Test & Measurement

- sales
- rentals
- calibration
- repair
- disposal

Complimentary Reference Material

This PDF has been made available as a complimentary service for you to assist in evaluating this model for your testing requirements.

TMG offers a wide range of test equipment solutions, from renting short to long term, buying refurbished and purchasing new. Financing options, such as Financial Rental, and Leasing are also available on application.
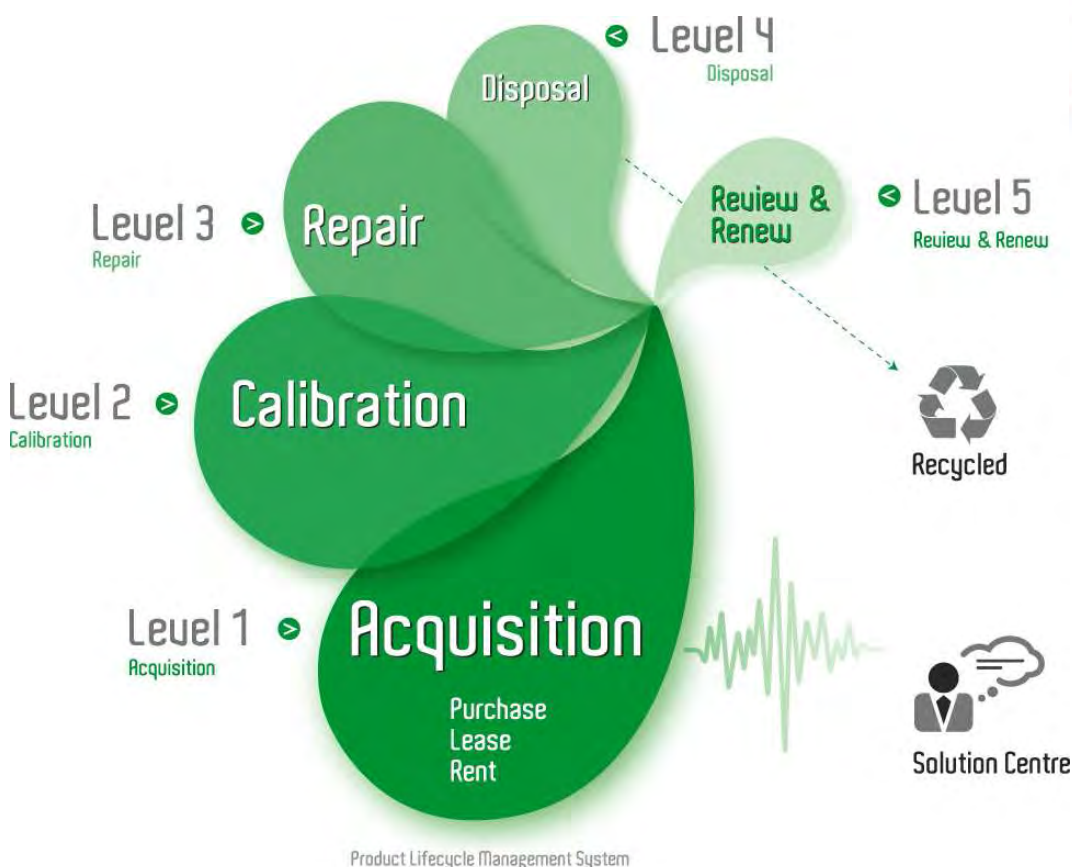
TMG will assist if you are unsure whether this model will suit your requirements.

Call TMG if you need to organise repair and/or calibrate your unit.

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TMG Corporate Website   **TMG Products Website**

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Solution Centre

Product Lifecycle Management System

NATA

CERTIFIED MANAGEMENT SYSTEM

R&S®ZVH
Cable and
Antenna Analyzer
Where mobility counts

ROHDE & SCHWARZ

R&S®ZVH Cable and Antenna Analyzer
At a glance

The R&S®ZVH cable and antenna analyzer is rugged, handy and designed for use in the field. Its low weight and simple operation make it indispensable for anyone who needs an efficient measuring instrument outdoors for the installation and maintenance of antenna systems.

When it comes to the installation or maintenance of antenna systems for mobile radio, broadcasting or radiocommunications, the R&S®ZVH cable and antenna analyzer performs fast, reliable and highly accurate measurements. Even in its basic configuration, the R&S®ZVH detects cable faults, measures the matching of filters and amplifiers and checks the loss of cable connections – the three most important tasks involved in setting up transmitter systems and putting them into operation. For further measurements such as the isolation between transmit and receive antennas or the output power of output amplifiers, suitable options are available to the RF service engineer or maintenance team.

Weighing only 3 kg, the R&S®ZVH is a handy instrument. Frequently used functions have their own function keys and are within reach of your fingertips. The built-in wizard lets users perform even extended test sequences fast and flawlessly. The R&S®ZVHView software makes it easy to generate test reports in just a few operating steps.

The brilliant color display is easy to read even under poor lighting conditions, and it has a monochrome mode for extreme conditions. The capacity of the R&S®ZVH battery enables uninterrupted operation for up to 4.5 hours. The battery is changed within seconds. And if it rains? No problem – all connectors are splash-proof.

