R&S®ZNL
Vector Network Analyzer
The 3-in-1 allrounder

3 year warranty

ROHDE & SCHWARZ

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R&S®ZNL
Vector Network Analyzer
At a glance

Measuring equipment for RF applications must satisfy high quality standards. Instruments should be easy to use and offer high versatility. Fast measurements and reliable performance are crucial. The R&S®ZNL meets these challenges and offers even more: it combines the functionality of a vector network analyzer, a spectrum analyzer and a power meter in a single, compact box.

With frequency ranges from 5 kHz to 3 GHz or 6 GHz, the R&S®ZNL is well suited for RF component tests in industrial electronics and wireless communications.

Responding to constantly changing measurement needs in diverse environments, e.g. on test benches or production lines, can be challenging. The R&S®ZNL helps to reduce investment costs as it offers a unique option concept. The base unit can be extended with a fully integrated spectrum analyzer[1]. Moreover, the R&S®ZNL can be used as an RF power meter[2].

Instead of investing in multiple instruments, research labs, service centers, universities and production facilities can benefit from a single, compact instrument that offers even higher measurement speed and better RF performance than dedicated instruments in comparable classes.

The instrument simultaneously displays vector network analysis and spectrum analysis measurements on its 10.1" multitouch screen. Clear menu structures and numerous wizards make measurements convenient to configure.

Although the R&S®ZNL hosts a variety of different functionalities, it is a very compact instrument with an attractive form factor. With a weight of only 6 kg to 8 kg, a carrying handle and an optional battery pack, the R&S®ZNL is fully portable and can be operated wherever needed.

[1] R&S®ZNL3-B1 or R&S®ZNL6-B1 option.
[2] R&S®FPL1-K9 option; requires R&S®ZNL3-B1 or R&S®ZNL6-B1 option and an R&S®NRP external power sensor.

R&S®ZNL Vector Network Analyzer

Benefits and key features

Key features
- Frequency range from 5 kHz to 3 GHz (R&S®ZNL3) or 6 GHz (R&S®ZNL6)
- Two-port vector network analyzer for bidirectional measurements
- Universal instrument:
  - Vector network analyzer
  - Fully integrated spectrum analyzer (optional, for both R&S®ZNL3 and R&S®ZNL6)
  - Support for external power sensor
- Wide dynamic range of typ. 130 dB
- Output power range from –40 dBm to typ. + 3 dBm
- Measurement bandwidths from 1 Hz to 500 kHz
- Fast measurements, e.g. 16.7 ms for 401 points (100 kHz IFBW, 200 MHz span, 2-port TOSM (SOLT))
- Compact size, low weight (6 kg to 8 kg)
- Optional battery pack
- Windows 10 operating system

The 3-in-1 analyzer: compact vector network analyzer
- Solid RF performance
- Versatile features for lab and production
- Time domain analysis and distance-to-fault (DTF) measurements
- Compact 3-in-1 instrument
- Remote control via LAN and optional GPIB interface

The 3-in-1 analyzer: fully integrated spectrum analyzer
- Integrated hardware for solid RF performance
- Spectrum analyzer function
- Analog demodulation
- Digital demodulation

The 3-in-1 analyzer: RF power meter
- Precise power measurements

User interface with multitouch screen
- Clear menu structures for efficient operation
- Large 10.1" touchscreen for convenient operation
- Integrated PC
- Simultaneous display of multiple measurement modes with MultiView function

Fully portable – ideal for field use
- Battery and DC power supply for field use
- Accessories for transport and field use

The 3-in-1 analyzer: compact vector network analyzer

The R&S®ZNL combines the functionality of a vector network analyzer, a spectrum analyzer and a power meter in a single, compact box. The all-in-one instrument is ideal for environments that involve constantly changing test requirements in development, production and service.

Solid RF performance

Vector network analyzers such as the R&S®ZNL can characterize electronic networks in the frequency domain, e.g. by measuring the magnitude and phase of S-parameters. Components can also be analyzed in the time domain with the R&S®ZNL-K2 option.

