®ZC220)
  - typ. -9 dBm to -8 dBm (R&S®ZC330)
  - typ. -18 dBm to -13 dBm (R&S®ZC500)
- Wide dynamic range
  - typ. 120 dB (R&S®ZC110)
  - typ. 120 dB (R&S®ZC140)
  - typ. 105 dB (R&S®ZC170)
  - typ. 115 dB (R&S®ZC220)
  - typ. 115 dB (R&S®ZC330)
  - typ. 100 dB (R&S®ZC500)
- Variable output power
- Automatic parameter setting
- Easy handling
- Highly stable measurements

<sup>1)</sup> Not suitable for R&S®ZC140 and R&S®ZC500.



# R&S®ZCxxx Millimeter-Wave Converters

## Benefits and key features

### Maximum performance and operating ease

- Variable output power
- Automatic parameter setting
- Convenient handling
- Multiport measurements
- Pulsed measurements
- Vector error correction

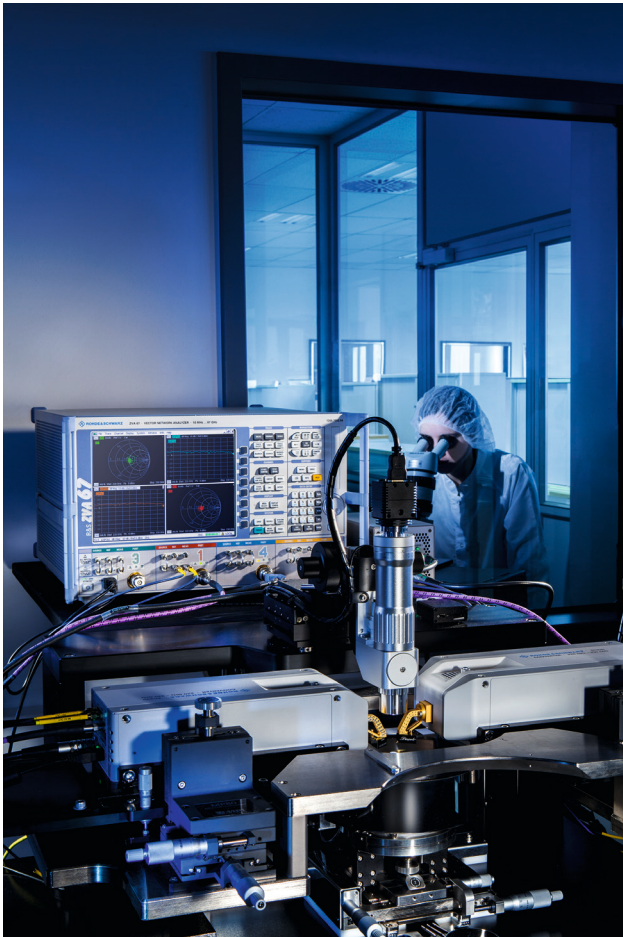
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### Versatile amplifier characterization and easy configuration

- On-wafer device characterization
- Wide power sweep range
- Possible configurations with the R&S®ZVA or R&S®ZVT

▷ [page 5](#)

On-wafer device characterization in the millimeter wave range.



Setup for a two-port measurement in WM-864 band with an R&S®ZVA24 vector network analyzer.



# Maximum performance and operating ease

## Variable output power

The R&S®ZCxxx converters deliver outstanding output powers (see page 2). A mechanical attenuator, accessible via the control screw on top of the converters, allows the power level to be manually controlled in a 40 dB range. This feature helps to avoid overloading the device under test (DUT) when performing measurements on low-noise amplifiers, for example. In addition, the output power can be controlled by varying the RF input power.

