

# R&S® ZNC

## Vector Network Analyzer

### Specifications



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# Definitions

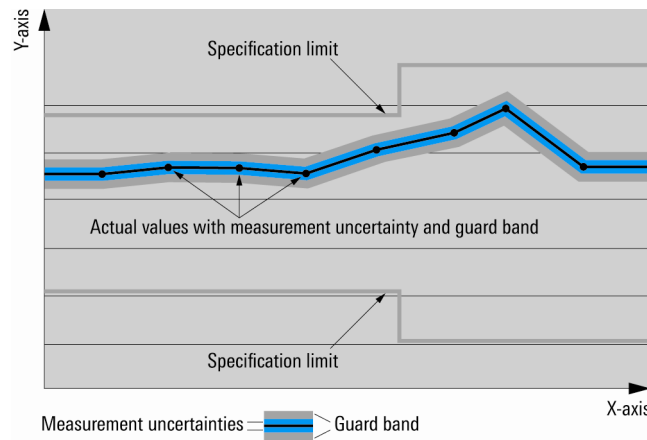
## General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 60 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable
- Unless stated otherwise, specifications apply to test ports and a nominal source power of  $-10$  dBm

## Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



## Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

## Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with  $<$ ,  $>$  or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

## Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

## Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

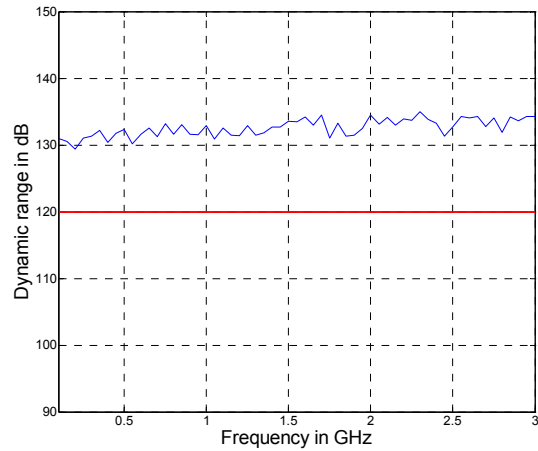
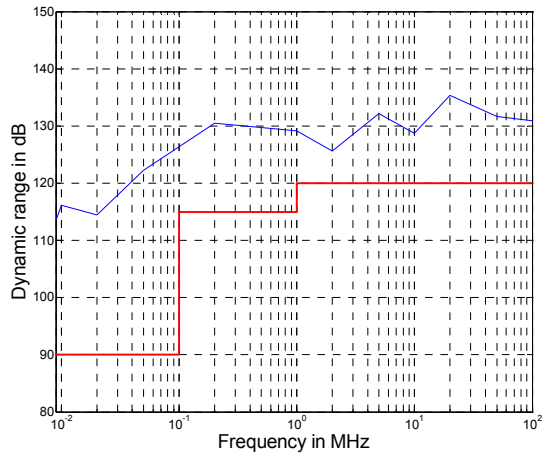
## Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

## Measurement range

|                              |                     |                       |
|------------------------------|---------------------|-----------------------|
| Impedance                    |                     | 50 $\Omega$           |
| Test port connector          |                     | N female              |
| Number of test ports         |                     | 2                     |
| Frequency range              |                     | 9 kHz to 3 GHz        |
| Static frequency accuracy    |                     | 8 ppm                 |
| Frequency resolution         |                     | 1 Hz                  |
| Number of measurement points | per trace           | 2 to 5001             |
| Measurement bandwidth        | 1/1.5/2/3/5/7 steps | 1 Hz to 300 kHz       |
| Dynamic range <sup>1</sup>   | 9 kHz to 100 kHz    | > 90 dB, typ. 110 dB  |
|                              | 100 kHz to 1 MHz    | > 115 dB, typ. 120 dB |
|                              | 1 MHz to 3 GHz      | > 120 dB, typ. 130 dB |



Dynamic range in dB versus frequency for the R&S<sup>®</sup>ZNC3.