High dynamic range

The R&S®ZNL features a wide dynamic range of up to 130 dB (typ.: at 10 Hz IFBW) and an output power of 3 dBm (typ.). These values facilitate measurements on high-rejection filters that call for a wide dynamic range.
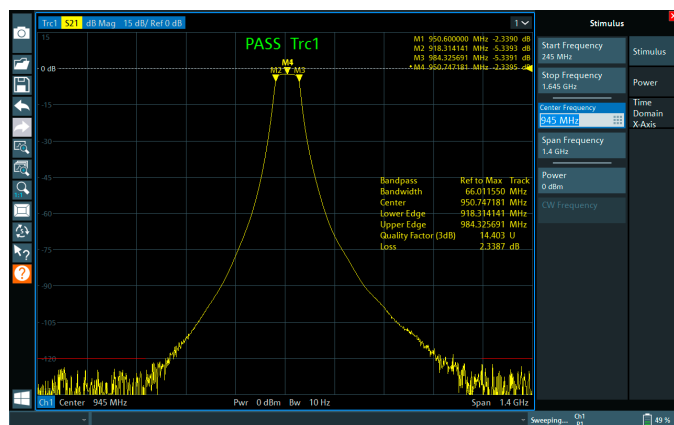
Low trace noise for high accuracy

The R&S®ZNL offers low trace noise of less than 0.0005 dB (typ.: at 10 kHz IFBW). This delivers stable, reproducible and precise measurements even at higher IF bandwidths. Using higher IF bandwidths, the R&S®ZNL can perform faster measurements while maintaining the stability normally only achieved with narrower IF bandwidths.

Measurement on a high-rejection bandpass filter using the bandpass filter function.

Fast measurements for high throughput

With measurement times of e.g. 16.7 ms for 401 points (full two-port calibration, 200 MHz span, 100 kHz IFBW), high-speed data processing and fast LAN or IEC/IEEE/GPIB data transfer, the R&S®ZNL meets the speed requirements encountered in production. Throughput can be maximized by using the segmented sweep function. Here, the frequency axis is divided into segments, and sweep parameters such as output power, IF bandwidth and number of points can be defined separately for each segment to optimally match the DUT characteristics. This increases measurement speed without any loss in accuracy.

Fixture compensation menu, showing the available compensation methods.
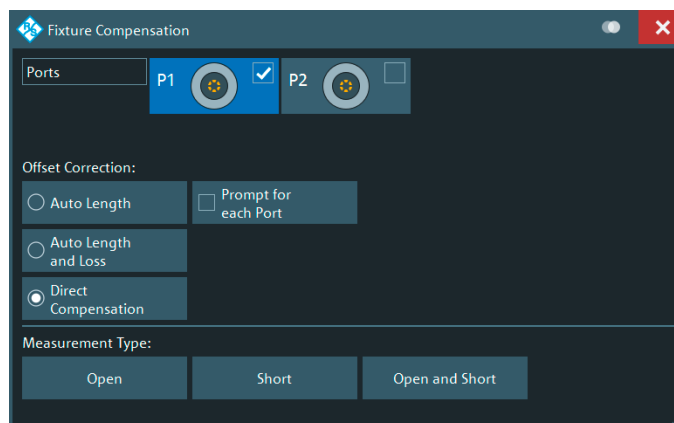
Features for production and lab

Versatile calibration features, support for calibration units

The R&S®ZNL calibration wizard guides users through the calibration process. Manual calibration kits and automatic calibration units are supported. Using a calibration unit minimizes the time needed to perform full system error correction. The calibration unit is ready for use right after it is connected to the R&S®ZNL. Calibrating a setup takes just a few steps. This is especially advantageous in production environments, helping to save time and maximize throughput. The calibration unit performs calibration with a single click on the "Start Auto Cal" button.

De/embedding and fixture compensation

Components are often specified together with the networks that match them to the impedance of the surrounding circuit. To characterize such components in a production environment, the R&S®ZNL can embed the DUT into a virtual matching network to provide realistic conditions by simulating the DUT installed in its operational environment. The R&S®ZNL offers a choice of predefined matching network topologies. It is also possible to read touchstone files into the R&S®ZNL and use them for embedding/deembedding. In addition, fixture compensation is available for correcting measurement results. This feature eliminates the unwanted effects of a test fixture or adapter located between the calibrated reference plane and the DUT.

Remote control via LAN and optional GPIB interface

The R&S®ZNL can be remotely controlled via its standard LAN interface. The optional GPIB interface can be used to connect a controller for remote control of the R&S®ZNL. Data is transmitted bidirectionally on the 8-bit parallel bus. The data measured during a sweep is transferred to the controller while the next sweep is in progress. As a result, data transfer time on the R&S®ZNL is virtually negligible.