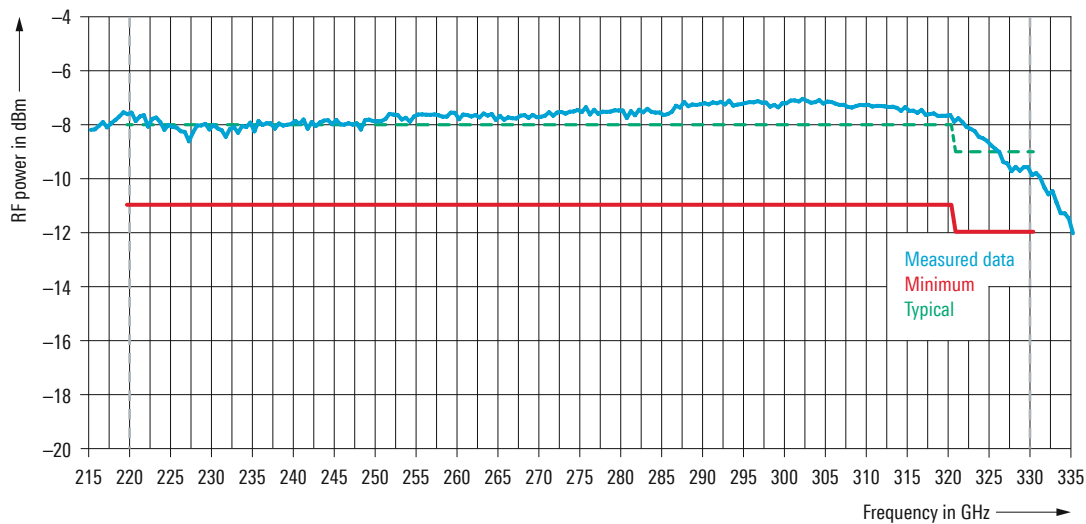
## Automatic parameter setting

The R&S®ZVA and R&S®ZVT firmware allows the R&S®ZCxxx converters to be operated if the R&S®ZVA-K8 converter control option is installed. The network analyzer automatically sets the right frequency band and configures the required parameters when an R&S®ZCxxx is selected. For calibration, the analyzer automatically offers the calibration kit appropriate for that frequency band. The network analyzer also protects the converters by limiting the output power applied to their coaxial inputs.

## Convenient handling

For ease of use and to protect the waveguide port, the converters are supplied with a test port adapter for the waveguide connector. The adapter's screwed flange joints are easily accessible, facilitating calibration and connection of the DUT. The converters can be set up on four height-adjustable feet that can be screwed to the bottom, top or either side depending on the DUT's waveguide port orientation.

Output power of the R&S®ZC330



### Multiport measurements

Multiport devices such as couplers can be analyzed by using three or four converters. The test setup can be configured with an R&S®ZVA24, R&S®ZVA40, R&S®ZVA50 or R&S®ZVA67 network analyzer and an R&S®SMB100A microwave generator, plus one converter per test port. Alternatively, an R&S®ZVT20 can be used. The R&S®ZVT20 in six-port configuration has three internal sources that allow up to four converters to be connected without requiring an external signal generator.

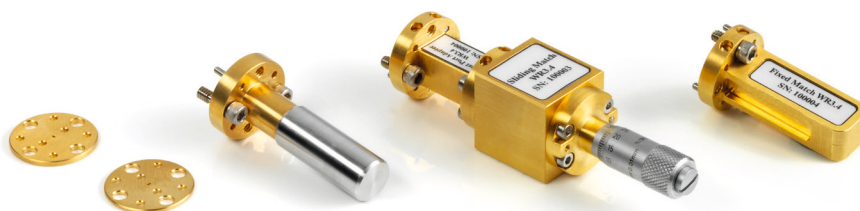
### Pulsed measurements

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.

### Vector error correction

Calibration can be performed using the appropriate R&S®ZV-WRxx or R&S®ZCWMxx waveguide calibration kit. The characteristic data of the calibration kit standards is stored in the analyzer firmware and is automatically loaded when an R&S®ZV-WRxx is selected. The calibration kit contains the following standards: short, shim, shim 2 (in some calibration kits only), fixed match and, optionally, sliding match. 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 with each other. A sliding match can be used instead of the fixed match. Rohde&Schwarz offers two versions of the calibration kit – with and without a sliding match.

R&S®ZV-WR03 waveguide calibration kit for calibration up to 330 GHz.



# Versatile amplifier characterization and easy configuration

## On-wafer device characterization

The R&S®ZCxxx millimeter-wave converters can be combined with wafer probers from all established prober manufacturers to perform on-wafer measurements. The R&S®ZVA/ R&S®ZVT vector network analyzer and the R&S®ZCxxx millimeter-wave converters are supported by software such as QAlibria™ (MPI Corporation) and WinCalXE™ (Form Factor).

## Wide power sweep range

The output power of the converters can be varied by 40 dB using the control screw on top of the converters. The output power can also be controlled by varying the RF input power. A total power sweep range of up to 70 dB is advantageous for amplifier compression point measurements.

## Possible configurations with the R&S®ZVA or R&S®ZVT

For a two-port configuration the following options are required:

- R&S®ZVAxx-B16 direct generator/receiver access
- R&S®ZVA-K8 converter control software
- R&S®ZCPS converter power supply (supplies two R&S®ZCxxx)
- R&S®ZV-WRxx or R&S®ZCWMxx waveguide calibration kit

In addition, diverse accessories are required for the various analyzer models as specified in the tables below.

The following accessories are supplied as standard with the R&S®ZCxxx millimeter-wave converters:

- One test port adapter per converter
- Hex ball driver
- Spare screws and alignment pins
- Two IF cables for measurement and reference converter output signals

The R&S®ZCSTC converter set transport case is available as an option.

