

# R&S® ZVH

## Cable and Antenna Analyzer

### Operating Manual



1309.6946.12 – 01

The Operating Manual describes the following R&S® ZVH models and options

- R&S ZVH4 (1309.6800.24)
- R&S ZVH8 (1309.6800.28)
- R&S ZVH-K9 (1309.6852.02)
- R&S ZVH-K39 (1309.6830.02)

© 2010 Rohde & Schwarz GmbH & Co. KG

Muehldorfstr. 15, 81671 Munich, Germany

Phone: +49 89 4129-0

Fax: +49 89 4129-12 164

E-mail: [info@rohde-schwarz.com](mailto:info@rohde-schwarz.com)

Internet: <http://www.rohde-schwarz.com>

81671 Munich, Germany

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The following abbreviations are used throughout this manual:

R&S® ZVH is abbreviated as R&S ZVH.

## Basic Safety Instructions

### Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.

### Symbols and safety labels

						
Observe product documentation	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

### Tags and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.

	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	indicates the possibility of incorrect operation which can result in damage to the product.

In the product documentation, the word ATTENTION is used synonymously.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

### Operating states and operating positions

*The product may be operated only under the operating conditions and in the positions specified by the manufacturer. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.*

1. The R&S ZVH is protected against dripping water and dust (IP degree 51). Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 4600 m above sea level, max. transport altitude 12000 m above sea level. A tolerance of  $\pm 10\%$  shall apply to the nominal voltage and of  $\pm 5\%$  to the nominal frequency.

2. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

### Electrical Safety

*If the information on electrical safety is not observed either at all to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.*

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
3. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
4. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
5. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
6. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
7. For measurements in circuits with voltages  $V_{\text{rms}} > 30 \text{ V}$ , suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
8. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
9. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

10. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
11. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
12. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
13. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
14. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

### Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

#### **Repair and service**

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

#### **Batteries and rechargeable batteries/cells**

*If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.*

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.

8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

### Transport

1. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
2. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

### Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

## Informaciones Elementales de Seguridad

### **Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!**

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad adjunto de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

#### Símbolos y definiciones de seguridad

						
Ver documentación de producto	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electrostática

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. Las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios.

**Palabras de señal y su significado**

 <b>PELIGRO</b>	PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.
 <b>ADVERTENCIA</b>	ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.
 <b>ATENCIÓN</b>	ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.
 <b>AVISO</b>	AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.  En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el area económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

**Estados operativos y posiciones de funcionamiento**

*El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.*

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento. R&S ZVH está protegido contra roción y polvo (modo de protección IP 51). Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 4600 m sobre el nivel del mar, transporte hasta 12000 m sobre el nivel del mar. Se aplicará una tolerancia de  $\pm 10\%$  sobre el voltaje nominal y de  $\pm 5\%$  sobre la frecuencia nominal.
2. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

### Seguridad eléctrica

*Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.*

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
3. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
4. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
5. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
6. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
7. En las mediciones en circuitos de corriente con una tensión  $U_{\text{eff}} > 30 \text{ V}$  se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
8. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
9. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
10. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.

11. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
12. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
13. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
14. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

### Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio

### Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

### Baterías y acumuladores o celdas

*Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.*

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).

8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

### Transporte

1. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
2. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

### Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (povos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

### Kundeninformation zur Batterieverordnung (BattV)

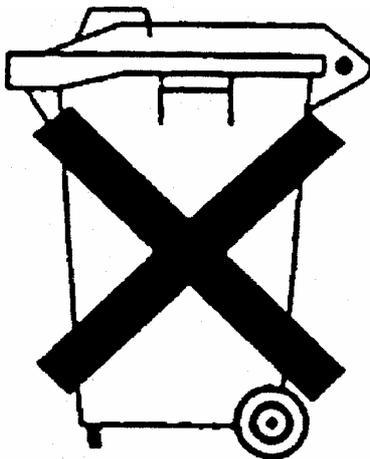
Dieses Gerät enthält eine schadstoffhaltige Batterie. Diese darf nicht mit dem Hausmüll entsorgt werden.

Nach Ende der Lebensdauer darf die Entsorgung nur über eine Rohde&Schwarz-Kundendienststelle oder eine geeignete Sammelstelle erfolgen.

### Safety Regulations for Batteries (according to BattV)

This equipment houses a battery containing harmful substances that must not be disposed of as normal household waste.

After its useful life, the battery may only be disposed of at a Rohde & Schwarz service center or at a suitable depot.



### Normas de Seguridad para Baterías (Según BattV)

Este equipo lleva una batería que contiene sustancias perjudiciales, que no se debe desechar en los contenedores de basura domésticos.

Después de la vida útil, la batería sólo se podrá eliminar en un centro de servicio de Rohde & Schwarz o en un depósito apropiado.

### Consignes de sécurité pour batteries (selon BattV)

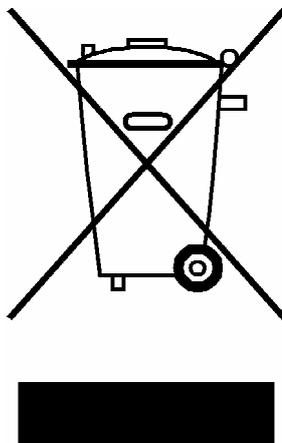
Cet appareil est équipé d'une pile comprenant des substances nocives. Ne jamais la jeter dans une poubelle pour ordures ménagères.

Une pile usagée doit uniquement être éliminée par un centre de service client de Rohde & Schwarz ou peut être collectée pour être traitée spécialement comme déchets dangereux.

## Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).



Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.

# Qualitätszertifikat

## Certificate of quality

### Certificat de qualité



**Sehr geehrter Kunde,**

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

**Der Umwelt verpflichtet**

- ▮ Energie-effiziente, RoHS-konforme Produkte
- ▮ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ▮ ISO 14001-zertifiziertes Umweltmanagementsystem

**Dear Customer,**

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

**Environmental commitment**

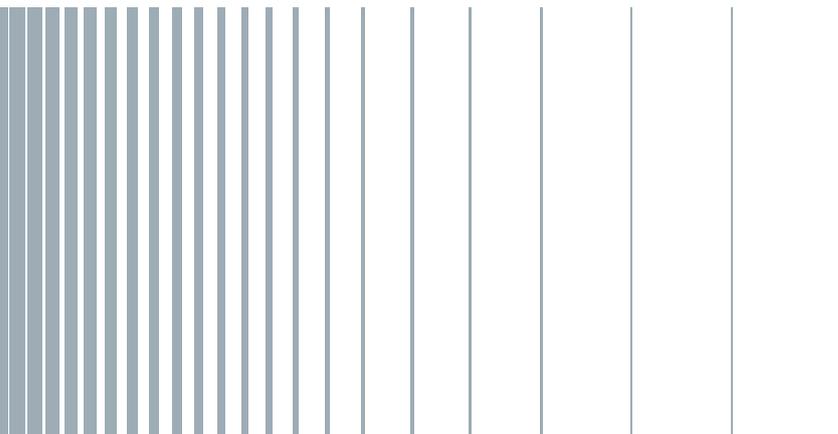
- ▮ Energy-efficient products
- ▮ Continuous improvement in environmental sustainability
- ▮ ISO 14001-certified environmental management system

**Cher client,**

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

**Engagement écologique**

- ▮ Produits à efficience énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001




**ROHDE & SCHWARZ**

CE Declaration of Conformity



Certificate No.: 2010-70

This is to certify that:

Equipment type	Stock No.	Designation
ZVH4	1309.6800.24	Handheld Cable and Antenna Analyzer
ZVH8	1309.6800.28	

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits (2006/95/EC)
- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61010-1: 2001  
 EN 61326-1: 2006  
 EN 61326-2-1: 2006  
 EN 55011: 2007 + A2: 2007  
 EN 61000-3-2: 2006  
 EN 61000-3-3: 1995 + A2: 2001+ A2: 2005

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

**ROHDE & SCHWARZ GmbH & Co. KG**  
**Mühldorfstr. 15, D-81671 München**

Munich, 2010-09-29

Central Quality Management GF-QZ / Chadzelek

1309.6800.xx

CE

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# Documentation Overview

The user documentation for the R&S R&S ZVH is divided as follows:

## Quick Start Guide

The Quick Start Guide provides basic information on the instrument's functions.

It covers the following topics:

- overview of all elements of the front and rear panels
- basic information on how to set up the R&S ZVH
- information on how to operate the R&S ZVH in a network
- instructions on how to perform measurements

## Operating Manual

The Operating Manual provides a detailed description on the instrument's functions

It covers the following topics:

- instructions on how to set up and operate the R&S ZVH in its various operating modes
- instructions on how to perform measurements with the R&S ZVH
- instructions on how to work with the available software options and applications

## Service Manual

The Service Manual provides information on maintenance.

It covers the following topics:

- instructions on how to perform a performance test
- instructions on how to repair the R&S ZVH including a spare parts list
- mechanical drawings

## Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided on the internet.

## Internet Site

The internet site at: [R&S ZVH Cable and Antenna Analyzer](#) provides the most up to date information on the R&S ZVH. The most recent manuals are available as printable PDF files in the download area.

Also provided for download are firmware updates including the corresponding release notes, instrument drivers, current data sheets, application notes and image versions.

## Conventions Used in the Documentation

The following conventions are used throughout the R&S R&S ZVH Operating Manual:

### Typographical conventions

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements both on the screen and on the front and rear panels, such as dialog boxes, softkeys, menus, options, buttons etc., are enclosed by quotation marks.
"KEYS"	Key names are written in capital letters and enclosed by quotation marks.
<i>Input</i>	Input to be entered by the user is displayed in italics.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
"Links"	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

### Other conventions

- **Remote commands:** Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.