Time domain analysis and distance-to-fault (DTF) measurements

The R&S®ZNL offers powerful time domain analysis (R&S®ZNL-K2 option) to measure components such as filters and high-speed digital data cables in the frequency and time domain.

With 100001 points per trace, the R&S®ZNL can measure electrically long DUTs such as long cables without any limitations. The gating function of the R&S®ZNL makes it easy to locate cable faults and analyze them in detail.
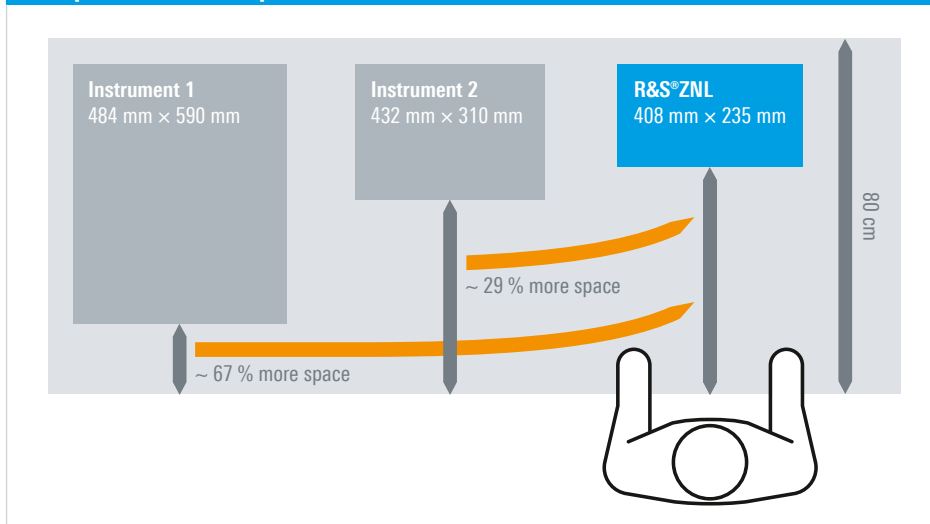
The distance-to-fault measurements option (R&S®ZNL-K3) allows the detection of cable discontinuities, which is important for base station antenna installation, for example. Users can select from a range of common cable types with predefined velocity factor and frequency-dependent attenuation, or create their own cable profiles. The R&S®ZNL-K2 and R&S®ZNL-K3 options use internal DC extrapolation. The low start frequency of 5 kHz is helpful as it provides improved accuracy.

Compact 3-in-1 instrument

With a depth of less than 24 cm and a weight of only 6 kg to 8 kg, the R&S®ZNL is the most compact instrument in its class. The small footprint leaves plenty of space on the workbench – more than with any other comparable benchtop analyzer.

With the R&S®ZNL3-B1 or R&S®ZNL6-B1 spectrum analyzer option installed, even more space is saved as the instrument offers the functionality of two analyzers in the same compact size. Adding support for R&S®NRP power sensors additionally provides power meter functionality, turning the R&S®ZNL into a 3-in-1 allrounder with a network analyzer, spectrum analyzer and power meter in a single box.

Comparison of footprint of different VNAs

Instrument 1
484 mm × 590 mm

Instrument 2
432 mm × 310 mm

R&S®ZNL
408 mm × 235 mm

80 cm

~ 29 % more space

~ 67 % more space

The 3-in-1 analyzer: fully integrated spectrum analyzer

The spectrum analyzer function includes an I/Q analyzer, which is the standard function for digital signal analysis. This application provides measurement and display functions for I/Q data. The captured I/Q data can be transferred to third-party software tools (e.g. Matlab® or Python) for further analysis. The 40 MHz analysis bandwidth option (R&S®FPL1-B40) allows single-carrier signals with up to 40 MHz bandwidth to be analyzed and demodulated.