<b>R&amp;S®ZCxxx, two-port setup</b>		
<b>Vector network analyzer type and model, order no.</b>	<b>Required accessories, order no.</b>	<b>Description</b>
R&S®ZVA24, 1145.1110.26	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
R&S®ZVA24, 1145.1110.28	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZCAK, 1323.7746.24	adapter kit (power divider, two right angle SMA (m/m) adapters)
R&S®ZVA40, 1145.1110.42	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
R&S®ZVA40, 1145.1110.45	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZCAK, 1323.7746.50	adapter kit (four 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters)
R&S®ZVA40, 1145.1110.48	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZCAK, 1323.7746.24	adapter kit (power divider, two right angle SMA (m/m) adapters)
R&S®ZVA50, 1145.1110.52	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZCAK, 1323.7746.50	adapter kit (four 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters)
R&S®ZVA67, 1305.7002.04	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZCAK, 1323.7746.67	adapter kit (power divider, two right angle SMA (m/m) adapters, three 1.85 mm (f) to 2.92 mm (m) adapters, four 1.85 mm (m) to 2.92 mm (f) adapters)
R&S®ZVT20, 1300.0000.20	4 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")

<b>R&amp;S®ZCxxx, four-port setup</b>		
<b>Vector network analyzer type and model, order no.</b>	<b>Required accessories, order no.</b>	<b>Description</b>
R&S®ZVT20, 1300.0000.20 (except for R&S®ZC140 and R&S®ZC500)	8 × R&S®ZV-Z193, 1306.4520.36	3.5 mm cables, length: 910 mm (36")
	1 × R&S®ZV-Z1228, 3626.4937.02	4 way power divider 27 GHz
	4 × R&S®ZV-Z1118, 1314.5373.00	adapter SMA m/m angle
R&S®ZVA24/-ZVA40/-ZVA50/-ZVA67	Please contact Rohde&Schwarz for configuration.	

# Specifications in brief

Specifications in brief		
R&S®ZCxxx millimeter-wave converter		
Frequency range	R&S®ZC110	75 GHz to 110 GHz
	R&S®ZC140	90 GHz to 140 GHz
	R&S®ZC170	110 GHz to 170 GHz
	R&S®ZC220	140 GHz to 220 GHz
	R&S®ZC330	220 GHz to 330 GHz
	R&S®ZC500	330 GHz to 500 GHz
Waveguide designator	R&S®ZC110	WM-2540
	R&S®ZC140	WM-2032
	R&S®ZC170	WM-1651
	R&S®ZC220	WM-1295
	R&S®ZC330	WM-864
	R&S®ZC500	WM-570
Output power at +7 dBm input power from the R&S®ZVA/R&S®ZVT	R&S®ZC110	> +12 dBm (n. trc.), typ. +14 dBm
	R&S®ZC140	> +5 dBm to +7 dBm (n. trc.), typ. +7 dBm to +9 dBm
	R&S®ZC170	> +5 dBm (n. trc.), typ. +9 dBm
	R&S®ZC220	> -4 dBm to -2 dBm (n. trc.), typ. 0 dBm to +2 dBm
	R&S®ZC330	> -12 dBm to -11 dBm (n. trc.), typ. -9 dBm to -8 dBm
	R&S®ZC500	> -24 dBm to -17 dBm (n. trc.), typ. -18 dBm to -13 dBm
Output power attenuation	manually adjustable (except R&S®ZC110)	0 dB to 40 dB
Dynamic range	R&S®ZC110	> 110 dB, typ. 120 dB
	R&S®ZC140	> 105 dB, typ. 120 dB
	R&S®ZC170	> 90 dB, typ. 105 dB
	R&S®ZC220	> 100 dB, typ. 115 dB
	R&S®ZC330	> 100 dB, typ. 115 dB
	R&S®ZC500	> 85 dB, typ. 100 dB

For data sheet, see PD 3607.1471.22 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)