# 1 Operating the R&S ZVH

This chapter provides information about basic functionality and about the user interface of the R&S ZVH.

## 1.1 Screen Layout

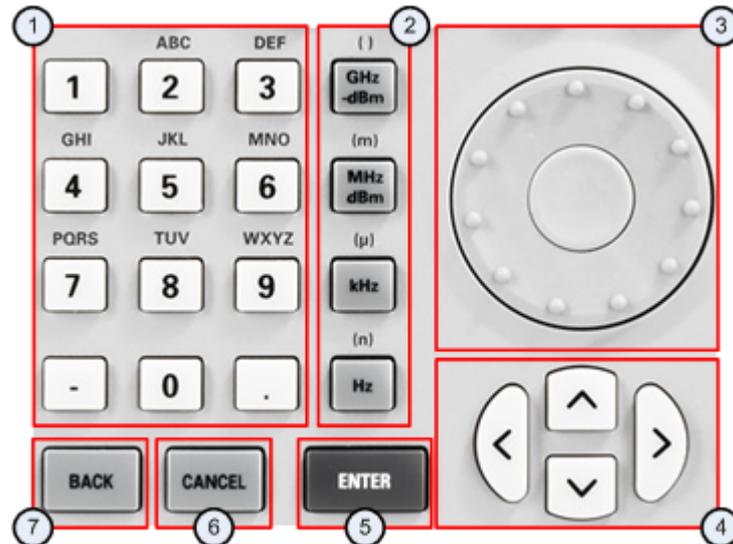
The following figure shows the screen layout in cable and antenna test operating mode. It shows all diagram areas that are the same for all operating modes of the R&S ZVH. Screen layouts that show specifics for each operating mode are provided in the corresponding sections of this manual.



1	Measurement information	13	Trace
2	GPS status	14	Reference Position
3	Date and time	15	Active menu item
4	Battery status	16	Selectable menu item
5	Hardware settings	17	Currently selected menu item
6	GPS information	18	Unavailable menu item
7	Marker information	19	Vertical axis labeling
8	Status line	20	Selectable softkey
9	Invalid trace indicator	21	Active softkey
10	Diagram	22	Unavailable softkey
11	Horizontal axis labeling	23	Selected softkey
12	Marker		

## 1.2 Means of Input

The user interface of the R&S ZVH provides several elements for you to input data.



- 1 Alphanumeric keys
- 2 Unit keys
- 3 Rotary knob
- 4 Cursor keys
- 5 Enter key
- 6 Cancel key
- 7 Back key

### 1.2.1 Using the Alphanumeric Keys

Using the alphanumeric keys, you can enter numeric values or characters. The alphanumeric keys include the number from 0 to 9, the alphabet, a minus sign and dot.

If you have to enter a numeric value, press the corresponding key. In case of numeric values, each key covers just the number that's printed on it.

You can enter negative values with the minus sign key and enter values that contain decimal places with the dot key.

If the R&S ZVH expects the input of a character, the key assignment changes. Each key covers one number and more than one character with the first choice being a character. If you need to enter a character, press the key several times until the character you require is selected. The following table shows an overview of character assignment.

You can correct entries with the BACK key. The BACK key moves the cursor one position backwards and deletes the character that was in that place.

Key	1.	2.	3.	4.	5.	6.	7.	8.	9.
1	1								
2	a	b	c	2	A	B	C		
3	d	e	f	3	D	E	F		
4	g	h	i	4	G	H	I		
5	j	k	l	5	J	K	L		
6	m	n	o	6	M	N	O		
7	p	q	r	s	7	P	Q	R	S
8	t	u	v	8	T	U	V		
9	w	x	y	z	9	W	X	Y	Z
0	0	blank	_						
-	-								
.	.								

### 1.2.2 Confirming and Cancelling Entries

Depending on the input you have made, there are several ways to confirm entries.

- Values without unit or values that have a fixed unit that you enter in an input field can be confirmed with the ENTER key or by pressing the rotary knob.

Alternatively, you can confirm such an entry by pressing the softkey that has opened the input field in question.

- Values that have flexible units, like frequency or time, can be confirmed with one of the unit keys.

If you confirm a such a value with the ENTER key, the R&S ZVH always uses the smallest possible unit (e.g. Hz).

- If you have opened a submenu or input field by accident, you can close it without making any changes with the CANCEL key.

### 1.2.3 Using the Rotary Knob

Using the rotary knob, you can do several things.

- The rotary knob works like a cursor key in dialog boxes or softkey submenus. In that case you can navigate to one of the items with the rotary knob. If the dialog box covers more than one screen page, it also scrolls through the dialog box.

Turning it to the right corresponds to a downward movement. Moving it to the left to an upward movement.

- The rotary knob increases or decreases any kind of numeric value if an input field is active.

Turning it to the right corresponds to an increase, turning it to the left to a decrease of a numeric value.

The rotary knob changes numeric values with a fixed step size.

- The rotary knob moves markers around.  
Again the step size is fixed.
- Pressing the rotary knob has the same effect as pressing the ENTER key as it confirms an entry or selection.

### 1.2.4 Using the Cursor Keys

Using the cursor keys, you can do several things.

- The cursor keys navigate through dialog boxes or softkey submenus.
- The up and down keys increase or decrease any kind of numeric value if an input field is active.  
The cursor keys change numeric values with a fixed step size.
- The up and down keys move markers around.  
The step size is fixed.
- The left and right keys move the cursor in an input field in the corresponding direction.

## 1.3 Presetting the R&S ZVH

Before you prepare a measurement, it is recommended to preset the R&S ZVH. During a preset, the R&S ZVH resets all settings to their default state. Restoring the default configuration has the advantage that old settings do not affect measurements.

The default setup is specific to the operating mode.

- ▶ Press the PRESET key.

The R&S ZVH restores its default setup.

You can also define your own default settings via a dataset. These are then loaded after pressing the PRESET key instead of the factory default.

- ▶ Press the SETUP key.
- ▶ Press the "User Preferences" softkey.
- ▶ Select the "Preset Dataset" menu item.

The R&S ZVH opens a dialog box to select the dataset that contains the settings you would like to have as the preset settings.

- ▶ Select the dataset with the settings you want.
- ▶ Select the "Preset Mode" menu item in the "User Preferences" dialog box.
- ▶ Select the "User Defined" item from the dropdown menu.

The R&S ZVH now loads the settings of the dataset after you press PRESET.

## 1.4 Taking Screenshots

You can take and store a screenshot of the current screen anytime with the  key.

- ▶ Press the  key.

The R&S ZVH takes a screenshot.

If available, the R&S ZVH stores the screenshot on an external storage device (USB memory stick or SD card). If both are connected, the R&S ZVH uses the SD card.

If no external device is available, the R&S ZVH stores the screenshot in its internal memory. In that case you can transfer the pictures with the R&S ZVHView software to your computer.

All screenshots get the name "Screenshot#####" by default. The files also get numbers (####) in ascending order, beginning with 0000. If you want another default name for your screenshots, beginning with a certain number, you can set this up in the "User Preference" menu.

- ▶ Press the SETUP key.
- ▶ Press the "User Preference" softkey.
- ▶ Select the "Default Filename" and "File Name Counter Starts At" items and assign a file name and number as you wish.

The file format of screenshots is either \*.png or \*.jpg, depending on your configuration in the "User Preference" menu.

- ▶ Press the SETUP key.
- ▶ Press the "User Preference" softkey.
- ▶ Select the "Capture Screen Format" item to select the screenshot file format.

## 1.5 Measurement Setup

The "Measurement Setup" dialog box provides an overview of the current configuration of the R&S ZVH. In addition, you can also change the configuration in this dialog box.

- ▶ Press the SETUP key.
- ▶ Press the "Measurement Setup" softkey.
- ▶ Select one of the menu items and change the settings as you like.

Note that the contents of the "Measurement Setup" dialog box are customized for each operating mode of the R&S ZVH. Therefore, the order and number of displayed settings is different in each mode.