Different modes of operation turn the R&S®ZNL vector network analyzer into a versatile multipurpose instrument. The R&S®ZNL3-B1/R&S®ZNL6-B1 hardware option extends the base unit with a fully integrated spectrum analyzer on a dedicated hardware board. There is no need to reboot the instrument in order to switch between different modes.
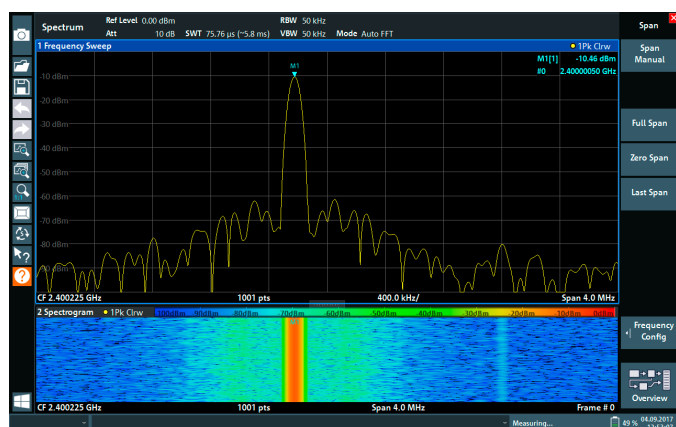
Integrated hardware for solid RF performance
The R&S®ZNL3-B1 and R&S®ZNL6-B1 options are dedicated hardware boards, delivering performance comparable to that of pure spectrum analyzers in the economy and midrange classes. The R&S®ZNL equipped with the spectrum analyzer hardware features a phase noise of typ. –108 dBc (1 Hz) at 10 kHz offset, a third-order intercept point of typ. +20 dBm, and a displayed average noise level (DANL) of typ. –150 dBm.

Spectrum analyzer function
In the spectrum analyzer mode, the instrument provides functions corresponding to those of a conventional spectrum analyzer. The analyzer measures the frequency spectrum of the RF input signal over the selected frequency range with the selected resolution and sweep time. Alternatively, it displays the waveform of the video signal for a fixed frequency. This application requires the R&S®ZNL3-B1 or R&S®ZNL6-B1 spectrum analyzer option.
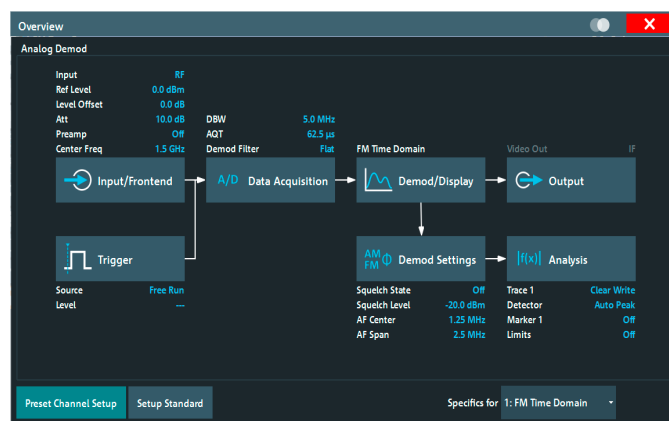
Analog demodulation
The R&S®FPL1-K7 option adds analog demodulation capabilities to the R&S®ZNL. It determines the characteristics of amplitude, frequency and phase modulated signals and also measures other components such as residual FM and synchronous modulation. Typical applications of the R&S®FPL1-K7 include:
▪ Transient and settling time measurements of oscillators like VCOs and PLLs
▪ Troubleshooting of AM/FM transmitters
▪ Simple chirp analysis of pulsed and continuous wave signals

Digital demodulation
The R&S®ZNL equipped with an R&S®ZNL3-B1 or R&S®ZNL6-B1 option can analyze and demodulate digitally modulated single-carrier signals with up to 40 MHz analysis bandwidth. The R&S®ZNL receives and digitizes the signal, which is then analyzed by the R&S®VSE vector signal explorer software with the R&S®VSE-K70 and/or R&S®VSE-K106 option. The software runs directly on the R&S®ZNL or an external PC.

Spectrum analyzer mode: the R&S®ZNL provides the full functionality of a standard spectrum analyzer.

Overview of analog demodulation menu: all setting functions are accessible here.

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The 3-in-1 analyzer: RF power meter

Precise power measurements

The R&S®FPL1-K9 option adds support for R&S®NRP power sensors [1], enabling precise power measurements. This application requires the R&S®ZNL3-B1 or R&S®ZNL6-B1 spectrum analyzer option to be installed.

Power sensors can be connected via USB or via the ruggedized power sensor connector included in the R&S®FPL1-B5 additional interfaces option.

Up to four power sensors can be connected in parallel. Power sensors can also be used to trigger measurements at defined power levels.

[1] The R&S®NRP power sensors supported by R&S®FPL1-K9 are listed in the R&S®ZNL data sheet.