<sup>1</sup> The dynamic range is defined as the difference between the actual maximum source power and the RMS value of the data trace of the transmission magnitude, which is produced by noise and crosstalk with the test ports short-circuited. The specification applies at 10 Hz measurement bandwidth, without system error correction. The dynamic range can be increased by using a measurement bandwidth of 1 Hz. Crosstalk does not limit the dynamic range.

## Measurement speed

|  |   |           |
|--|---|-----------|
| Measurement time   | for 201 measurements points, with 200 MHz span, 300 kHz measurement bandwidth with 900 MHz center frequency   | < 8 ms    |
| Measurement time per point                               | 300 kHz measurement bandwidth, CW mode  | < 4 us    |
| Time for measurement and data transfer                   | for 201 measurements points, with 800 MHz start frequency, 1 GHz stop frequency, 300 kHz measurement bandwidth, (No additional time for data transfer is needed, as this occurs simultaneously during the measurement.) | typ. 8 ms |
| Switching time between channels                          | with no more than 2001 points   | < 5 ms    |
| Switching time between two preloaded instrument settings | with no more than 2001 points   | < 5 ms    |

### Typical sweep times versus number of measurement points <sup>2</sup>

| Number of measurement points   | 51     | 201    | 401    | 1601    | 5001    |
|--|--------|--------|--------|---------|---------|
| 800 MHz start frequency, 1 GHz stop frequency, AGC LOW DIST, 1 kHz measurement bandwidth |        |        |        |         |         |
| With correction switched OFF   | 48 ms  | 182 ms | 358 ms | 1410 ms | 4400 ms |
| With 2-port TOSM calibration   | 95 ms  | 362 ms | 714 ms | 2820 ms | 8800 ms |
| 800 MHz start frequency, 1 GHz stop frequency, AGC AUTO, 100 kHz measurement bandwidth   |        |        |        |         |         |
| With correction switched OFF   | 3.5 ms | 9 ms   | 13ms   | 39 ms   | 110 ms  |
| With 2-port TOSM calibration   | 5.0 ms | 17 ms  | 22 ms  | 73 ms   | 170 ms  |
| 800 MHz start frequency, 1 GHz stop frequency, AGC AUTO, 300 kHz measurement bandwidth   |        |        |        |         |         |
| With correction switched OFF   | 3.0 ms | 8 ms   | 11 ms  | 23 ms   | 82 ms   |
| With 2-port TOSM calibration   | 4.5 ms | 15 ms  | 18 ms  | 54 ms   | 156 ms  |
| 100 kHz start frequency, 3 GHz stop frequency, AGC LOW DIST, 1 kHz measurement bandwidth |        |        |        |         |         |
| With correction switched OFF   | 49 ms  | 183 ms | 361 ms | 1430 ms | 4450 ms |
| With 2-port TOSM calibration   | 96 ms  | 364 ms | 721 ms | 2860 ms | 8900 ms |
| 100 kHz start frequency, 3 GHz stop frequency, AGC AUTO, 100 kHz measurement bandwidth   |        |        |        |         |         |
| With correction switched OFF   | 4.5 ms | 11 ms  | 18 ms  | 58 ms   | 129 ms  |
| With 2-port TOSM calibration   | 8.0 ms | 20 ms  | 32 ms  | 94 ms   | 235 ms  |
| 100 kHz start frequency, 3 GHz stop frequency, AGC AUTO, 300 kHz measurement bandwidth   |        |        |        |         |         |
| With correction switched OFF   | 4.0 ms | 10 ms  | 15 ms  | 47 ms   | 110 ms  |
| With 2-port TOSM calibration   | 7.0 ms | 17 ms  | 25 ms  | 88 ms   | 180 ms  |

<sup>2</sup> Sweep time is to be understood as cycle time; static frequency accuracy of the instrument applies; measured with firmware version 1.20, Windows 7.