Key facts
❙ Frequency range from 100 kHz to 3.6 GHz or 8 GHz
❙ Typ. 100 dB dynamic range for filter and antenna isolation measurements
❙ Built-in DC voltage supply (bias) for active components such as amplifiers
❙ Power meter option
❙ Saving of measurement results on SD memory card or USB memory stick
❙ Easy operation with user-configurable test sequences (wizard)
❙ Easy-to-replace Li-ion battery for up to 4.5 h of operation
❙ Rugged, splash-proof housing for rough work in the field
❙ Easy handling due to low weight (3 kg with battery) and easy-to-reach function keys

Distance-to-fault measurement at a mobile radio antenna system with the R&S®ZVH.

R&S®ZVH
Cable and
Antenna Analyzer
Benefits and
key features

Installation and maintenance of antenna systems
❚ Distance-to-fault measurements
❚ One-port cable loss measurements
❚ Reflection measurements
❚ Transmission measurements
❚ Built-in DC voltage supply
❚ Terminating power measurements
❚ Directional power measurements
❚ Position finding using GPS receiver
❚ Spectrum analysis measurements
❚ Spectrogram measurements
▷ page 4

Easy operation
❚ Test report in just a few steps using the R&S®ZVH wizard
❚ Channel tables for frequency setting
❚ Optimal reading of measurement results in any situation
❚ Operation in different languages
❚ Easy-to-access, well-protected connectors
▷ page 8

Documentation and remote control
❚ R&S®ZVHView software for documenting measurement results
❚ Remote control via LAN or USB
▷ page 12

Easy-to-replace Li-ion battery for up to 4.5 h of operation.

Installation and maintenance of antenna systems

The R&S®ZVH is designed for the installation and mainte-
nance of antenna systems for mobile radio. For this pur-
pose, it provides all the important measurement functions
for setting up and maintaining the system:
ı Distance-to-fault measurements on cables and one-port
  cable loss measurements
ı Measuring of antenna match

Additional amplifiers, multiplexers and filters are fre-
quently integrated in antenna systems. The R&S®ZVH-K39
transmission measurement option measures the trans-
mission characteristics of components as well as the
isolation between the transmit and the receive antenna.
If the mobile station does not emit enough power even
though the antenna system is in proper working order, the
R&S®ZVH-K9 option and a power sensor transform the
R&S®ZVH into a power meter that can determine the out-
put power of the base station quickly and accurately.

Distance-to-fault measurements
Pinched cables and loose or corroded cable connections
severely impair the transmission of the transmit or receive
signal. The distance-to-fault function measures the exact
distance to the location of the fault. A threshold value de-
fines which cable faults are out of tolerance and are to be
added to the list of faults. This considerably simplifies the
evaluation of the measurement.

Distance-to-fault (DTF) measurement.

List display of cable faults that exceed a predefined threshold.

4

One-port cable loss measurement.

Reflection measurement.

Display of current position during a transmission measurement with R&S®HA-Z240 GPS receiver connected.

One-port cable loss measurements

The R&S®ZVH makes it easy to determine the cable loss of already installed cables. Simply connect one end of the cable to the R&S®ZVH test port and terminate the other end with a short or leave it open.

Reflection measurements

A reflection measurement measures with high precision the matching of antennas and amplifiers. The measurement is based on vector system error correction. Results are displayed either as return loss (dB) or as VSWR.

Transmission measurements

The R&S®ZVH-K39 option is used to measure the transmission characteristics of components such as filters and amplifiers. The R&S®ZVH delivers insertion loss or gain characteristics in just a few operating steps. The high dynamic range of typically up to 100 dB enables the user to measure the isolation between antennas.

Position finding using GPS receiver

By using the R&S®HA-Z240 GPS receiver, the R&S®ZVH documents where a measurement is carried out. The display indicates the longitude, latitude and altitude of the site. If required, the position can be stored together with the measurement results for documentation purposes.

Built-in DC voltage supply

The built-in DC bias supplies power to active DUTs such as amplifiers at both test ports via the RF cable. This function is especially useful for tower-mounted amplifiers (TMA). The voltage of the internal DC source can be set in steps as small as 1 V in the range from 12 V to 32 V. The maximum current is 500 mA. If the power delivered by the internal source is not sufficient, an external voltage source of max. 50 V and 600 mA can be connected to supply active components, usually amplifiers.

Terminating power measurements

When equipped with R&S®NRP-Zx or R&S®FSH-Zx terminating power sensors and the R&S®ZVH-K9 option, the R&S®ZVH becomes an accurate RF power meter with a measurement range from –67 dBm to +45 dBm. Whichever sensor is used, the true RMS value of the measured signal is obtained over the whole measurement range regardless of the signal waveform. For this reason, the sensors are especially suitable for measurements involving GSM/EDGE, WCDMA/HSDPA, CDMA2000® 1xEV-DO or LTE as well as future digital standards. Using the R&S®FSH-Z101 or R&S®NRP-Z4 USB adapter cable, the power sensors can also be connected directly to a laptop.