Examples of R&S®NRP power sensors: R&S®NRP8SN and R&S®NRP8S
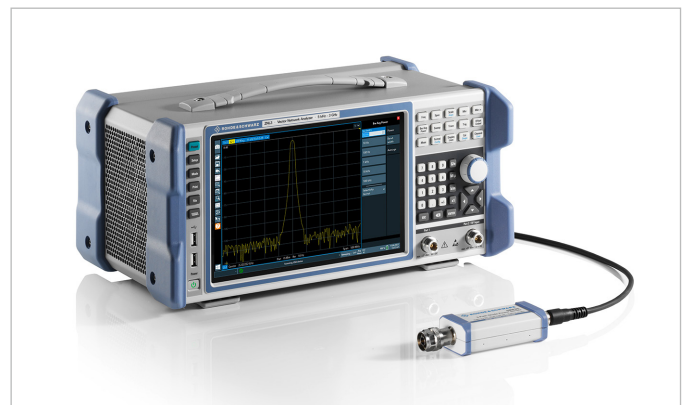
The R&S®ZNL with the R&S®FPL1-K9 option supports external R&S®NRP power sensors to deliver precise power measurements.

Clearly structured user interface

10.1" high-resolution touchscreen
▪ 1280 × 800 pixel

Toolbar
▪ Fast access to standard functions such as print, save/open file, undo, redo, help

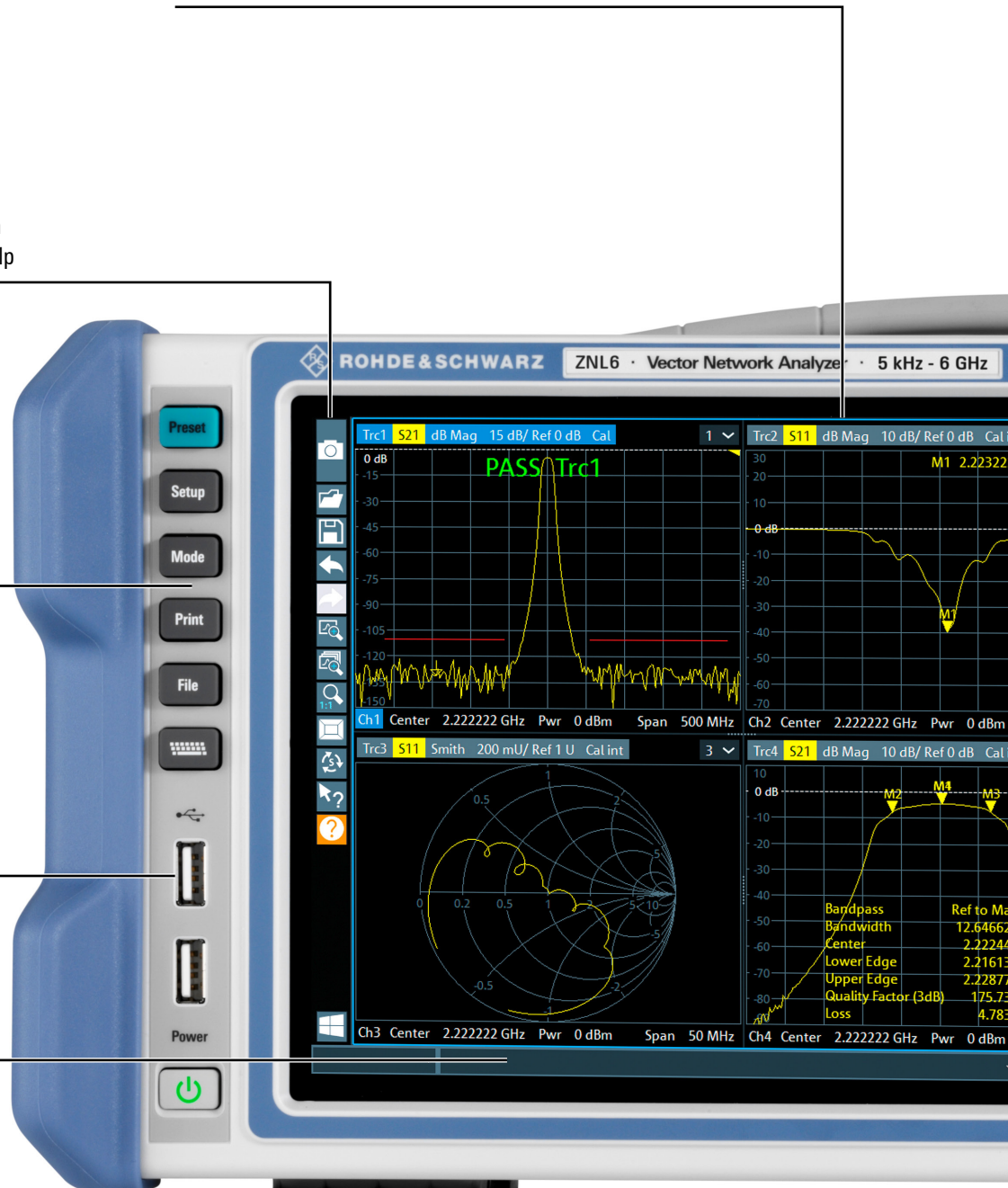**System keys**
▪ For setups, presets, etc.