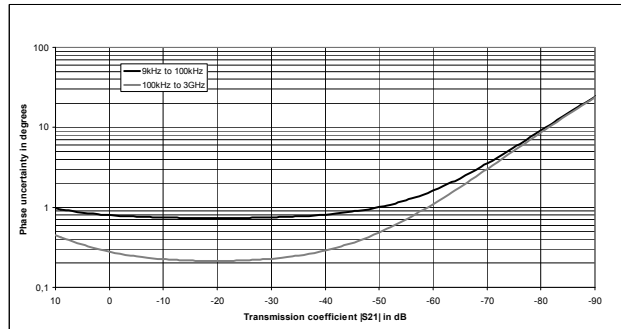
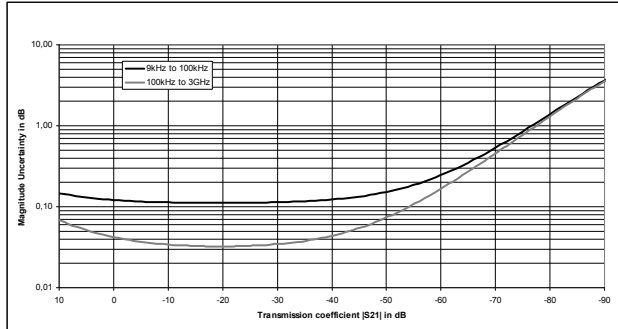
## Measurement accuracy

This data is valid between +18 °C and +28 °C, provided the temperature has not varied by more than 1 °C after calibration. Validity of the data is conditional on the use of an R&S® ZV-Z270 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).

### Accuracy of transmission measurements

|             |                  |                     |
|-------------|------------------|---------------------|
| Above 9 kHz | +5 dB to –35 dB  | < 0.05 dB or < 0.5° |
|             | –35 dB to –50 dB | < 0.1 dB or < 1°    |
|             | –50 dB to –60 dB | < 0.2 dB or < 2°    |

Specifications are based on a matched DUT, a measurement bandwidth of 10 Hz and a nominal source power of –10 dBm.

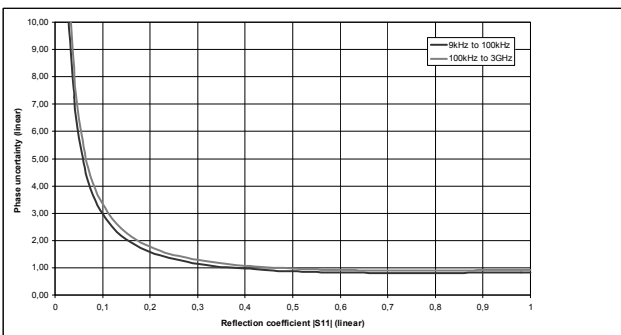
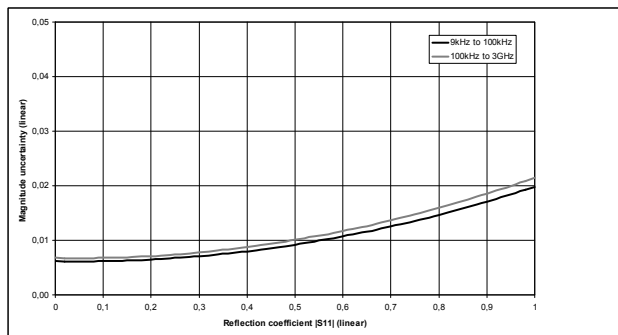


Typical accuracy of transmission magnitude and transmission phase measurements for the R&S® ZNC3 in the frequency range from 9 kHz to 3 GHz. Analysis conditions  $S_{11} = S_{22} = 0$ , cal. power –10 dBm, meas. power –10 dBm.

### Accuracy of reflection measurements

|                 |                  |                   |
|-----------------|------------------|-------------------|
| 9 kHz to 50 MHz | 0 dB to –15 dB   | < 0.3 dB or < 2°  |
|                 | –15 dB to –25 dB | < 0.8 dB or < 6°  |
|                 | –25 dB to –35 dB | < 3.0 dB or < 17° |
| 50 MHz to 3 GHz | 0 dB to –15 dB   | < 0.2 dB or < 2°  |
|                 | –15 dB to –25 dB | < 0.6 dB or < 4°  |
|                 | –25 dB to –35 dB | < 2.0 dB or < 12° |

Specifications are based on an isolating DUT, a measurement bandwidth of 10 Hz and a nominal source power of –10 dBm.