## 1.6 Menu and Softkey Overview

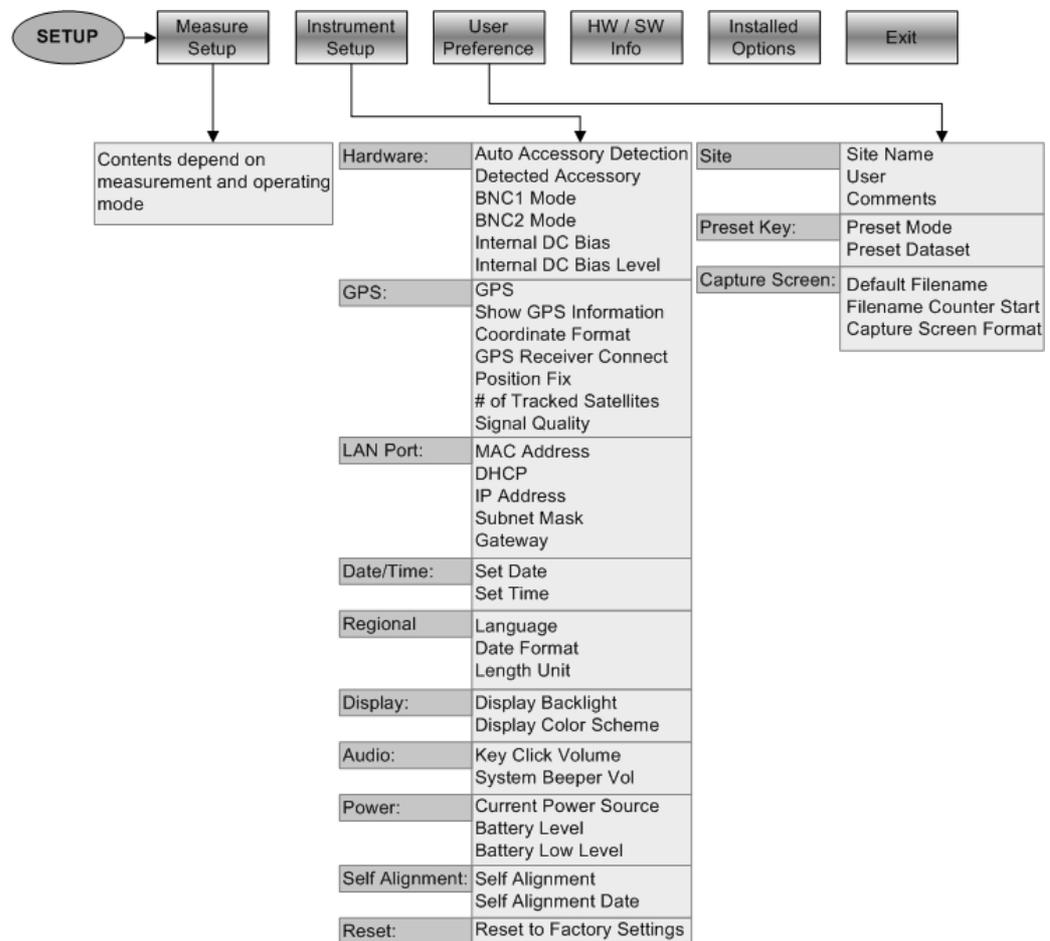
This chapter shows an overview of all instrument functions in the form of softkey and menu overviews.

### 1.6.1 General Functions

General functions are those that are available for all operating modes.

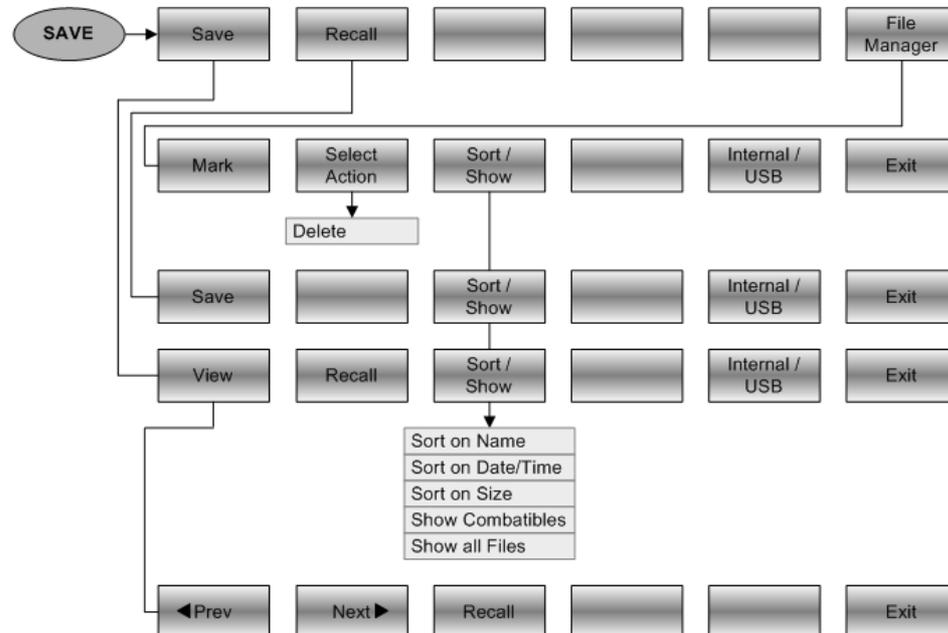
#### 1.6.1.1 Configuring the R&S ZVH

The SETUP key opens the setup menu that contains functionality to set up the R&S ZVH in general and functionality to set up the measurement.



### 1.6.1.2 Saving and Recalling Measurement Settings and Results

The SAVE/RECALL key opens the file manager that contains functionality to manage datasets and other files.



### 1.6.1.3 Selecting the Operating Mode

The MODE key opens the mode menu that contains functionality to select the operating mode of the R&S ZVH.



## 1.6.2 Using the Cable and Antenna Test Mode

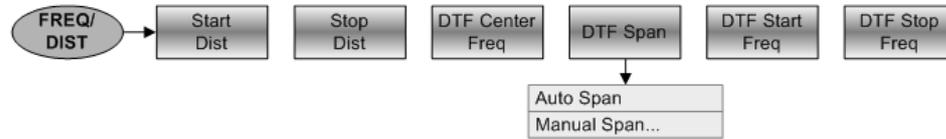
This section contains all softkeys and menus that are available in cable and antenna test operating mode.

### 1.6.2.1 Setting Frequency and Distance Parameters

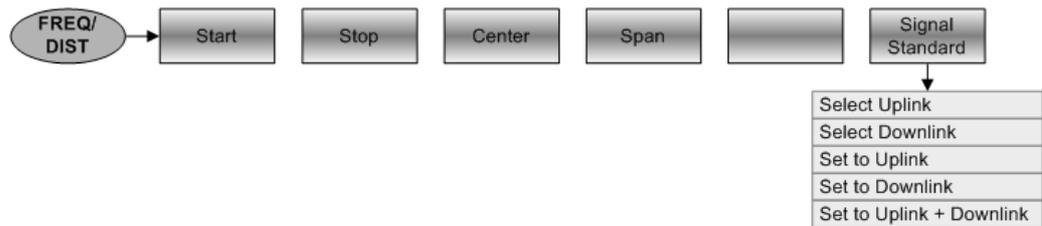
The **FREQ/DIST** key opens the frequency menu that contains functionality to set up the horizontal axis of the measurement diagram.

The contents of the frequency menu depend on the measurement you have currently selected.

This is what the frequency menu looks like for distance-to-fault measurements.

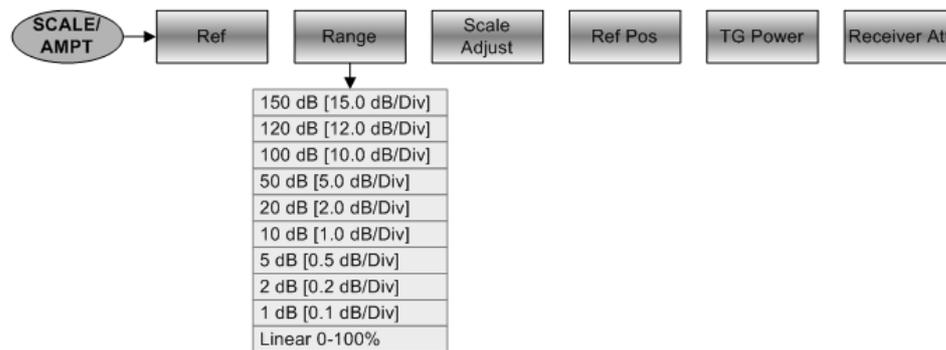


This is what the frequency menu looks like for reflection, transmission and cable loss measurements.



### 1.6.2.2 Setting Amplitude Parameters

The SCALE/AMPT key opens the amplitude menu that contains functionality to set up the vertical axis of the measurement diagram.



### 1.6.2.3 Setting and Triggering the Sweep

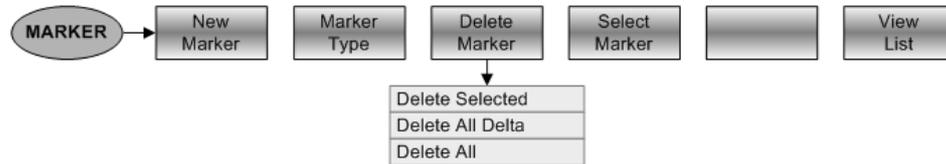
The SWEEP/BW key opens the sweep menu that contains functionality to set up and trigger the sweep.



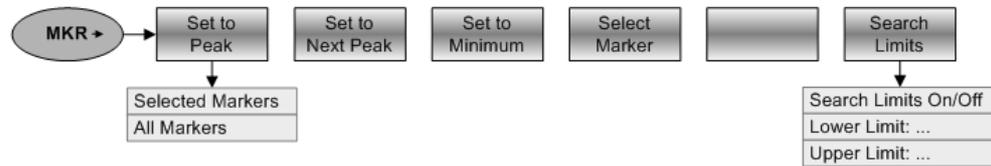
### 1.6.2.4 Using Markers

The MARKER and MKR→ keys open the marker menu and marker to menu that contain functionality to use markers.

This is what the marker menu looks like.



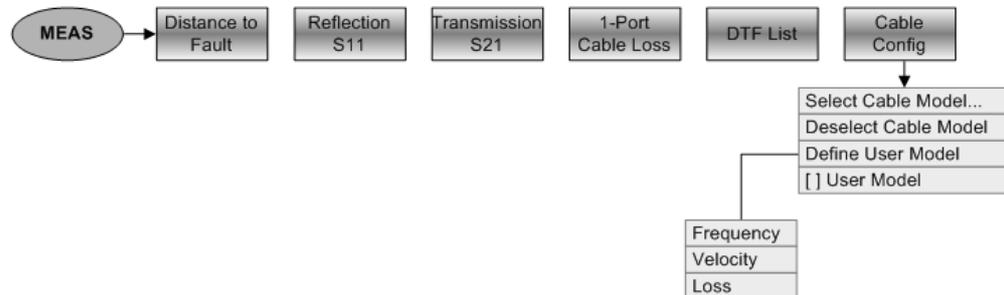
This is what the marker to menu looks like.