Two USB 2.0 ports
▪ For storage media
▪ For accessories

Status bar

Softkey bar
◗ Quick access to key functions
◗ Hardware settings at a glance

Numerical keypad
◗ With unit keys for frequency and level

Function keys

Control knob

Port 1

Port 2/RF input

User interface with multitouch screen

Clear menu structures for efficient operation

The R&S®ZNL has a clearly structured user interface. Measurements can be configured in just a few steps.

Users can drag and drop traces, channels and diagrams to arrange and combine them in any desired way. Different instrument setups can be saved and reloaded, and switching between setups is possible with minimal effort.

The R&S®ZNL offers a variety of marker functions for efficient analysis of the measured trace:

❙ Up to ten markers per trace are available. Results are represented in different formats such as magnitude, phase, impedance, admittance and VSWR.
❙ The unit of the marker can be chosen independently of the displayed trace format.
❙ Markers and traces can be named to describe the specific application.
❙ Available marker functions include maximum, minimum, RMS and peak-to-peak detection, as well as bandwidth measurement, etc.

Moreover, the user can define limit lines to verify compliance of the DUT with specified values and required standards.

Large 10.1" touchscreen for convenient operation

The large 10.1" multitouch screen allows users to arrange measurement tasks as required and move and combine traces, channels and diagrams by using the drag-and-drop function.

Integrated PC

With its fully integrated, powerful PC platform running the Windows 10 operating system, the R&S®ZNL is a standalone solution. There is no need for an external PC or controller. The analyzer's solid state hard disk ensures fast boot-up time and high reliability to satisfy the most demanding requirements.

Simultaneous display of multiple measurement modes with MultiView function

To support full DUT characterization, the MultiView function simultaneously displays all active vector network analyzer, spectrum analyzer and power meter measurements. Measurements are updated in real time and can be accessed directly by tapping on the desired window.

With the test sequencer activated in MultiView mode, vector network analyzer measurements and spectrum analyzer measurements can be performed alternately.

In MultiView mode, all active measurements are displayed at the same time. Here, a vector network analyzer measurement (two different representations) is displayed along with a spectrum analyzer measurement.

Fully portable – ideal for field use

Due to its unique hardware concept, the R&S®ZNL combines multiple functionalities in a compact form factor. Its weight is correspondingly low. Depending on the options installed, the R&S®ZNL weighs between 6 kg and 8 kg.

Battery and DC power supply for field use
With a carrying handle and an optional battery pack (R&S®FPL1-B31), the R&S®ZNL is a fully portable instrument ideal for field use.

The optional 12 V/24 V DC power supply (R&S®FPL1-B30) is available for operation of the R&S®ZNL in vehicles.

Accessories for transport and field use
For transport and field deployment of the R&S®ZNL, the optional R&S®FPL1-Z2 transport bag protects the instrument against damage and the ingress of dirt. Side vents and a transparent top cover allow portable operation while the instrument is safely stored in the bag. A carrying vest holster (R&S®FPL1-Z3 option) is also available.

For outdoor use in challenging light conditions, the instrument display can be equipped with an anti-glare film (R&S®FPL1-Z5 option). This improves the contrast of the display and protects the screen against scratches.

The R&S®ZNL can be stowed and carried in a robust transport bag.

Rear view of the R&S®ZNL with battery compartment. The batteries can be easily accessed.