Directional power measurements

The R&S®ZVH-K9 option in combination with the R&S®FSH-Z14 and R&S®FSH-Z44 directional power sensors transforms the R&S®ZVH into a full-featured directional power meter for the frequency ranges from 25 MHz to 1 GHz and from 200 MHz to 4 GHz. The R&S®ZVH can then simultaneously measure the output power and the matching of antennas in transmitter systems under operating conditions. The power sensors measure average power up to 120 W and normally eliminate the need for any extra attenuators. They are compatible with the common GSM/EDGE, 3GPP WCDMA, cdmaOne, CDMA2000® 1xEV-DO, LTE, DVB-T and DAB standards. In addition, the peak envelope power (PEP) up to max. 300 W can be determined. Using the R&S®FSH-Z144 USB adapter cable, the directional power sensors can also be connected directly to a laptop.

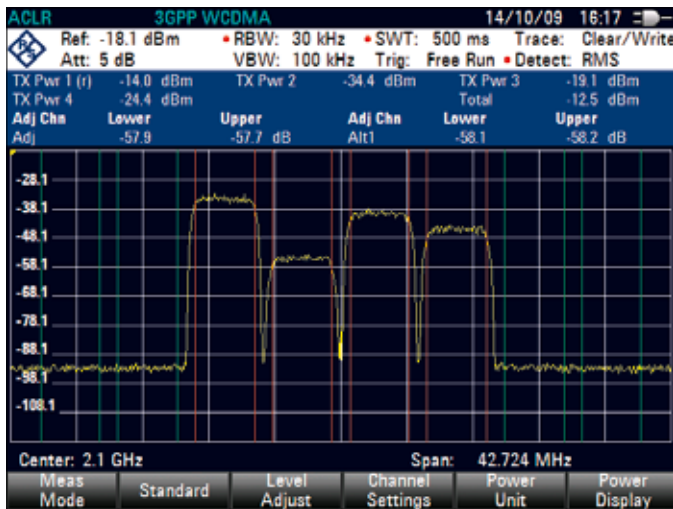Terminating power measurement.
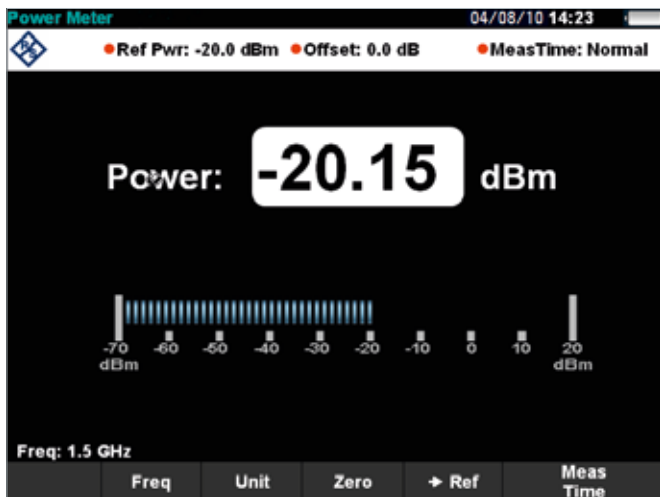
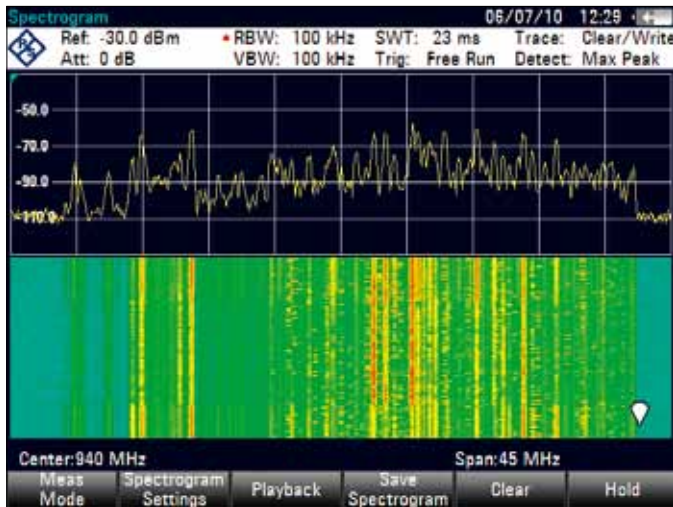Measurement of the forward (TX output) and the reflected power of an antenna.
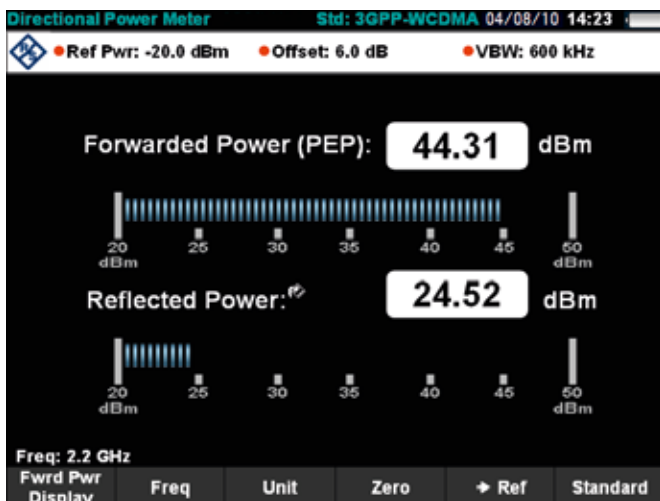
CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA - USA).