Typical accuracy of reflection magnitude and reflection phase measurements for the R&S® ZNC3 in the frequency range from 9 kHz to 3 GHz. Analysis conditions  $S_{12} = S_{21} = 0$ , cal. power –10 dBm, meas. power –10 dBm.

| Trace stability             |  |                    |                                  |
|-----------------------------|--|--------------------|----------------------------------|
| Trace noise magnitude (RMS) | at 0 dBm source power, 0 dB reflection | IF bandwidth       |                                  |
|                             | 9 kHz to 20 kHz                        | 1 kHz              | < 0.008 dB RMS, typ. 0.004 dB    |
|                             | 20 kHz to 100 kHz                      | 1 kHz              | < 0.004 dB RMS, typ. 0.001 dB    |
|                             | 100 kHz to 100 MHz                     | 10 kHz             | < 0.002 dB RMS, typ. 0.001 dB    |
|                             | 100 MHz to 3 GHz                       | 10 kHz             | < 0.004 dB RMS, typ. 0.002 dB    |
| Trace noise phase (RMS)     | at 0 dBm source power, 0 dB reflection | IF bandwidth       |                                  |
|                             | 9 kHz to 20 kHz                        | 1 kHz              | < 0.07° RMS, typ. 0.04° RMS      |
|                             | 20 kHz to 100 kHz                      | 1 kHz              | < 0.035° RMS, typ. 0.01° RMS     |
|                             | 100 kHz to 100 MHz                     | 10 kHz             | < 0.015° RMS, typ. 0.005° RMS    |
|                             | 100 MHz to 3 GHz                       | 10 kHz             | < 0.035° RMS, typ. 0.02° RMS     |
| Temperature dependence      | at 0 dB transmission or reflection     |                    |                                  |
|                             | 9 kHz to 3 GHz                         | magnitude<br>phase | typ. 0.01 dB/°C<br>typ. 0.15°/°C |

## Effective system data

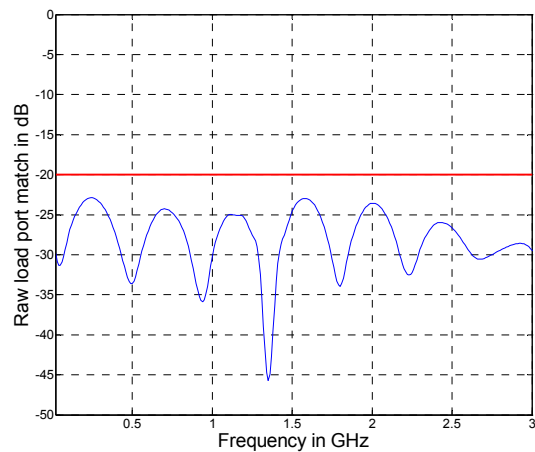
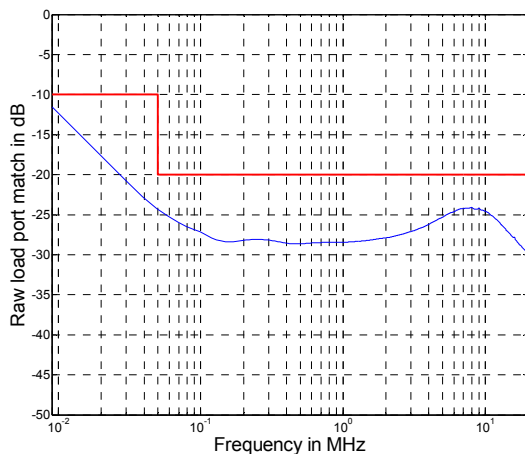
This data is valid between +18 °C and +28 °C, provided the temperature has not varied by more than 1 °C after calibration. The data is based on a measurement bandwidth of 10 Hz and system error calibration with an R&S®ZV-Z270 calibration kit. Frequency points, measurement bandwidth and sweep time have to be identical for measurement and calibration (no interpolation allowed).