Specifications in brief

Specifications in brief		
Network analysis		
Frequency range	R&S®ZNL3	5 kHz to 3 GHz
	R&S®ZNL6	5 kHz to 6 GHz
Dynamic range		>120 dB (spec.); typ. >130 dB
Output power		0 dBm (spec.); typ. + 3 dBm
Trace noise		<0.0035 dB (spec.); typ. < 0.0005 dB
Measurement speed		
Sweep time	401 points, 2-port TOSM, 200 MHz span, 100 kHz IFBW	16.7 ms
Data transfer	over IEC/IEEE/GPIB, 201 points	typ. 3 ms
	HiSLIP over 1 Gbit/s LAN	typ. 2.5 ms
Measurement parameters		S-parameters (S_{xy}), wave quantities, wave ratios, impedance parameters (Z_{xy}), admittance parameters (Y), stability factors
Display formats		dB, magnitude, phase, Smith chart, polar diagram, SWR, unwrapped phase, linear magnitude, inverse Smith chart, real, imaginary, delay
Calibration methods		reflection normalization (open or short), reflection (OSM (OSL)), enhanced reflection normalization (OM or SM), transmission normalization (response calibration), transmission normalization in both directions (response calibration), one-path two-port, TOSM (SOLT)
Number of points	vector network analyzer mode	1 to 100 001
	spectrum analyzer mode	101 to 100 001
IF bandwidth (IFBW)		1 Hz to 500 kHz, in steps of 1/1.5/2/3/5/7
Spectrum analysis (R&S®ZNL3 with R&S®ZNL3-B1 or R&S®ZNL6 with R&S®ZNL6-B1 option)		
Frequency range	R&S®ZNL3	5 kHz to 3 GHz (1 Hz resolution)
	R&S®ZNL6	5 kHz to 6 GHz (1 Hz resolution)
Displayed average noise level (DANL)	RF attenuation 0 dB	<−140 dBm (spec.); typ. <−150 dBm
Phase noise	1 GHz, 10 kHz offset	<−103 dBc (1 Hz); <−108 dBc (1 Hz)
Max. signal analysis bandwidth	with R&S®FPL1-B40 option	40 MHz
Intermodulation		
Third-order intercept point (TOI)	300 MHz ≤ f_{in} ≤ 3 GHz	>16 dBm (spec.); typ. >20 dBm
Second harmonic intercept (SHI)	900 MHz ≤ f_{in} ≤ 1.5 GHz	70 dBm (nom.)
General features		
Limit lines	vector network analyzer mode	single, segmented, upper limit, lower limit
Number of channels	within one vector network analyzer setup	no limitation
Number of channel setups		max. 14
Number of traces (simultaneous display)	vector network analyzer mode	no limitation
	spectrum analyzer mode (R&S®ZNL3-B1/ZNL6-B1 option)	6
Number of markers	vector network analyzer mode	10 + 1 reference marker (per trace)
	spectrum analyzer mode (R&S®ZNL3-B1/ZNL6-B1 option)	16
General data		
Operating system		Windows 10
Display		10.1" (26.4 cm) WXGA color LCD, touchscreen
Dimensions (W × H × D)		408 mm × 186 mm × 235 mm (16.06 in × 7.32 in × 9.25 in)
Weight	depending on configuration	6 kg to 8 kg (13.23 lb to 17.64 lb)