6

ACLR measurement on a 3GPP WCDMA signal with four carriers.

Simultaneous display of spectrum and spectrogram.

Spectrum analysis measurements

The R&S®ZVH-K1 option equips the R&S®ZVH for spectrum analysis measurements and offers the following measurement functions:

❙ Channel power
❙ Occupied bandwidth
❙ Power on pulsed TDMA signals
❙ Adjacent channel power (ACLR)
❙ Spurious emissions (spectrum emission mask)
❙ Modulation spectrum on pulsed signals with gated sweep
❙ Field strength with directional or isotropic antenna
❙ Harmonic distortion
❙ AM modulation depth
❙ Frequency counter
❙ Noise marker
❙ AM/FM audio frequency demodulator

Spectrogram measurements

Equipped with the R&S®ZVH-K14 spectrogram measurement application, the R&S®ZVH can provide a history of the spectrum. This application can be used to analyze intermittent faults or time-dependent frequency and level variations. Specific analyses can be made by replaying recorded data and setting time lines and markers.

The R&S®ZVH with terminating power sensor.

The R&S®ZVH with directional power sensor.

Easy operation

The built-in wizard lets users run even complex test sequences for the installation and maintenance of antenna systems easily and quickly. All frequently used functions such as calibration, frequency, marker and measurement functions are directly accessible via keys.

All basic settings can be conveniently made in a straightforward list. Measurement results including instrument settings are saved to the internal memory or the replaceable SD memory card or the USB memory stick. Predefined instrument settings can be locked to prevent them from being changed unintentionally. This reduces the risk of incorrect measurements.

User-defined test sequences can be selected and started using the WIZARD key. For documentation purposes, the contents of a screenshot can be saved as a graphics file.
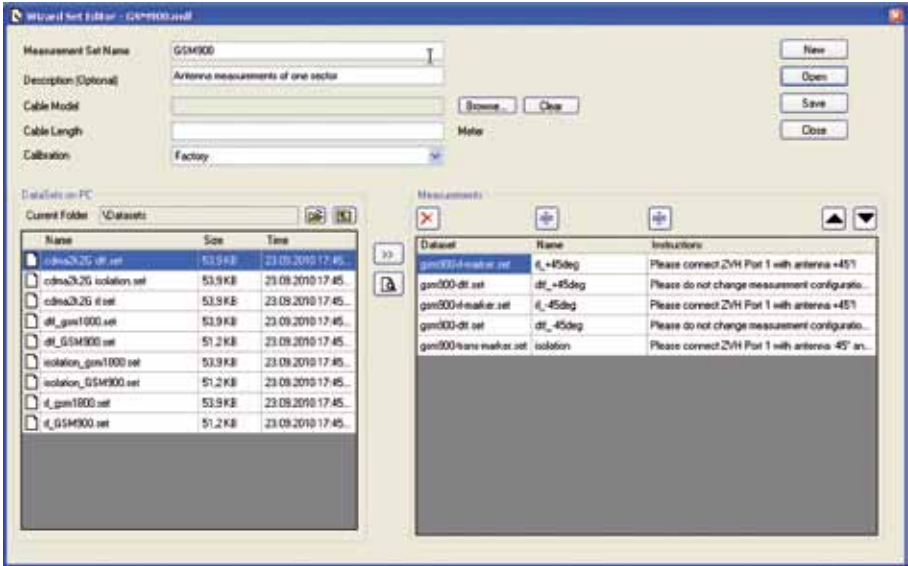
By using the wizard definition editor in R&S®ZVHView, predefined instrument settings can be combined into test sequences on a PC and then transferred to the R&S®ZVH.
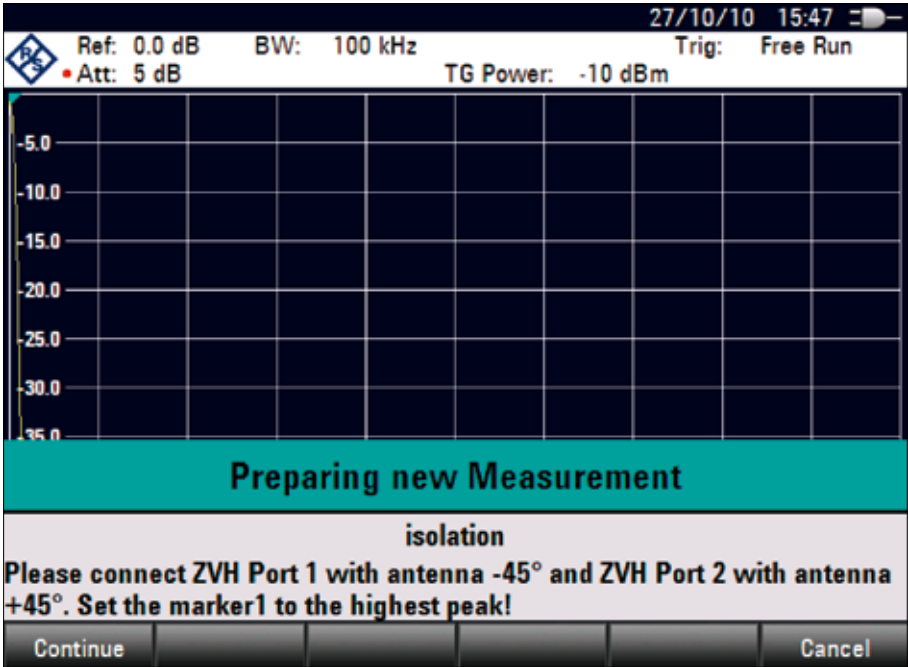
Each individual measurement in a test sequence can be assigned comments providing helpful information to the user.