|                              | 9 kHz to 100 kHz | 100 kHz to 3 GHz |
|------------------------------|------------------|------------------|
| <b>Directivity</b>           | 46               | 45               |
| <b>Source match</b>          | 41               | 40               |
| <b>Load match</b>            | 44               | 45               |
| <b>Reflection tracking</b>   | 0.02             | 0.02             |
| <b>Transmission tracking</b> | 0.028            | 0.018            |

## Factory-calibrated system data

This data is valid between +18 °C and +28 °C, provided the temperature has not varied by more than 1 °C after calibration. The data is based on a source power of -10 dBm and a measurement bandwidth of 1 kHz.

|                       |                 |                       |
|-----------------------|-----------------|-----------------------|
| Directivity           | 9 kHz to 50 kHz | > 20 dB, typ. 35 dB   |
|                       | 50 kHz to 3 GHz | > 30 dB, typ. 50 dB   |
| Source match          | 9 kHz to 50 kHz | > 20 dB, typ. 35 dB   |
|                       | 50 kHz to 3 GHz | > 30 dB, typ. 50 dB   |
| Reflection tracking   | 9 kHz to 3 GHz  | < 0.5 dB, typ. 0.1 dB |
| Load match            | 9 kHz to 50 kHz | > 10 dB, typ. 15 dB   |
|                       | 50 kHz to 3 GHz | > 20 dB, typ. 25 dB   |
| Transmission tracking | 9 kHz to 3 GHz  | < 0.5 dB, typ. 0.1 dB |

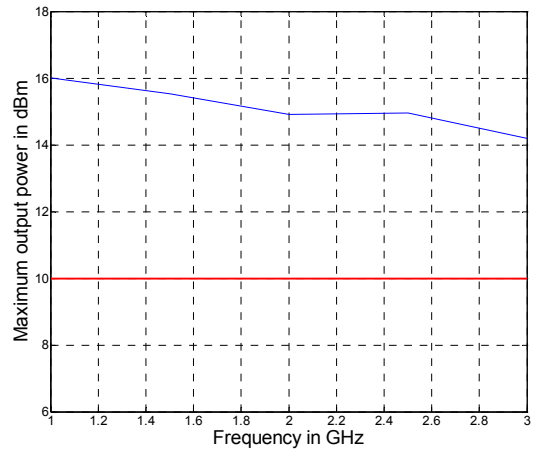
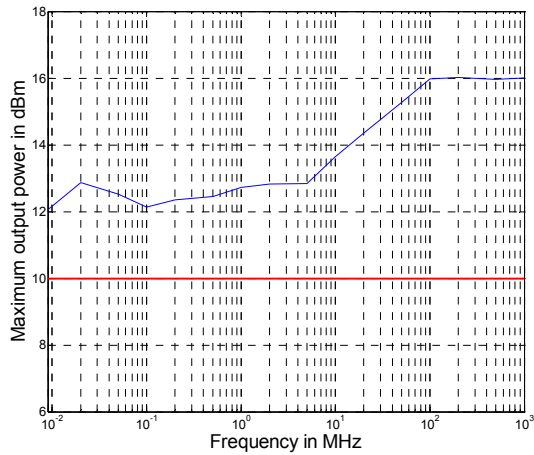


Raw load port match versus frequency for the R&S®ZNC3.