Ordering information

Designation	Type	Order No.
Base unit		
Vector network analyzer, 5 kHz to 3 GHz, two ports, N (f)	R&S®ZNL3	1323.0012.03
Vector network analyzer, 5 kHz to 6 GHz, two ports, N (f)	R&S®ZNL6	1323.0012.06
Hardware options		
Spectrum analyzer function for R&S®ZNL3	R&S®ZNL3-B1	1323.1802.02
Spectrum analyzer function for R&S®ZNL6	R&S®ZNL6-B1	1323.2067.02
Extended power range for R&S®ZNL3	R&S®ZNL3-B22	1323.1860.02
Extended power range for R&S®ZNL6	R&S®ZNL6-B22	1323.2021.02
Receiver step attenuator for R&S®ZNL3 port 1	R&S®ZNL3-B31	1323.1848.02
Receiver step attenuator for R&S®ZNL3 port 2	R&S®ZNL3-B32	1323.1854.02
Receiver step attenuator for R&S®ZNL6 port 1	R&S®ZNL6-B31	1323.2038.02
Receiver step attenuator for R&S®ZNL6 port 2	R&S®ZNL6-B32	1323.2044.02
Additional removable HDD	R&S®ZNL-B19	1323.2938.02
OCXO accurate reference frequency	R&S®FPL1-B4	1323.1902.02
Additional interfaces	R&S®FPL1-B5	1323.1883.02
GPIB interface	R&S®FPL1-B10	1323.1890.02
DC power supply (12 V/24 V)	R&S®FPL1-B30	1323.1877.02
Lithium-ion battery pack	R&S®FPL1-B31	1323.1725.02
40 MHz analysis bandwidth [1]	R&S®FPL1-B40	1323.1931.02
Software options		
Time domain analysis	R&S®ZNL-K2	1323.1819.02
Distance-to-fault measurements	R&S®ZNL-K3	1323.1825.02
AM/FM/φM analog modulation analysis [1]	R&S®FPL1-K7	1323.1731.02
Measurements with R&S®NRP power sensors [1]	R&S®FPL1-K9	1323.1754.02
Noise figure measurements [1,3]	R&S®FPL1-K30	1323.1760.02
License dongle [2]	R&S®FSPC	1310.0002.03
Vector signal explorer base software [2]	R&S®VSE	1345.1011.06
Vector signal analysis [2]	R&S®VSE-K70	1320.7522.06
EUTRA/LTE NB-IoT/narrowband IoT analysis [2]	R&S®VSE-K106	1320.7900.06
Recommended extras		
Calibration kits		
Calibration kit, N (m), 50 Ω, 0 Hz to 9 GHz	R&S®ZV-Z170	1317.7683.02
Calibration kit, N (f), 50 Ω, 0 Hz to 9 GHz	R&S®ZV-Z170	1317.7683.03
Calibration kit, 3.5 mm (m), 50 Ω, 0 Hz to 15 GHz	R&S®ZV-Z135	1317.7677.02
Calibration kit, 3.5 mm (f), 50 Ω, 0 Hz to 15 GHz	R&S®ZV-Z135	1317.7677.03
Calibration units		
Calibration unit, 2 ports, N (f), 5 kHz to 6 GHz	R&S®ZN-Z150	1335.6710.72
Calibration unit, 2 ports, SMA (f), 100 kHz to 8.5 GHz	R&S®ZN-Z151	1317.9134.32
Cables		
N (m)/N (m), 50 Ω, length: 0.6 m/0.9 m, 0 Hz to 18 GHz	R&S®ZV-Z191	1306.4507.24/36
N (m)/3.5 mm (m), 50 Ω, length: 0.6 m/0.9 m, 0 Hz to 18 GHz	R&S®ZV-Z192	1306.4513.24/36
3.5 mm (f)/3.5 mm (m), 50 Ω, length: 0.6 m/0.9 m, 0 Hz to 26.5 GHz	R&S®ZV-Z193	1306.4520.24/36
Accessories		
Protective hard cover	R&S®FPL1-Z1	1323.1960.02
Transport bag, with transparent cover	R&S®FPL1-Z2	1323.1977.02
Carrying vest holster	R&S®FPL1-Z3	1323.1683.02
Spare battery pack	R&S®FPL1-Z4	1323.1677.02
Anti-glare film	R&S®FPL1-Z5	1323.1690.02
For a list of the R&S®NRP power sensors supported by R&S®FPL1-K9, refer to the R&S®ZNL data sheet.		

[1] Requires R&S®ZNL3-B1 or R&S®ZNL6-B1 hardware option.
[2] Use of R&S®VSE with R&S®ZNL requires R&S®ZNL3-B1 or R&S®ZNL6-B1 hardware option.
[3] Requires R&S®FPL1-B5 hardware option for noise source control.

Warranty

Warranty		
Base unit		3 years
All other items [1]		1 year
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 with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

[1] For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

From pre-sale to service.
At your doorstep.

The Rohde & Schwarz network in over 70 countries ensures optimum on-site support by highly qualified experts.
User risks are reduced to a minimum at all stages of the project:
▮ Solution finding/purchase
▮ Technical startup/application development/integration
▮ Training
▮ Operation/calibration/repair

- Sales locations
- Lead service centers
- Service centers

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Gumi City
Tokyo
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Osaka
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UAE
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India
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Oman
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Shenzhen
Taiwan
Hyderabad
Hanoi
Kaohsiung
Hong Kong
Vietnam
Bangalore
Thailand
Ho Chi Minh City
Philippines
Penang
Malaysia
Selangor
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South Africa
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Service that adds value
▪ Worldwide
▪ Local and personalized
▪ Customized and flexible
▪ Uncompromising quality
▪ Long-term dependability

Rohde & Schwarz
The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

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▪ Energy efficiency and low emissions
▪ Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
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