Test report in just a few steps using the R&S®ZVH wizard

When an antenna is being installed, the customer usually requests a test report. The required measurements are defined in test instructions. The R&S®ZVH wizard makes this procedure easy for the user and eliminates the need to consult the installation instructions. Configuring the R&S®ZVH wizard is very simple:

First, the user makes the instrument settings on the R&S®ZVH for each of the individual measurements as described in the test instructions, saves them and transfers them to a PC. Next, using the wizard definition editor on the PC, the user combines the settings of all individual measurements into a single test sequence. Here, the user can assign each measurement a comment with instructions for the field engineer. This comment will then be displayed on the R&S®ZVH at the beginning of the measurement. Last, the user transfers the data set containing the complete test sequence to the R&S®ZVH. After the test sequence is started on the instrument, the dialog-based wizard guides the user through the measurements and automatically saves the results.

Consequently, for the user on site, it takes only four steps to generate a test report:

1st step: Select the test sequence via the WIZARD key
2nd step: Perform the specified measurements
3rd step: Save the results on the R&S®ZVH
4th step: Transfer the measurement results to the PC and generate a test report

The advantages for the user:
∎ Easy creation of test sequences using the wizard
∎ Incorrect measurements are avoided due to predefined test sequences
∎ No need to consult test instructions
∎ Reproducible measurement results
∎ Time is saved by speeding up the installation process
∎ All members of an installation team use the same test sequence
∎ Uniform test report format
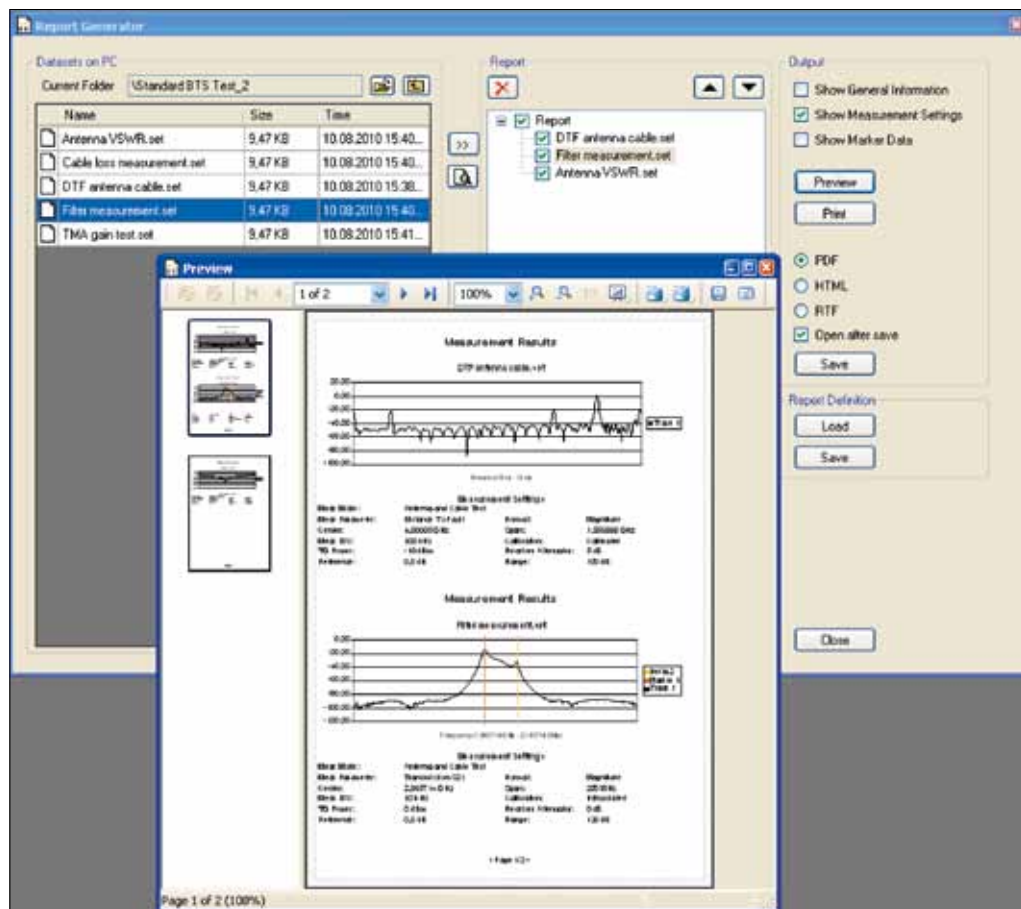
With just a few mouse clicks, the individual results of a test sequence are combined into a conclusive test report.