### 1.6.2.5 Selecting and Configuring the Measurement

The MEAS key opens the measurement menu that contains functionality to select and configure the measurement.

Transmission S21 is available only if you have installed option R&S ZVH-K39.



### 1.6.2.6 Selecting the Measurement Format

The SPAN/FORMAT key opens the span menu that contains functionality to select the measurement format.



### 1.6.2.7 Calibrating the Measurement

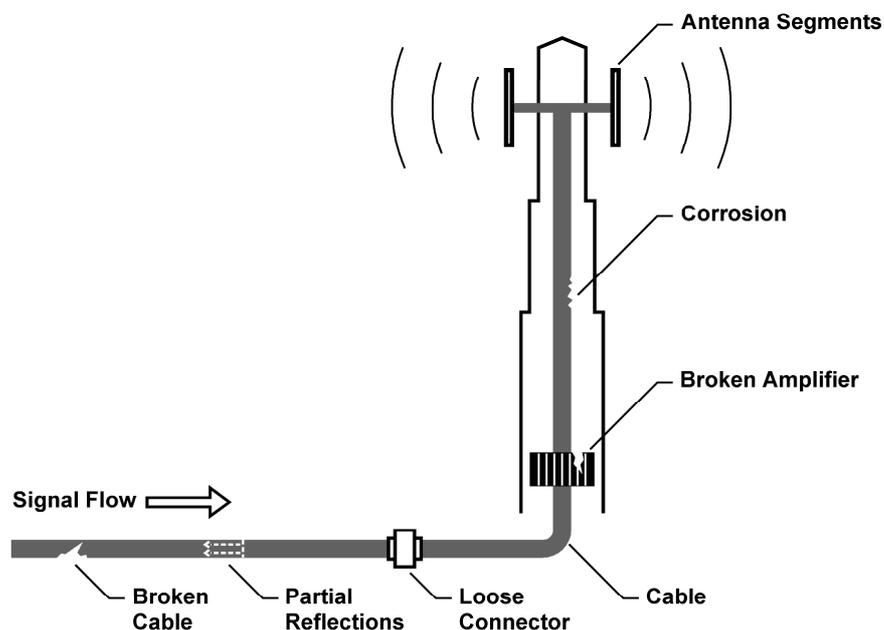
The CAL key opens the calibration menu that contains functionality to calibrate the R&S ZVH.



## 2 Cable and Antenna Test Mode

The cable and antenna test (CAT) mode provides functionality to measure cables and antennas of transmission equipment in wireless telecommunication systems.

In a perfect system, the signal would arrive at the antenna without any losses and be transmitted with the required power and frequency. In reality, however, you can encounter many possible mechanical defects in the system that cause a deterioration of the transmission quality. Figure 2-1 shows some typical defects in a transmission system.



**Figure 2-1: Typical defects of the transmission hardware**

The R&S ZVH provides the necessary functionality to test the system equipment for its characteristics and identify faults when it is being installed or maintained. Each measurement provides different aspects of the test you are performing.

- [Reflection Measurements](#) on page 17
- [Distance to Fault Measurements](#) on page 18
- [1-Port Cable Loss Measurements](#) on page 19
- [Transmission Measurements](#) on page 19

### Test setup

A typical test setup to test cables and antennas includes the R&S ZVH, an RF cable (e.g. R&S FSH-Z320, order no. 1309.6600.00), a calibration standard (R&S FSH-Z28 or R&S FSH-Z29, order no. 1300.7804.03 and 1300.7504.03) and the cable under test.

Cable and antenna tests also require a tracking generator which is already part of the R&S ZVH hardware. The tracking generator transmits a reference signal through the internal VSWR bridge to the test port.

- ▶ Connect the RF cable to the RF input (port 1).
- ▶ Connect the test cable to the RF cable.
- ▶ For measurement on DUTs that need an external voltage supply (e.g. power amplifiers), you can connect the supply voltage from a suitable AC power supply to the BIAS Port 1 or use the internal bias.

By default, the R&S ZVH is in cable test mode after you have turned it on. To switch to the cable test mode from another operating mode, proceed as follows.

- ▶ Press the MODE key.
- ▶ Press the "Antenna & Cable Test" softkey.

The R&S ZVH starts the antenna and cable test mode.

### Screen layout of the antenna and cable tester



- 1 Cable Model
- 2 GPS information
- 3 Hardware settings
- 4 Marker information
- 5 Status line:
  - S-matrix
  - Calibration status
  - Measurement format
- 6 Trace window
- 7 Marker (blue line)
- 8 Cable frequency
- 9 Cable length
- 10 Cable test softkey menu

## 2.1 Performing Measurements

In order to get an idea about problems in a transmission system that is exact as possible, the R&S ZVH features several measurements. Each measurement shows another aspect of the cable characteristics.

### 2.1.1 Reflection Measurements

The reflection (S11) measurement is a good way to get an idea if the transmission system works properly. If unusual amounts of signal power are being reflected, you can guess that there is something wrong in the system. This measurement helps to find reflections by displaying the magnitude of the reflections in dB in a specified frequency range.

The reflection measurement is the default measurement.

- ▶ Press the MEAS key.
- ▶ Press the "Reflection (S11)" softkey.

The R&S ZVH starts the reflection measurement over its entire frequency range.

Figure 2-2 shows an example of a reflection measurement without any major faults in the cable or the antenna.



Figure 2-2: Results of a reflection measurement

You can perform reflection measurements on the complete system or on individual components of the system. If you measure while two or more system components are connected, the results of the reflection measurement are an aggregate over these components. Therefore you can only see the aggregated magnitude of the reflected power in a specified frequency range.

To draw conclusions about which component is affected and determine the location of the fault, you need to perform further analysis using other measurements.

## 2.1.2 Distance to Fault Measurements

The distance to fault (DTF) measurement determines the exact location of possible faults in a transmission system. If you connect the end of the cable to the R&S ZVH, the DTF measurement shows you the exact distance to the fault (in meter or feet), regardless by what the fault is caused. In addition, the measurement shows the degree of the fault in dB. From this information, you can determine the component that has the fault and its seriousness.

In order to determine the distance to a cable fault, the R&S ZVH measures the reflections of the cable under test in the frequency domain. The R&S ZVH first determines the magnitude of the reflections for a particular frequency by comparing the phase of the reflected signal and a reference signal created by the tracking generator. It then performs inverse fast fourier transformation (IFFT) on the signal that has been received. In combination with the characteristics of the cable model, the R&S ZVH is able to determine the distance the reflections have been travelling.

Because of its sensitivity by first measuring in the frequency domain and subsequent IFFT, the measurement is able to locate faults in a cable accurately. To keep this accuracy, the R&S ZVH also accounts for any attenuation that occurs over distance in a cable.

If you are measuring the cable only, make sure to terminate the other end into a load.

- ▶ Press the MEAS key.
- ▶ Press the "Distance to Fault" softkey.

The R&S ZVH calculates the distance to cable faults.

Figure 2-3 shows the results of a DTF measurement. The peaks that the trace shows at the marker positions are possible faults. Depending on the distance, you can also get an idea of the component that is defective.

Marker 1, for example, shows a defect in the cable. Marker 2 shows a fault at the end of the cable, probably a bad or loose connection.



Figure 2-3: Results of a DTF measurement

### 2.1.3 1-Port Cable Loss Measurements

The cable loss measurement evaluates the power attenuation of a cable over a specified frequency range in dB. The amount of power that gets absorbed depends on the frequency and the length of the cable.

- ▶ Press the MEAS key.
- ▶ Press the "1-Port Cable Loss" softkey.

The R&S ZVH evaluates the cable loss over its entire frequency range.

Figure 2-4 shows the typical results of a cable loss measurement with a steadily declining loss in amplitude.



Figure 2-4: Results of a cable loss measurement

### 2.1.4 Transmission Measurements (R&S ZVH-K39)

You can equip the R&S ZVH with option R&S ZVH-K39 (order no 1309.6830.02) to enable forward transmission measurements (S21).

With the forward transmission measurement you can test if a radio signal can travel through the line without losses. The transmission measurement helps to find faults by displaying the magnitude of the reflections in dB in a specified frequency range.

Typically you would perform transmission measurements on a filter to test if it works alright or test the isolation of two antennas (e.g. two receiving antennas or a receiving and a transmitting antenna).

- ▶ Press the MEAS key.
- ▶ Press the "Transmission (S21)" softkey.

The R&S ZVH starts the forward transmission measurement over its entire frequency range.

Figure 2-5 shows the results of a transmission measurement on a filter. The results show that the filter works as it's supposed to.



Figure 2-5: Results of a transmission measurement on a filter

### 2.1.5 Selecting the Measurement Format

You can select several measurement formats for each measurement. The measurement format selects the way the results are displayed on the vertical axis.

The R&S ZVH provides the following measurement formats in CAT mode.

- Magnitude

This is the default format. It shows the magnitude of the results in dB.

- VSWR

The VSWR shows the standing wave ratio in a cartesian diagram. The VSWR is the ratio of the maximum voltage and the minimum voltage that occur in an electrical transmission line. The VSWR format is available for DTF and reflection measurements.