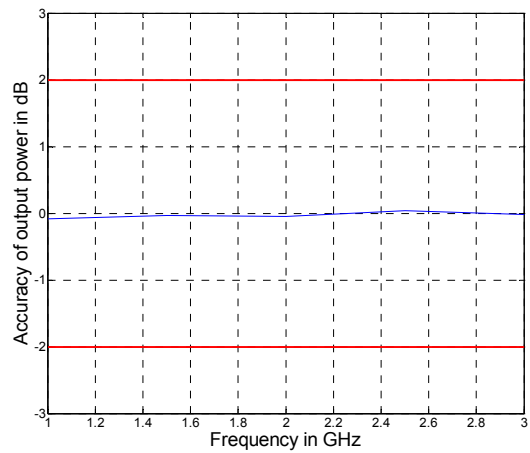
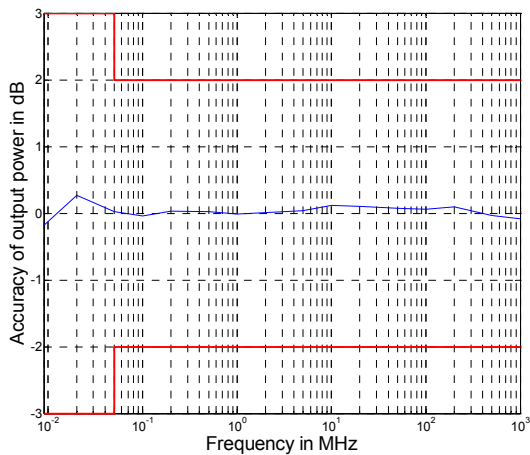
# Test port output

This data is valid from +18 °C to +28 °C.

|   |                        |                                  |
|---|------------------------|----------------------------------|
| Power range<br>(without R&S®ZNC3-B22 extended power range option) | 9 kHz to 100 MHz       | -10 dBm to +10 dBm, typ. +12 dBm |
|   | 100 MHz to 3 GHz       | -10 dBm to +10 dBm, typ. +13 dBm |
| Power range<br>(with R&S®ZNC3-B22 extended power range option)    | 9 kHz to 100 MHz       | -50 dBm to +10 dBm, typ. +12 dBm |
|   | 100 MHz to 3 GHz       | -50 dBm to +10 dBm, typ. +13 dBm |
| Power accuracy  | source power -10 dBm   |                                  |
|   | 9 kHz to 50 kHz        | < 3 dB                           |
|   | 50 kHz to 3 GHz        | < 2 dB, typ. 0.5 dB              |
| Power linearity   | referenced to -10 dBm  |                                  |
|   | source power ≥ -35 dBm | < 1 dB                           |
|   | source power < -35 dBm | < 2 dB                           |
| Power resolution  |                        | 0.01 dB                          |
| Harmonics   | at 0 dBm               |                                  |
|   | 20 kHz to 100 MHz      | typ. < -30 dBc                   |
|   | 100 MHz to 3 GHz       | < -25 dBc, typ. < -30 dBc        |



Maximum output power in dBm versus frequency for the R&S®ZNC3.



Output power accuracy in dB versus frequency for the R&S®ZNC3.



## Test port input

|                             |                                      |          |
|-----------------------------|--------------------------------------|----------|
| Match                       | without system error correction      |          |
|                             | 9 kHz to 50 kHz                      | > 10 dB  |
|                             | 50 kHz to 3 GHz                      | > 20 dB  |
| Maximum nominal input level |                                      | +13 dBm  |
| Power measurement accuracy  | at -10 dBm without power calibration |          |
|                             | 9 kHz to 100 kHz                     | < 2 dB   |
|                             | 100 kHz to 3 GHz                     | < 1 dB   |
| Receiver linearity          | referenced to -10 dBm                |          |
|                             | for +20 dB to +10 dB                 |          |
|                             | 9 kHz to 3 GHz                       | < 0.2 dB |
|                             | for +10 dB to -40 dB                 |          |
|                             | 9 kHz to 3 GHz                       | < 0.2 dB |
| Damage level                |                                      | +27 dBm  |
| Damage DC voltage           |                                      | 30 V     |

|             |   |                   |
|-------------|---|-------------------|
| Noise level | at 1 kHz measurement bandwidth,<br>normalized to 1 Hz |                   |
|             | 9 kHz to 100 kHz                                      | < -105 dBm (1 Hz) |
|             | 100 kHz to 3 GHz                                      | < -120 dBm (1 Hz) |

The noise level is defined as the RMS value of the specified noise floor.