Channel tables for frequency setting

As an alternative to entering a frequency, can be tuned using the R&S®ZVH channel numbers. The channel number is displayed in addition to the center frequency. Users who are familiar with the channel assignments commonly used in wireless communications or TV/broadcast applications can operate the R&S®ZVH even more easily. For a large number of countries, channel tables for the GSM, 3GPP WCDMA, TD-SCDMA, CDMA2000® and LTE wireless communications standards as well as TV channel tables are supplied with the R&S®ZVH.

Optimal reading of measurement results in any situation

The measurement results on the bright, straightforward 6.5" VGA color display are very easy to read. The backlighting of the display can be adjusted to the ambient lighting conditions. For use in extremely strong sunlight, a special monochrome mode provides optimal contrast.

Operation in different languages

The user interface of the R&S®ZVH is available in various languages. Almost all of the softkeys, operating instructions and messages will then be displayed in the selected language. The R&S®ZVH supports the following languages: English, Korean, Japanese, Chinese, Russian, Italian, Spanish, Portuguese, French, Hungarian and German.

Easy-to-access, well-protected connectors

Additional inputs/outputs such as the DC voltage supply (bias), interfaces and the SD memory card are easily accessible under dust-proof hinged covers on the side of the instrument.

Selecting the channel table.

Additional connectors (e.g. for SD memory card and USB interface) are protected by hinged covers.

Control elements

RF input

Connector for headphones

| External trigger input
| External reference input
| Bias input
| Connector for GPS receiver

LAN/USB interface
for remote control

Simple menu-based
operation via softkeys

Function keys

Kensington lock

Wizard for calling up user-
defined test sequences

Tracking generator output

Connector for power sensor

SD memory card/USB interface

Color LCD (640 × 480 pixel), can be switched
to high-contrast monochrome display in
extreme sunlight

Selection of operating mode (cable and
antenna measurements, power measure-
ment, etc.)

Selection of measurement function
(distance-to-fault, reflection or transmission
measurement, etc.)

General instrument setup

Screenshot

Rotary knob with Enter button

Cursor keys

Documentation and remote control

R&S®ZVHView software for documenting measurement results

The R&S®ZVHView software makes it easy to define test sequences, administer instrument settings and document measurement results. The report function, with just a few mouse clicks, combines the individual results of a test sequence into a test report that is saved in .pdf, .html or .rtf format. R&S®ZVHView comes with the R&S®ZVH.

R&S®ZVHView offers users the following advantages:
▪ Fast data exchange between the R&S®ZVH and a PC via a USB or LAN connection
▪ Easy further processing of measurement results by means of data export in ASCII or Excel format
▪ Storage of graphics data in .bmp, .pcx, .png and .wmf format
▪ Generation of user-defined test sequences (wizard)
▪ Easy creation of test reports in. pdf, .html and .rtf format
▪ Printout of all relevant data via Windows PC
▪ Simple comparison of measurement results
▪ Subsequent analysis of measurement results by displaying/hiding and shifting markers
▪ Subsequent display of limit lines
▪ Generation of cable data using an integrated cable editor and downloading to the R&S®ZVH for distance-to-fault measurement
▪ Editor for generating limit lines and channel lists
▪ Compatible with Windows XP, Vista and Windows 7

Remote control via LAN or USB

The R&S®ZVH can be remote controlled via the USB or LAN interface and can therefore be integrated into user-specific programs. The SCPI-compatible remote control commands are activated by the R&S®ZVH-K40 option.

The R&S®ZVHView software.
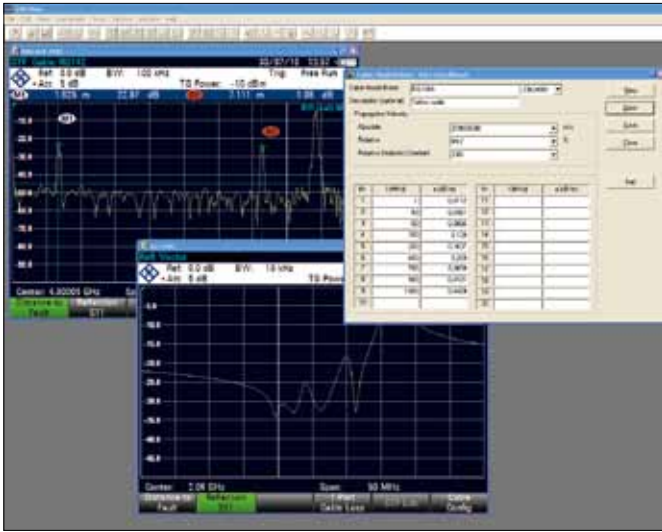
The R&S®ZVH with a laptop.