The following pictures show the results of a reflection measurement in Magnitude format (left side) and VSWR format (right side).



Figure 2-6: Measurement results in magnitude and VSWR format

## 2.1.6 Calibrating Measurements

To get the best and most accurate results, the measurement has to be calibrated. The R&S ZVH provides several calibration methods. You will need one of the available calibration standards R&S FSH-Z28 or R&S FSH-Z29 (order numbers 1300.7804.03 and 1300.7504.03).

To successfully calibrate the test setup, you have to connect the calibration standard at the reference plane, usually the output of the RF measurement cable.

Calibration is performed over the R&S ZVH's entire frequency range. This eliminates the need for recalibration when you change a parameter or select a different cable or model.

Calibration also remains valid after turning off the R&S ZVH or changing into another operating mode as calibration data is saved in the internal memory of the R&S ZVH. As a precondition for calibration to remain valid, however, the instrument temperature must not change by more than 5 °C after calibration.

### Calibration states

The R&S ZVH features several calibration states that it displays in the status line. The possible states depend on the calibration type (see below).

- (fcal)  
The R&S ZVH uses factory calibration. Factory calibration is restored after a preset or self alignment.  
The calibration data for the factory calibration is already in the memory of the R&S ZVH when it is delivered. The factory calibration is a full two-port calibration.
- (fcal?)  
The R&S ZVH uses factory calibration. However, the calibration is not accurate because the TG power and receiver attenuation are not in line with the default settings. In that case you should perform calibration.
- (cal)  
The R&S ZVH uses user calibration. To get that state you have to perform either a full 1-port or a full 2-port calibration.
- (cal?)  
The R&S ZVH uses user calibration. However, the calibration is not accurate because the TG power and receiver attenuation are not in line with the settings at the time it has been calibrated. In that case you should perform calibration.
- (norm)  
The R&S ZVH uses normalization. To get that state you have to normalize the transmission.

- (norm?)

The R&S ZVH uses normalization. However, the calibration is not accurate because the TG power and receiver attenuation are not in line with the settings at the time it has been calibrated. In that case you should perform calibration.

### Calibration methods

The following calibration types are available in antenna and cable test mode.

- Full 2-Port

Both test ports are calibrated for a complete set of measurements. The calibration routine therefore requires the connection of the standards load, open and short to both test ports, and a through connection of the test ports. The influences of the test setup and of the isolation between the test ports are thereby determined and taken into account in the subsequent measurement of the device under test.

While this method is the most time-consuming during calibration, it does provide the greatest accuracy for all measurements at both test ports without recalibration and is thus the most flexible.

- Full 1-Port

Test port 1 is calibrated for measurements on that port. The calibration routine requires the calibration standards open, short and load to be connected one after another.

- Normalize Transmission

Both test ports are calibrated for transmission measurements. The calibration routine requires only a through connection. In the subsequent measurement, the isolation between the test ports is not taken into account, a possible cross-talk between the test ports in the test setup is not eliminated.

### Performing a Full 2-Port Calibration

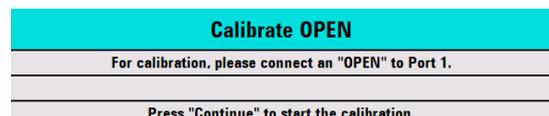
The procedure below shows a full 2-port calibration routine. All other calibration methods principally work the same way, except for the type and number of calibration standards you are going to need.

- ▶ Disconnect the DUT from the RF cable.

After disconnecting the DUT, the R&S ZVH is ready for calibration.

- ▶ Press the CAL key.
- ▶ Press the "Full 2-Port" softkey.

The R&S ZVH asks you to connect an "Open" to port 1.



- ▶ Firmly connect the "Open" of the calibration standard to port 1.
- ▶ You can abort the calibration any time by pressing the "Cancel" softkey.

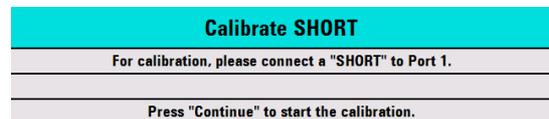
- ▶ Press the "Continue" softkey to start calibration.

The R&S ZVH calibrates the "Open".



- ▶ Disconnect the "Open".

Next, the R&S ZVH asks you to connect a "Short" to port 1.

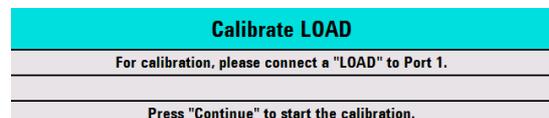


- ▶ Firmly connect the "Short" of the calibration standard to port 1.
- ▶ Press the "Continue" softkey to start calibration.

The R&S ZVH calibrates the "Short".

- ▶ Disconnect the "Short".

Next, the R&S ZVH asks you to connect a "Load" (50 Ω termination) to port 1.

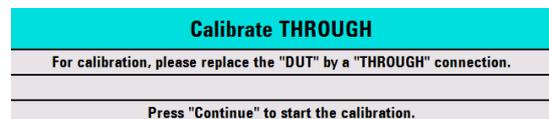


- ▶ Firmly connect the "Load" of the calibration standard to port 1.
- ▶ Press the "Continue" softkey to start calibration.

The R&S ZVH calibrates the "Load".

- ▶ Disconnect the "Load".

Next, the R&S ZVH asks you to set up a "Through" connection from port 1 to port 2.



- ▶ Firmly connect the "Through" connection to port 1 and port 2.
- ▶ Press the "Continue" softkey to start calibration.

The R&S ZVH calibrates the "Through" connection.

After finishing the calibration routine, the R&S ZVH shows that calibration is finished for a short time (**Calibration done!**). The status line now says (Cal) to indicate successful calibration.

## 2.2 Configuring Cable and Antenna Tests

For valid measurement results, you need to specify the characteristics of the cable under test like model or frequency range.

### 2.2.1 Selecting the Cable Model

To determine the speed of propagation, and therefore the precise distance to any faults, you have to specify the cable model that you want to test.

The R&S ZVH already comes with an assortment of predefined cable models that you can use without doing anything. If you want to test a cable that is not listed, you can also define cable models manually, either directly on the R&S ZVH or with the "Cable Model Editor" of the R&S ZVHView software package that is delivered with the R&S ZVH.

#### 2.2.1.1 Selecting a Predefined Cable Model

- ▶ Press the MEAS key.
- ▶ Press the "Cable Config" softkey.
- ▶ Select the "Cable Model" menu item.

The R&S ZVH opens the file manager to select the cable model.

- ▶ Select the cable model that you are testing with the rotary knob or the cursor keys.
- ▶ Confirm the selection with the "Select" softkey.

The R&S ZVH shows the currently selected cable model in the diagram header.

- ▶ Select the "Deselect Cable Model" item from the "Cable Config" menu if you want to perform measurements without using a particular cable model.

Stat	Name	Size	Date	Time
	\Public\Cable Models\...			
	\Public			
	5088-HLFR.cbimod	1 kB	31/05/2010	15:21
	5092-HLFR.cbimod	1 kB	31/05/2010	15:21
	5128-HLFR.cbimod	1 kB	31/05/2010	15:21
	5168-HLFR.cbimod	1 kB	31/05/2010	15:21
	5228-HLFR.cbimod	1 kB	31/05/2010	15:21
	5328-HLFR.cbimod	1 kB	31/05/2010	15:21
	5438-HLFR.cbimod	1 kB	31/05/2010	15:21
	5628-HLFR.cbimod	1 kB	31/05/2010	15:21
	FLC114-50J.cbimod	1 kB	31/05/2010	15:21
	FLC12-50J.cbimod	1 kB	31/05/2010	15:21
	FLC158-50J.cbimod	1 kB	31/05/2010	15:21
	FLC78-50J.cbimod	1 kB	31/05/2010	15:21
	HCC12-50J.cbimod	1 kB	31/05/2010	15:21
	HCC158-50J.cbimod	1 kB	31/05/2010	15:21
	HCC300-50J.cbimod	1 kB	31/05/2010	15:21
	HCC78-50J.cbimod	1 kB	31/05/2010	15:21
	HCF12-50.cbimod	1 kB	31/05/2010	15:21
	HJ12-50.cbimod	1 kB	31/05/2010	15:21

#### 2.2.1.2 Creating a Cable Model

The R&S ZVH provides two ways to define customized cable models.

The first way is to define a cable model with the "Cable Model Editor" that is part of the R&S ZVHView software package. The R&S ZVHView is delivered with the R&S ZVH. With this software, you can define a cable model on a PC and then transfer it to the R&S ZVH.

Then you can select it just like any other predefined cable model.



- ▶ Press the "DTF Span" softkey.

By default, the R&S ZVH automatically calculates the best span ("Auto Span") for the best length resolution. If the required span is too large for the current center frequency, the R&S ZVH sets the center frequency to the smallest possible frequency.

- ▶ Select the "Manual Span..." menu item
- ▶ Enter the span you need manually.

The R&S ZVH sets the new span. Note that the maximum span you can set depends on the maximum cable distance you have defined and is never greater than the span calculated by the "Auto Span" function. The minimum span that you can set is 10 MHz.

### Setting the displayed frequency range

After you have selected the span, you can set a particular frequency range whose results the R&S ZVH displays.

In the default configuration, the R&S ZVH adjusts the DTF start and DTF stop frequency according to the span and the center frequency. The distance from center frequency to the start and stop frequency is the same. Alternatively, you can directly set a DTF start and DTF stop frequency.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the "DTF Center Freq" softkey.
- ▶ Enter the frequency that you'd like to be in the center of the horizontal axis.