## Additional front panel connectors

|            |   |
|------------|---|
| <b>USB</b> | (four) universal serial bus connectors for connecting USB devices (USB 2.0) |
|------------|---|

## Display

|                   |  |
|-------------------|--|
| <b>Screen</b>     | 30.7 cm (12.1") diagonal WXGA color LCD with touchscreen |
| <b>Resolution</b> | 1280 × 800 × 262144 (high color, 125 dpi)                |

## Rear panel connectors

|             |   |
|-------------|---|
| <b>GPIB</b> | optional remote control in line with IEEE 488, IEC60625; 24-pin |
|-------------|---|

|            |  |
|------------|--|
| <b>LAN</b> | local area network connector, 8-pin, RJ-45 |
|------------|--|

|                               |  |                                   |
|-------------------------------|--|-----------------------------------|
| <b>10 MHz REF</b>             | either input or output for external frequency reference signal |                                   |
| Connector type                |  | BNC, female                       |
| Input frequency range         |  | 1 MHz to 20 MHz in steps of 1 MHz |
| Maximum permissible deviation |  | 1 kHz                             |
| Input power                   |  | -10 dBm to +15 dBm                |
| Input impedance               |  | 50 Ω                              |
| Output frequency              |  | 10 MHz                            |
| Output frequency accuracy     |  | 80 Hz                             |
| Output power                  |  | +9 dBm ± 4 dB at 50 Ω             |

|                |                                      |
|----------------|--------------------------------------|
| <b>MONITOR</b> | DVI connector (for external monitor) |
|----------------|--------------------------------------|

|                                |   |  |
|--------------------------------|---|--|
| <b>USER CONTROL</b>            | several control and trigger signals, 25-pin D-Sub, 3.3 V TTL for controlling external generators, for limit checks, sweep signals, etc. |  |
| CHANNEL BIT 0 to CHANNEL BIT 3 | pin 8 to pin 11 (outputs)   | channel-specific, user-configurable bits                                     |
| CHANNEL BIT 4 to CHANNEL BIT 7 | pin 16 to pin 19 (outputs)  | channel-specific, user-configurable bits                                     |
| DRIVE PORT 1 to DRIVE PORT 4   | pin 16 to pin 19 (outputs)  | indicated drive ports (alternatively user-selectable to channel bits 4 to 7) |
| PASS 1 and PASS 2              | pin 13 and pin 14 (outputs)   | pass/fail results of limit checks  |
| BUSY                           | pin 4 (output)  | measurements running   |
| READY FOR TRIGGER              | pin 6 (output)  | ready for trigger  |
| EXT GEN TRIGGER                | pin 21 (output)   | control signal for external generator  |
| EXT GEN BLANK                  | pin 22 (input)  | handshake signal from external generator                                     |
| EXTERNAL TRIGGER               | pin 2 (input)   | first trigger input for analyzer, 5 V tolerant                               |
| EXTERNAL TRIGGER 2             | pin 25 (input)  | second trigger input for analyzer, 5 V tolerant                              |

|                                       |                            |                      |
|---------------------------------------|----------------------------|----------------------|
| <b>EXT TRIGGER</b>                    | trigger input for analyzer |                      |
| Connector type                        |                            | BNC, female          |
| TTL signal (edge- or level-triggered) |                            | 3 V, 5 V tolerant    |
| Polarity (selectable)                 |                            | positive or negative |
| Minimum pulse width                   |                            | 1 $\mu$ s            |
| Input impedance                       |                            | > 10 k $\Omega$      |

## Option

### R&S<sup>®</sup>ZNC3-B22

|                             |                           |                                  |
|-----------------------------|---------------------------|----------------------------------|
| <b>Extended power range</b> |                           |                                  |
| Frequency range             | R&S <sup>®</sup> ZNC3-B22 | 9 kHz to 3 GHz                   |
| Power range                 | 9 kHz to 100 MHz          | -50 dBm to +10 dBm, typ. +12 dBm |
|                             | 100 MHz to 3 GHz          | -50 dBm to +10 dBm, typ. +13 dBm |