Specifications in brief

Specifications in brief		R&S®ZVH4	R&S®ZVH8
Frequency range		100 kHz to 3.6 GHz	100 kHz to 8 GHz
Standard measurement functions		reflection measurement, distance-to-fault measurement, one-port cable loss measurement	
Output power (port 1, port 2)		0 dBm to –40 dBm (nominal), in 1 dB steps	
Maximum permissible spurious signal level		+17 dBm (nominal)	
Number of points		631	
Distance-to-fault (DTF) measurement			
Display modes		return loss (dB), VSWR	
Resolution in meters		(1.58 × velocity factor/span)	
Horizontal display range		3 m to 1500 m	
Reflection measurement			
Directivity	100 kHz to 3 GHz (nominal)	> 43 dB (nominal)	> 43 dB (nominal)
	3 GHz to 3.6 GHz	> 37 dB (nominal)	> 37 dB (nominal)
	3.6 GHz to 6 GHz	–	> 37 dB (nominal)
	6 GHz to 8 GHz	–	> 31 dB (nominal)
Display modes		return loss (dB), VSWR, one-port cable loss	
Transmission measurement (R&S®ZVH-K39)			
Dynamic range (S_{21})	100 kHz to 300 kHz	> 50 dB (nominal)	> 50 dB (nominal)
	300 kHz to 2.5 GHz	> 80 dB, typ. 100 dB	> 80 dB, typ. 100 dB
	2.5 GHz to 3.6 GHz	> 70 dB, typ. 90 dB	> 70 dB, typ. 90 dB
	3.6 GHz to 6 GHz	–	> 70 dB, typ. 90 dB
	6 GHz to 8 GHz	–	> 50 dB (nominal)
Display modes		magnitude in dB (loss, gain)	
DC voltage supply (DC bias, port 1 and port 2)			
Voltage range	internal voltage supply	+12 V to +32 V, in 1 V steps	
Maximum output power		4 W (battery), 10 W (AC supply)	
Maximum current		500 mA	
Maximum voltage	external voltage supply	50 V	
Maximum current		600 mA	
General data			
Display		6.5" color LCD with VGA resolution	
Battery operating time	R&S®HA-Z204, 4.5 Ah	up to 3 h	
	R&S®HA-Z206, 6.75 Ah	up to 4.5 h	
Dimensions (W × H × D)		194 mm × 300 mm × 69 mm (144 mm) [1], (7.6 in × 11.8 in × 2.7 in (5.7 in)) [1]	
Weight		3 kg, (6.6 lb)	

[1] With carrying handle.

Ordering information

Designation	Type	Order No.
Base unit		
Cable and Antenna Analyzer, 100 kHz to 3.6 GHz	R&S®ZVH4	1309.6800.24
Cable and Antenna Analyzer, 100 kHz to 8 GHz	R&S®ZVH8	1309.6800.28
Accessories supplied		
Li-ion battery pack (4.5 Ah), USB cable, LAN cable, plug-in power supply, CD-ROM with R&S®ZVHView software and documentation, quick start guide		
Software options (usually via software license)		
Spectrum Analysis Application	R&S®ZVH-K1	1309.6823.02
Power Meter Measurement Application, R&S®FSH-Zx power sensors or R&S®NRP-Zx power sensors + R&S®NRP-Z4 required	R&S®ZVH-K9	1309.6852.02
Spectrogram Measurement Application	R&S®ZVH-K14	1309.7007.02
Transmission Measurement Application	R&S®ZVH-K39	1309.6830.02
Remote Control via USB or LAN Application	R&S®ZVH-K40	1309.7013.02
Accessories		
RF Cable (length 1 m), N male/N female connectors for R&S®FSH-K41 option, DC to 8 GHz	R&S®FSH-Z320	1309.6600.00
RF Cable (length 3 m), N male/N female connectors for R&S®FSH-K41 option, DC to 8 GHz	R&S®FSH-Z321	1309.6617.00
Combined Open/Short/50 Ω Load Calibration Standard, for calibrating the VSWR and DTF measurements, DC to 3.6 GHz	R&S®FSH-Z29	1300.7510.03
Combined Open/Short/50 Ω Load Calibration Standard, for calibrating the VSWR and DTF measurements, DC to 8 GHz	R&S®FSH-Z28	1300.7810.03
Matching Pad, 50 Ω/75 Ω, bidirectional, 0 Hz to 2.7 GHz, N female/N male connectors, load capacity 2 W, series resistor 25 Ω	R&S®RAZ	0358.5714.02
Matching Pad, 50 Ω/75 Ω, bidirectional, 0 Hz to 2.7 GHz, N female/N male connectors, load capacity 2 W, L section	R&S®RAM	0358.5414.02
Matching Pad, 50 Ω/75 Ω, bidirectional, 0 Hz to 1 GHz, BNC female/N male connectors, load capacity 1 W	R&S®FSH-Z38	1300.7740.02
Li-Ion Battery Pack, 4.5 Ah	R&S®HA-Z204	1309.6130.00
Li-Ion Battery Pack, 6.75 Ah	R&S®HA-Z206	1309.6146.00
Battery Charger for Li-ion battery pack, 4.5 Ah/6.75 Ah [1]	R&S®HA-Z203	1309.6123.00
12 V Car Adapter	R&S®HA-Z202	1309.6117.00
Soft Carrying Bag (W × H × D: 260 mm × 360 mm × 280 mm)	R&S®HA-Z220	1309.6175.00
Hard Case	R&S®HA-Z221	1309.6181.00
Carrying Holster including chest harness and rain cover	R&S®HA-Z222	1309.6198.00
SD Memory Card, 2 Gbyte	R&S®HA-Z232	1309.6223.00
GPS Receiver	R&S®HA-Z240	1309.6700.03
Spare USB Cable	R&S®HA-Z211	1309.6169.00
Spare LAN Cable	R&S®HA-Z210	1309.6152.00
Spare AC Power Supply	R&S®HA-Z201	1309.6100.00
Power sensors supported by the R&S®ZVH-K9 option (average power measurement)		
Power Sensor, 200 pW to 200 mW, 10 MHz to 8 GHz	R&S®FSH-Z1	1155.4505.02
Power Sensor, 200 pW to 200 mW, 10 MHz to 18 GHz	R&S®FSH-Z18	1165.1909.02
Directional Power Sensor, 30 mW to 300 mW, 25 MHz to 1 GHz	R&S®FSH-Z14	1120.6001.02
Directional Power Sensor, 30 mW to 300 W, 200 MHz to 4 GHz	R&S®FSH-Z44	1165.2305.02
USB Adapter Cable for R&S FSH-Z1/-Z18, length 1.8 m	R&S FSH-Z101	1164.6242.02
USB Adapter Cable for R&S®FSH-Z14/-Z44, length 1.8 m	R&S®FSH-Z144	1145.5909.02
Universal Power Sensor [2], 200 pW to 200 mW, 10 MHz to 8 GHz	R&S®NRP-Z11	1138.3004.02
Universal Power Sensor [2], 200 pW to 200 mW, 10 MHz to 18 GHz	R&S®NRP-Z21	1137.6000.02
Universal Power Sensor [2], 2 nW to 2 W, 10 MHz to 18 GHz	R&S®NRP-Z22	1137.7506.02
Universal Power Sensor [2], 20 nW to 15 W, 10 MHz to 18 GHz	R&S®NRP-Z23	1137.8002.02
Universal Power Sensor [2], 60 nW to 30 W, 10 MHz to 18 GHz	R&S®NRP-Z24	1137.8502.02
Universal Power Sensor [2], 200 pW to 200 mW, 10 MHz to 33 GHz	R&S®NRP-Z31	1169.2400.02