The R&S ZVH adjusts the frequency range according to span and center frequency.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the "DTF Start Freq" or the "DTF Stop Freq" softkey.
- ▶ Enter the start frequency and stop frequency you need.

The R&S ZVH adjusts the frequency range according to your settings.

Note that the distance from start to stop frequency has to be equal to the span. The R&S ZVH adjusts the values if you enter a frequency range that is not the same as the span.

#### 2.2.2.2 Setting the Start and Stop Distance for DTF Measurements

The start and stop distance define the scaling of the horizontal axis.

In the default setting, the horizontal axis start at 0 m and covers the maximum or stop distance you have set. By adjusting the start and stop distance, you can zoom in to a particular section of the cable for further analysis.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the "Start Dist" or "Stop Dist" softkey.

- ▶ Enter the distance you want the display to start from and to end at.

In auto span mode, the R&S ZVH adjusts the frequency settings in order to get the best display resolution.

If you have set the span manually, the R&S ZVH zooms in to the section of the cable you have defined. The results maintain their accuracy in that case.

### 2.2.2.3 Setting the Frequency Range for CAT Measurements (except DTF)

When you measure the reflection, transmission or cable loss, the frequency range that the R&S ZVH displays is defined by the span, the center frequency or start and stop frequencies.

#### Defining the span

The span you should select depends on the frequency band you are analyzing and the frequency range you need information about.

The minimum span for both measurements is 10 Hz, the maximum span depends on the R&S ZVH and is either 3.6 GHz (R&S ZVH4) or 8 GHz (R&S ZVH8).

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the **"Span"** softkey.
- ▶ Enter the span you need.

The R&S ZVH sets the span you have entered.

#### Setting the displayed frequency range

In the default configuration, the R&S ZVH adjusts the start and stop frequency according to the span and the center frequency, with the center frequency being in the middle of the horizontal axis. Alternatively, you can directly set the start and stop frequency.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the **"Center"** softkey.
- ▶ Enter the center frequency you need.

Alternatively, set the frequency range independent of the span and the center frequency.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the **"Start"** softkey and enter a start frequency.
- ▶ Press the **"Stop"** softkey and enter a stop frequency.

#### 2.2.2.4 Selecting a Signal Standard for CAT Measurements

When you measure the reflection, transmission or cable loss, the R&S ZVH provides several configurations for measurements on a particular signal standard. When you select one of these, the R&S ZVH loads the corresponding parameters like center frequency or span and you do not have to set those anymore.

- ▶ Press the **FREQ/DIST** key.
- ▶ Press the "Signal Standard" softkey.
- ▶ Select either the "Select Uplink" or "Select Downlink" menu items.

The R&S ZVH opens a dialog box to select the standard.

- ▶ Select the standard you need.

The R&S ZVH loads the settings of the standard you have selected.

### 2.2.3 Configuring the Vertical Axis

The amplitude menu contains all settings related to the level display.

#### 2.2.3.1 Adjusting the Scale of the Diagram

Scaling parameters control the way the results look like. You have got several options to improve the vertical scaling of the measurement diagram.

The unit of the level axis is dB.

##### Setting the reference value

The reference value defines the amplitude of the reference line. The unit of the reference is dB.

The R&S ZVH indicates the position of the reference value with a yellow triangle at the vertical axis (0.0).

When you change the reference value, the R&S ZVH adjusts the labels of the vertical axis. Changing the reference value changes the vertical position of the trace. It does not change the position of the reference line.

- ▶ Press the **AMPT/SCALE** key.
- ▶ Press the "Ref" softkey.
- ▶ Enter the reference value you want or move the reference with the rotary knob.

The R&S ZVH sets up the display accordingly.

### Defining the display range

The display range defines the scale of the vertical axis and therefore the amplitude between two horizontal grid lines.

The unit depends on the measurement format.

When you change the display range, you can increase or decrease the amplitude the R&S ZVH displays and, e.g. include signal parts that are outside the displayed screen area. The position of the reference value and the trace do not change.

- ▶ Press the AMPT/SCALE key.
- ▶ Press the "Range" softkey.
- ▶ Select one of the menu items to select the display range you want.

### Adjusting the vertical axis automatically

The R&S ZVH provides an automatic scaling routine that scales the vertical axis in a way that the results fit ideally on the display. The R&S ZVH does this by determining the minimum and maximum trace values and scaling the vertical axis according to these values.

- ▶ Press the SCALE/AMPT key.
- ▶ Press the "Scale Adjust" softkey.

The R&S ZVH performs automatic adjustment of the vertical axis.

### Setting the reference position

The reference position defines the position of the reference line in the diagram. The reference position is a linear value between 0 and 10. Each value represents one horizontal grid line of the diagram. 0 corresponds to the top grid line and 10 corresponds to the bottom grid line.

When you change the reference position, the R&S ZVH also shifts the position of the trace by the magnitude of the reference position change. It has no effect on the reference value itself.

- ▶ Press the SCALE/AMPT key.
- ▶ Press the "Ref Pos" softkey.
- ▶ Enter the reference position you want.

The R&S ZVH moves the trace accordingly.

#### 2.2.3.2 Setting the Attenuation

The R&S ZVH provides function to attenuate the signal at both the tracking generator output and the RF input.

- ▶ Press the AMPT/SCALE key.
- ▶ Press the "TG Power" softkey.

- ▶ Enter the attenuation of the signal at the tracking generator output.  
You can attenuate the signal from 0 dBm to -40 dBm.
- ▶ Press the "Receiver Att" softkey.
- ▶ Enter the attenuation of the signal at the RF input.  
You can set an RF attenuation in the range from 0 dB to 40 dB in 5 dB steps.

## 2.2.4 Setting and Triggering the Sweep

When setting up the sweep you have to deal with several parameters that are interdependent. For easy and quick access, most of these parameters are combined in the sweep menu.

### 2.2.4.1 Setting the Measurement Bandwidth

The measurement bandwidth determines the noise figure of the receiver. Small bandwidths result in higher measurement dynamics for S21 measurements. However, small bandwidths cause longer measurement times because of the settling time of the filter.

Possible bandwidths are between 100 Hz and 100 kHz in a 1-3 sequence.

- ▶ Press the SWEEP/BW key.  
In its default state, the R&S ZVH selects the bandwidth automatically ("Auto Meas BW" softkey). In that state, the bandwidth is coupled to the span.  
The default setting is a compromise between measurement speed and good performance.
- ▶ Press the "Manual Meas BW" softkey.  
The R&S ZVH opens an input field to define the measurement bandwidth.
- ▶ Enter the measurement bandwidth you want to work with.  
As an indicator that the BW is no longer coupled to the span, the R&S ZVH displays a red dot in front of the BW item in the hardware settings.

### 2.2.4.2 Holding Measurements

The measurement starts as soon as you start the R&S ZVH. As the cable and antenna tester measures continuously, the R&S ZVH provides a hold function that stops the display update and leaves room for further analysis of the measurement results.

- ▶ Press the MEAS key.
- ▶ Press the "Hold" softkey.  
The R&S ZVH interrupt the display update.

To resume the display update, press the "Hold" softkey again.

### 2.2.4.3 Working with Triggers

To respond to events, the R&S ZVH has a variety of trigger functions. The trigger can either be external or generated internally.

- ▶ Press the SWEEP key.
- ▶ Press the "Trigger" softkey.

The submenu for setting the trigger opens. By default, Free Run is active.

In CAT mode, the R&S ZVH provides the following trigger functions.

#### Free Run

A new sweep starts on completion of the previous sweep. This is the default setting for the R&S ZVH.

#### External Rise / External Fall

A sweep starts on the rising edge (RISE) or on the falling edge (FALL) of an external trigger signal. The external trigger signal is fed in via the BNC connector Ext Trigger. The switching threshold is 1.4 V, i.e. a TTL signal level.

- ▶ Select the trigger you need for your measurement.

The trigger readout (Trig) shows the current trigger setting.

When external trigger are selected, you can delay the start of the measurement with respect to the trigger event by entering a delay time. In this way, time differences between the trigger event and the measurement can be allowed for.

- ▶ Press the "Trigger" softkey.
- ▶ Select the "Trigger Delay..." menu item.

The R&S ZVH opens an input field to specify the trigger delay.

- ▶ Enter the trigger delay you require.

The range for the trigger delay is 0  $\mu$ s to 100 s. The step size depends on the length of the delay time.

Trigger delay	Step size
0 s to 1 ms	10 $\mu$ s
1 ms to 10 ms	100 $\mu$ s
10 ms to 100 ms	1 ms
100 ms to 1 s	10 ms
1 s to 10 s	100 ms
10 s to 100 s	1 s

## 2.3 Analyzing Measurement Results

### 2.3.1 Working with Traces

The R&S ZVH can transfer a trace to the trace memory and also display the current trace and the trace in the trace memory for comparison. The saved trace is always displayed in white to distinguish it from the current trace.

- ▶ Press the TRACE key.
- ▶ Press the "Trace ▶ Memory" softkey.

The R&S ZVH transfers the trace to the trace memory.

- ▶ Press the "Show Memory" softkey.

The R&S ZVH displays the saved trace in white.

You can remove the memory trace by pressing the "Show Memory" softkey again.

The memory traces are bit-mapped into the picture memory. Therefore, when the memory trace is recalled, it will not be adapted to any modifications of the reference level or span that may have been made in the meantime.

When you load a data set, the R&S ZVH stores the corresponding trace in the trace memory. You can view that trace with the "Show Memory" softkey.