# 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 two-port R&S®ZVA24, 10 MHz to 24 GHz	R&S®ZVA24-B16	1164.0209.24
Direct Generator/Receiver Access for four-port R&S®ZVA24, 10 MHz to 24 GHz	R&S®ZVA24-B16	1164.0209.26
Direct Generator/Receiver Access for two-port R&S®ZVA40, 10 MHz to 40 GHz	R&S®ZVA40-B16	1164.0209.40
Direct Generator/Receiver Access for four-port R&S®ZVA40, 10 MHz to 40 GHz	R&S®ZVA40-B16	1164.0209.42
Direct Generator/Receiver Access for two-port R&S®ZVA50, 10 MHz to 50 GHz	R&S®ZVA50-B16	1164.0209.50
Direct Generator/Receiver Access for four-port R&S®ZVA50, 10 MHz to 50 GHz	R&S®ZVA50-B16	1164.0209.52
Direct Generator/Receiver Access for two-port R&S®ZVA67, 10 MHz to 67 GHz	R&S®ZVA67-B16	1164.0209.67
Direct Generator/Receiver Access for four-port R&S®ZVA67, 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 for R&S®ZVT20, 10 MHz to 20 GHz	R&S®ZVT20-B63	1300.1606.03
Additional Port 4 for R&S®ZVT20, 10 MHz to 20 GHz	R&S®ZVT20-B64	1300.1606.04
Additional Port 5 for R&S®ZVT20, 10 MHz to 20 GHz	R&S®ZVT20-B65	1300.1606.05
Additional Port 6 for 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 WM-2540	R&S®ZC110	1323.7617.02
Converter WM-2032	R&S®ZC140	1323.7623.02
Converter WM-1651	R&S®ZC170	1323.7630.02
Converter WM-1295	R&S®ZC220	1323.7646.02
Converter WM-864	R&S®ZC330	1323.7669.02
Converter WM-570	R&S®ZC500	1323.7681.02
Converter Set Transport Case	R&S®ZCSTC	1323.7730.00
Converter Power Supply (supplies up to two converters)	R&S®ZCPS	1325.6101.02
Power Supply Cable for R&S®ZCPS, 1.2 m	R&S®ZCPSC	1323.8159.12
Power Supply Cable for R&S®ZCPS, 1.6 m	R&S®ZCPSC	1323.8159.16
Power Supply Cable for R&S®ZCPS, 2.0 m	R&S®ZCPSC	1323.8159.20
Test Cable, 3.5 mm (f) to 3.5 mm (m), length: 910 mm (two cables per converter required)	R&S®ZV-Z193	1306.4520.36
Test Cable, 2.92 mm (f) to 2.92 mm (m), length: 910 mm (two cables per converter required)	R&S®ZV-Z195	1306.4536.36

Designation	Type	Order No.
Waveguide Calibration Kit WR10 (without sliding match), compatible with converter R&S®ZC110	R&S®ZV-WR10	1307.7100.10
Waveguide Calibration Kit WR10 (with sliding match), compatible with converter R&S®ZC110	R&S®ZV-WR10	1307.7100.11
Waveguide Calibration Kit WR08 (without sliding match), compatible with converter R&S®ZC140	R&S®ZV-WR08	1307.7900.10
Waveguide Calibration Kit WR08 (with sliding match), compatible with converter R&S®ZC140	R&S®ZV-WR08	1307.7900.11
Waveguide Calibration Kit WR06 (without sliding match), compatible with converter R&S®ZC170	R&S®ZV-WR06	1307.8807.10
Waveguide Calibration Kit WR06 (with sliding match), compatible with converter R&S®ZC170	R&S®ZV-WR06	1307.8807.11
Waveguide Calibration Kit WR05 (without sliding match), compatible with converter R&S®ZC220	R&S®ZV-WR05	1307.8106.10
Waveguide Calibration Kit WR05 (with sliding match), compatible with converter R&S®ZC220	R&S®ZV-WR05	1307.8106.11
Waveguide Calibration Kit WR03 (without sliding match), compatible with converter R&S®ZC330	R&S®ZV-WR03	1307.7300.30
Waveguide Calibration Kit WR03 (with sliding match), compatible with converter R&S®ZC330	R&S®ZV-WR03	1307.7300.31
Waveguide Calibration Kit WM-570 (without sliding match), compatible with converter R&S®ZC500	R&S®ZCWM-570	1322.3099.10
Converter Control Software	R&S®ZVA-K8	1307.7022.02
Adapter Kit, including a power divider and two right angle SMA (m/m) adapters (required if R&S®ZVA24 var. 28 or R&S®ZVA40 var. 48 (VNAs with four sources) is used)	R&S®ZCAK	1323.7746.24
Adapter Kit, including four 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters (required if R&S®ZVA50 is used)	R&S®ZCAK	1323.7746.50
Adapter Kit, including a power divider, two right angle SMA (m/m) adapters, three 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters (required if R&S®ZVA67 is used)	R&S®ZCAK	1323.7746.67
Torque Wrench, for waveguide flange screws	R&S®ZV-Z1000	1314.5467.02
Angled Wrench, for waveguide flange screws	R&S®ZCAW	1175.1960.00
Angled Torque Wrench, for waveguide flange screws	R&S®ZCTW	1175.2014.02
Micropositioner Platform for Converter	R&S®MP80SET-RS	3628.3521.02
4 Way Power Divider, 27 GHz	R&S®ZV-Z1228	3626.4937.02

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	