Designation	Type	Order No.
Wideband Power Sensor [2], 1 nW to 100 mW, 50 MHz to 18 GHz	R&S®NRP-Z81	1137.9009.02
Thermal Power Sensor [2], 1 µW to 100 mW, DC to 18 GHz	R&S®NRP-Z51	1138.0005.02
Thermal Power Sensor [2], 1 µW to 100 mW, DC to 40 GHz	R&S®NRP-Z55	1138.2008.02
Thermal Power Sensor [2], 300 nW to 100 mW, DC to 50 GHz	R&S®NRP-Z56	1171.8201.02
Thermal Power Sensor [2], 300 nW to 100 mW, DC to 67 GHz	R&S®NRP-Z57	1171.8401.02
Average Power Sensor [2], 200 pW to 200 mW, 9 kHz to 6 GHz	R&S®NRP-Z91	1168.8004.02
Average Power Sensor [2], 2 nW to 2 W, 9 kHz to 6 GHz	R&S®NRP-Z92	1171.7005.02
USB Adapter (passive) for connecting R&S®NRP-Zx power sensors to the R&S®ZVH	R&S®NRP-Z4	1146.8001.02

[1] Battery charger is required to charge the battery pack outside the R&S®ZVH4/R&S®ZVH8.
[2] For the R&S®NRP-Zx power sensors, the R&S®NRP-Z4 USB adapter is also required.

Service options		
Two-Year Calibration Service	R&S®CO2ZVH	Please contact your local Rohde&Schwarz sales office.
Three-Year Calibration Service	R&S®CO3ZVH	
Five-Year Calibration Service	R&S®CO5ZVH	
One-Year Repair Service following the warranty period	R&S®RO2ZVH	
Two-Year Repair Service following the warranty period	R&S®RO3ZVH	
Four-Year Repair Service following the warranty period	R&S®RO5ZVH	

For data sheet, see PD 5214.4588.22 and www.rohde-schwarz.com.

Your local Rohde&Schwarz expert will help you determine the optimum solution for your requirements.
To find your nearest Rohde&Schwarz representative, visit
www.sales.rohde-schwarz.com

The rugged R&S®HA-Z221 hard case with extendible handle
and transport wheels provides sufficient room for the
R&S®ZVH and the R&S®ZVH accessories.

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

Rohde & Schwarz GmbH & Co. KG

www.rohde-schwarz.com

Regional contact

❚ Europe, Africa, Middle East
+49 89 4129 123 45
customersupport@rohde-schwarz.com
❚ North America
1 888 TEST RSA (1 888 837 87 72)
customer.support@rsa.rohde-schwarz.com
❚ Latin America
+1 410 910 79 88
customersupport.la@rohde-schwarz.com
❚ Asia/Pacific
+65 65 13 04 88
customersupport.asia@rohde-schwarz.com

5214458812