## General data

|                       |  |   |
|-----------------------|--|---|
| Temperature loading   | in line with IEC 60068-2-1 and IEC 60068-2-2 |   |
|                       | operating temperature range                  | +5 °C to +40 °C   |
|                       | storage temperature range                    | -20 °C to +60 °C  |
| Damp heat             |  | +40 °C at 85 % rel. humidity,<br>in line with IEC 60068-2-30  |
| Altitude              | operating environment                        | max. 2000 m   |
|                       | storage environment                          | max. 4500 m   |
| Mechanical resistance | vibration, sinusoidal                        | 5 Hz to 55 Hz, 0.15 mm amplitude<br>constant,<br>55 Hz to 150 Hz, 0.5 g constant,<br>in line with IEC 60068-2-6   |
|                       | vibration, random                            | 10 Hz to 300 Hz, acceleration 1.2 g (RMS)<br>in line with IEC 60068-2-64  |
|                       | shock  | 40 g shock spectrum,<br>in line with MIL-STD-810E method<br>no. 516.4 procedure I   |
| Calibration interval  |  | 1 year  |
| EMC, RF emission      |  | in line with CISPR 11/EN 55011 group 1<br>class A (for a shielded test setup);<br>the instrument complies with the emission<br>requirements stipulated by EN 55011 and<br>EN 61326-1 class A; this means that the<br>instrument is suitable for use in industrial<br>environments |
| EMC, immunity         |  | in line with EMC Directive 2004/108/EC<br>including: IEC/EN 61326-1 (immunity test<br>requirement for industrial environment,<br>EN 61326 table 2), IEC/EN 61326-2-1,<br>IEC/EN 61000-3-2, IEC/EN 61000-3-3   |
| Safety                |  | in line with IEC 61010-1, EN 61010-1 and<br>UL 61010-1  |
| Power supply          |  | 100 V to 240 V at<br>50 Hz to 60 Hz,<br>max 1.8 A to 0.8 A respectively   |
| Power consumption     |  | max. 160 W, typ. 110 W  |
| Test mark             |  | VDE, GS, cCSA <sub>US</sub> , CE conformity mark  |
| Dimensions            | W × H × D                                    | 461.1 mm × 239.9 mm × 351.0 mm<br>(18.2 in × 9.6 in × 13.9 in)  |
| Weight                |  | 13.5 kg (29.7 lbs)  |
| Shipping weight       |  | 18.5 kg (40.8 lbs)  |

## Ordering information

| Designation                             | Type          | Order No.    |
|---|---------------|--------------|
| <b>Base unit</b>                        |               |              |
| Vector Network Analyzer, 3 GHz, 2 ports | R&S® ZNC3     | 1311.6004K12 |
| <b>Options</b>                          |               |              |
| Extended Power Range                    | R&S® ZNC3-B22 | 1316.1752.02 |
| GPIB Interface                          | R&S® ZNC-B10  | 1316.1617.02 |
| Time Domain Analysis                    | R&S® ZNC-K2   | 1316.1630.02 |
| 19" Rackmount Kit                       | R&S® ZZA-KN5  | 1175.3040.00 |

| <b>Service options</b>                                 |             |   |
|--|-------------|---|
| Two-Year Calibration Service                           | R&S® CO2ZNB | Please contact your local Rohde & Schwarz sales office. |
| Three-Year Calibration Service                         | R&S® CO3ZNB |   |
| Five-Year Calibration Service                          | R&S® CO5ZNB |   |
| One-Year Repair Service following the warranty period  | R&S® RO2ZNB |   |
| Two-Year Repair Service following the warranty period  | R&S® RO3ZNB |   |
| Four-Year Repair Service following the warranty period | R&S® RO5ZNB |   |

For product brochure, see PD 5214.5610.12 and [www.rohde-schwarz.com](http://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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