### 2.3.2 Using Markers

The R&S ZVH has six markers, five of which can be used as either markers or delta markers.

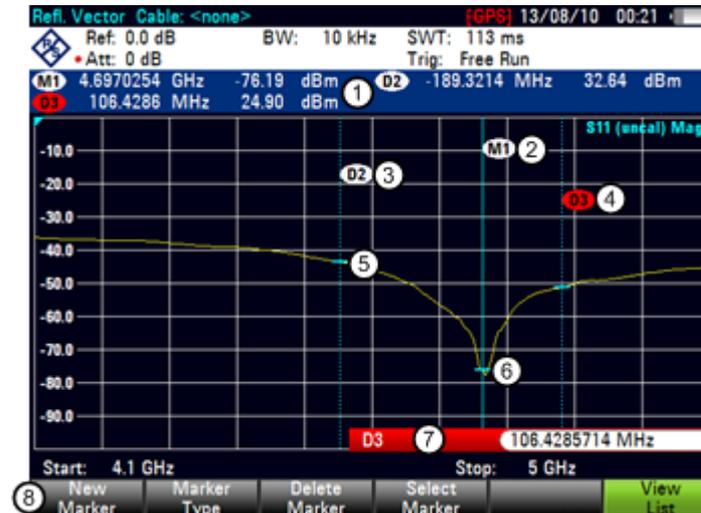
The markers cannot leave the trace and indicate the horizontal and vertical coordinates of the point they are positioned on. The horizontal position of a marker is shown by a vertical line which extends from the top to the bottom of the measurement diagram. The marker list above the diagram area shows the exact coordinates of all markers in use.

When measuring the distance-to-fault, the horizontal unit is meter or feet. For all other measurements the horizontal axis is the frequency axis. The unit of the vertical axis is dB for distance-to-fault and cable loss measurements and dBm for all others.

The position of a delta marker is indicated by a dashed line to distinguish it from a normal marker. The delta marker level is always a relative to the main marker level and so the delta marker level unit is always dB. The delta marker frequency is always relative to the main marker – in other words, the delta marker frequency is the frequency difference between the frequency at the point marked by the main marker and the frequency at the point marked by the delta marker.

To measure complex signals, you can activate up to six markers. Marker 1 is always a normal marker and the reference of all delta markers. Markers 2 to 6 are either markers or delta markers depending on your set up.

### Screen Layout with Active Markers



- 1 Marker list
- 2 Marker label: M(x)
- 3 Delta marker label: D(x)
- 4 Active marker label (red label)
- 5 Delta marker (blue dotted line)
- 6 Marker (blue line)
- 7 Marker input field
- 8 Marker menu

#### 2.3.2.1 Positioning Markers

- ▶ Press the MARKER key.

The marker menu opens.

If, as yet, no marker has been activated, the R&S ZVH automatically activates the main marker and positions it on the maximum level that has been measured. In addition, the marker frequency input field opens.

You can perform the following actions:

- Position the marker with the cursor keys.  
When positioning the marker with the cursor keys, the step size is 10% of the span.
- Position the marker with the rotary knob  
When positioning the marker with the rotary knob, the step size is one pixel.
- Enter a marker position with the number keys and confirm the entry with one of the unit keys.
- ▶ Confirm the marker position with the ENTER key.  
The marker input field closes.

By default, the marker list above the diagram area is active. The marker list shows the horizontal position of all markers and the corresponding vertical value. If inactive, the list shows only the coordinates of markers 1 and 2.

You can turn it off and on again whenever you like.

- ▶ Press the "View List" softkey.

The marker list turns off or on, depending on its original state.

### 2.3.2.2 Positioning a Delta Marker

When a normal marker is already in use, you can add delta markers.

- ▶ Press the MARKER key.
- ▶ Press the "New Marker" softkey.

The R&S ZVH activates a delta marker and positions it on the next maximum level that has been measured. In addition, the delta marker input field opens.

The R&S ZVH adds the delta marker to the marker list and shows the marker position relative to the normal marker (M1).

You can perform the following actions:

- Enter a delta marker position with the number keys and confirm the entry with one of the unit keys.
- Change the delta marker position with the rotary knob or the cursor keys.
- ▶ Confirm the delta marker position with the ENTER key.

The delta marker input field closes.

- ▶ To add more markers, press the "New Marker" softkey several times until you have the number of markers you want in the display.

### 2.3.2.3 Selecting the Marker Type

When you add new markers, they will be delta markers by default. Their coordinates are relative to the first marker (M1). You can turn delta markers into normal markers if you need absolute information about the marker position.

- ▶ Press the MARKER key.
- ▶ Select the delta marker you want to convert with the "Select Marker" softkey.

The corresponding marker symbol turns red and the marker input field opens.

- ▶ Press the "Marker Type" softkey.

The delta marker turns into a normal marker. Its label changes accordingly (e.g. D2 to M2) and its coordinates are now absolute values.

#### 2.3.2.4 Automatic Positioning of Markers

The R&S ZVH offers functions that make setting the markers easier or allow to make instrument settings on the basis of the current marker position:

- "Set to Peak"

The Peak function places the active marker or the delta marker on the highest level value of the trace.

- "Set to Next Peak"

The Next Peak function places the active marker or delta marker on the next highest level value of the trace, relative to its current position.

- "Set to Minimum"

The Minimum function places the active marker or delta marker on the lowest value of the trace.

▶ Press the MKR→ key.

▶ Press the "Set to Peak", "Set to Next Peak" or "Set to Minimum" softkey.

The R&S ZVH positions the marker accordingly.

#### 2.3.2.5 Removing Markers

Remove markers any time you want.

##### Removing selected markers

▶ Select the marker you want to delete with the "Select Marker" softkey.

The corresponding marker symbol turns red and the marker input field opens.

▶ Press the MARKER key.

▶ Press the "Delete Marker" softkey.

▶ Select the "Delete Selected" menu item.

▶ Confirm the selection with the ENTER key.

The R&S ZVH deletes the marker.

Note that if you delete marker 1 (M1) all delta markers that are relative to that marker are also deleted.

##### Removing delta markers only

▶ Press the MARKER key.

▶ Press the "Delete Marker" softkey.

▶ Select the "Delete All Delta" menu item.

▶ Confirm the selection with the ENTER key.

The R&S ZVH deletes all delta markers.

**Removing all markers at the same time.**

- ▶ Press the MARKER key.
- ▶ Press the "Delete Marker" softkey.
- ▶ Select the "Delete All" menu item.
- ▶ Confirm the selection with the ENTER key.

The R&S ZVH deletes all markers and delta markers.

**2.3.2.6 Using Marker Search Limits**

The R&S ZVH allows you to use only a limited section of the trace for the "Set to Peak", "Set to Next Peak" and "Minimum" functions.

- ▶ Press the MKR→ key.
- ▶ Press the "Search Limits" softkey.
- ▶ Select the "Search Limits On/Off" menu item.
- ▶ Confirm the selection with the ENTER key.

The R&S ZVH activates the marker search limits.

An [X] indicates an active search limit. Two vertical red lines show the lower and upper limits in the diagram.

By default, the search limit range is over the whole span.

- ▶ Press the "Search Limits" softkey
- ▶ Select the "Lower Limit" menu item.
- ▶ Confirm the selection with the ENTER key.

The R&S ZVH opens an input field to define the lower limit of the search range.

- ▶ Enter the lower limit.
- ▶ Confirm the entry with one of the unit keys.

If the span is wide enough, the R&S ZVH displays a red vertical line to indicate the lower limit.

- ▶ Define the upper search limit the same way.

**Deactivating marker search limits**

- ▶ Press the "Search Limits" softkey.
- ▶ Select the "Search Limits On/Off" menu item.
- ▶ Confirm the selection.

The "Search Limits" softkey turns grey again and in the "Search Limits" menu, the [X] is no longer displayed.

## 3 Working with the Measurement Wizard

When testing antennas and cables it is often necessary to perform a sequence of standardized and recurring measurements, often in an environment that is not easily accessible. To make sure that measurements are performed as required and to avoid a constant adjustment of parameters, the R&S ZVH features a measurement wizard.

The measurement wizard combines several measurement configurations to a sequence of measurements (or measurement set). Because all relevant parameters have been set prior to the actual measurement and cannot be changed once the measurement procedure has begun, the wizard is a good way to avoid mistakes and save time when setting up measurements.

This chapter deals with the functionality of the measurement wizard. For details on the individual measurements you can perform with the wizard, refer to the corresponding chapters.

- [Performing Measurements](#) on page 17

Note that it is necessary to install and use the R&S ZVHView software package to use the full functionality of the measurement wizard.

### 3.1.1 Preparing the Measurement

Before you can use the measurement wizard you have to define a measurement set with the R&S ZVHView software package and transfer it to the R&S ZVH.

The R&S ZVHView software package is delivered with the R&S ZVH. The latest version is also available for download on the [R&S ZVH website](#).

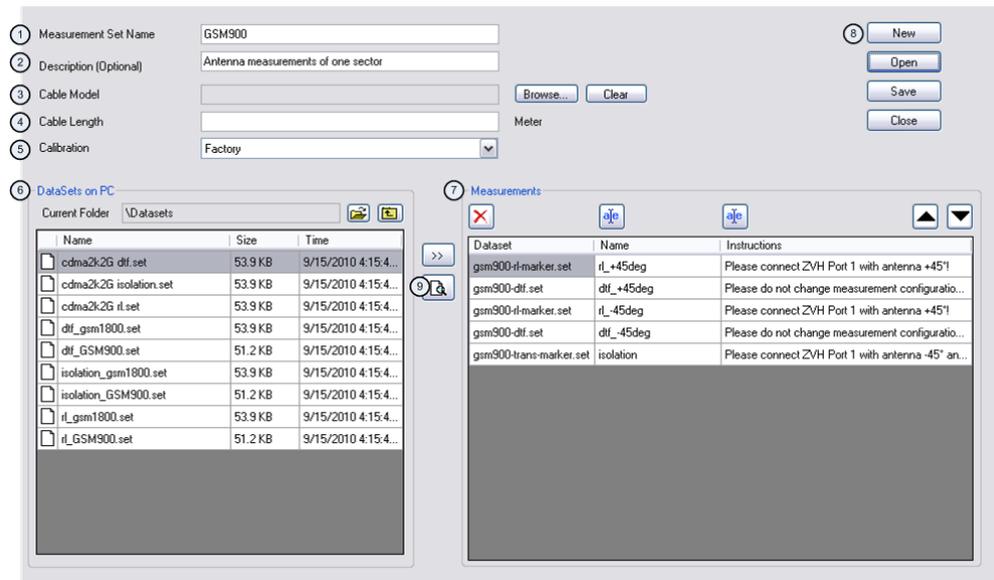
#### 3.1.1.1 Creating a Measurement Set

A measurement set consists of several datasets. A dataset is a file that contains the settings of a specific R&S ZVH configuration, e.g. frequency, scaling etc. To get hold of a dataset, set up the R&S ZVH as you need and save the configuration or use one of the predefined datasets.

For more information on datasets see "[Saving Dataset](#)" on page 53.

- ▶ Start the R&S ZVHView software on your PC.
- ▶ Select the "Wizard Set Editor" with the  button.

The R&S ZVH opens a dialog that provides all functionality to manage measurement sets.



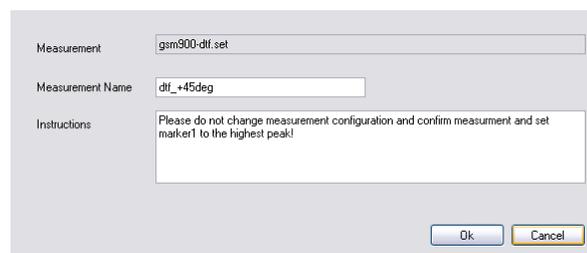
- 1 Name of the measurement set
- 2 Description of the measurement task
- 3 Cable model selection
- 4 Approximate cable length
- 5 Calibration method
- 6 List of datasets that are available via the PC
- 7 List of datasets that are currently part of the measurement set
- 8 File management options
- 9 Preview dataset button

► Set up the measurement set as you like by adding or removing datasets.

The editor also allows you to add comments to each measurement that is part of the measurement set. You can also rename the measurement.

► Select one of the datasets and click on the  button.

The R&S ZVH opens another dialog box.



In this dialog box, you can

- see the name of the selected dataset
- define a name for the corresponding measurement
- include instructions about performing the measurement.

You can add instructions for every measurement that you include in the set to avoid handling measurements incorrectly.

The R&S ZVH shows these instructions before the measurement starts.

### 3.1.1.2 Uploading Measurement Sets

In order to perform the actual measurements, you have to upload the wizard definition file that contains the set of measurements to the R&S ZVH.

- ▶ Select the "Wizard Set Control" function with the  button.

The R&S ZVH opens a dialog box to select the measurement set(s) to upload.

- ▶ Select the measurement set you want to upload.
- ▶ Copy the files with the  button.

## 3.1.2 Using the Measurement Wizard

Now that the measurement set is available on the R&S ZVH you can start performing measurements.

### 3.1.2.1 Starting the Measurement Wizard

- ▶ Press the WIZARD key.

The R&S ZVH opens the wizard dialog box. The dialog box contains information that you may later use for documentation purposes.

- ▶ Press the "Load Meas Set" softkey.

The R&S ZVH opens a dialog box to select the wizard definition file.

- ▶ Select the file that contains the measurement set that you require.
- ▶ Confirm the selection with the "Select" softkey.

The R&S ZVH returns to the measurement wizard dialog box. It now displays information about the measurement set you have just loaded.

Wizard	
<b>Measurement Definition</b>	<b>GSM900 antenna test with marker</b>
measurement set for a 3 segment cross polarized GSM900 antenna	
User	None
<b>Site</b>	
Site Name	2255 Wallberg
Comments	sector 1
GPS Position	[GPS: Lat. ...° ...' ..." N Long. ...° ...' ..." E Alt. ... m]
<b>Cable Definition</b>	
Use Wizard Cable Settings	No
Cable Model	<none>
Clear Cable Model	Clear
Cable Length	20 m
Calibration	Factory
<b>Measurements</b>	
rl_1a	<not done>
dtf_1a	<not done>
Load Meas Set	Start Meas Set
	Exit Wizard

The dialog box contains the following information:

- **Measurement Definition**

Name of the wizard definition file currently in use. Pressing the ENTER key on this field has the same effect as the "Load Meas Set" softkey.
- **Measurement Description**

Short description of the measurement task. This is a read only field that shows the description as defined with the R&S ZVHView software.
- **User**

Name of the person that performs the measurement.
- **Site Name**

Location of the measurement. This field is available on the R&S ZVH only.
- **Comments**

Comments about the measurement, e.g. the external conditions during the measurement.
- **GPS Position**

Shows the GPS position, if you have connected a GPS receiver. Pressing the ENTER key on this field results in an update of the GPS coordinates.
- **Use Wizard Cable Settings**

Determines if you want to use the cable characteristics as defined in the measurement set or if you want to be able change cable characteristics on site. Select "Yes" to use the predefined cable characteristics. In That case the parameters below will be locked.
- **Cable Model**

Cable model that you perform the measurement on. You can define a cable model with the R&S ZVHView software, but can also change the cable model on short notice, if necessary.
- **Clear Cable Model**

Deactivates the currently active cable model.
- **Cable Length**

Length of the cable that you perform the measurement on.
- **Calibration**

Calibration method to use before the measurement starts. This is a read only field, the calibration method has to be defined with R&S ZVHView.

You have to calibrate the R&S ZVH before you can begin with the measurement sequence defined in the wizard. If the R&S ZVH has already been calibrated with the defined routine prior to starting the wizard, the R&S ZVH skips the calibration and directly starts the measurement.

- Measurements

List of all individual measurements (datasets) that need to be performed for successful completion of the measurement task. The list also shows the measurements that still need to be performed.

Some parameters of the measurement setup you can still change directly on the R&S ZVH. These are mainly parameters whose details may not be available when you define the measurement set or whose details may differ depending on the measurement site, e.g. the cable length or the cable model if it is different to the one defined previously.

- ▶ To change a parameter, select it with the cursor keys and activate the corresponding input field with the ENTER key.
- ▶ Update all parameters that are not correct for the current measurement.

### 3.1.2.2 Performing a Sequence of Measurements

Now that you have updated all parameters concerning the measurement task, you can start the measurement procedure.

- ▶ Press the "Start Meas Set" softkey.

If you have not yet calibrated the R&S ZVH for the measurement, it asks you to perform the calibration routine. The stages of the calibration depend on the defined calibration routine.

For more information see "[Calibrating Measurements](#)" on page 21.

After having successfully calibrated the R&S ZVH, it starts to go through the measurements that are part of the measurement set. The sequence of measurements is as defined with R&S ZVHView.

Before each measurement, the R&S ZVH shows a message box.



The message box contains the information and instructions on how to prepare and perform the measurement that you have defined with the R&S ZVHView software.

- ▶ Make the necessary preparations, like connecting the cable.
- ▶ Press the "Confirm" softkey.

The R&S ZVH performs the measurement as defined in the dataset and measurement set. When finished, it shows the measurement results and says

**Measurement Done**.

Note that it is not possible to change any measurement parameters while using the measurement wizard. Marker functionality and scaling parameters are, however, available.

After each measurement step, you have three options:

- Continue with the next measurement.  
Finishes the current measurement and begins with the next measurement by showing the necessary preparations.
- Repeat the current measurement.  
Repeats the current measurement, e.g. if the results don't match your expectations and you want to validate the results.
- Abort the measurement set routine.  
Aborts the measurement and returns to the "Measurement Wizard" dialog box. The results of the measurements you have already finished are lost.

When you have finished all measurements that are part of the measurement set, the R&S ZVH asks you if you want to save the measurement results.

- ▶ Press the "Save Meas Results" softkey.

The R&S ZVH saves the results in its internal memory, or, if available on a SD card or memory stick.

If you have to store the results on the internal memory, make sure that it has enough space left to store them. Else it may happen that the results get lost. If the space is not enough, you can delete old data with the file manager. For more information see [Saving and Loading Instrument Settings and Measurement Results](#) on page 53.

The results for a measurement set consist of a number of files, each file corresponding to one of the performed measurements. For easy evaluation, the R&S ZVH includes the name of the measurement as defined in the wizard dialog or R&S ZVHView in the file name.

All result files that belong to a measurement set are stored in the same directory. The directory is named after the measurement name and site. The syntax is 'sitename\_measurement\_#'.

The R&S ZVH adds numbers in ascending order to files as well as directories if you perform a measurement or measurement set more than once.

### 3.1.3 Evaluating Results

The R&S ZVHView software provides functionality to evaluate results and compile measurement reports. However, before you can start to evaluate the results you have to download the results to your computer.

- ▶ Select the "Wizard Result Control" function with the  button.

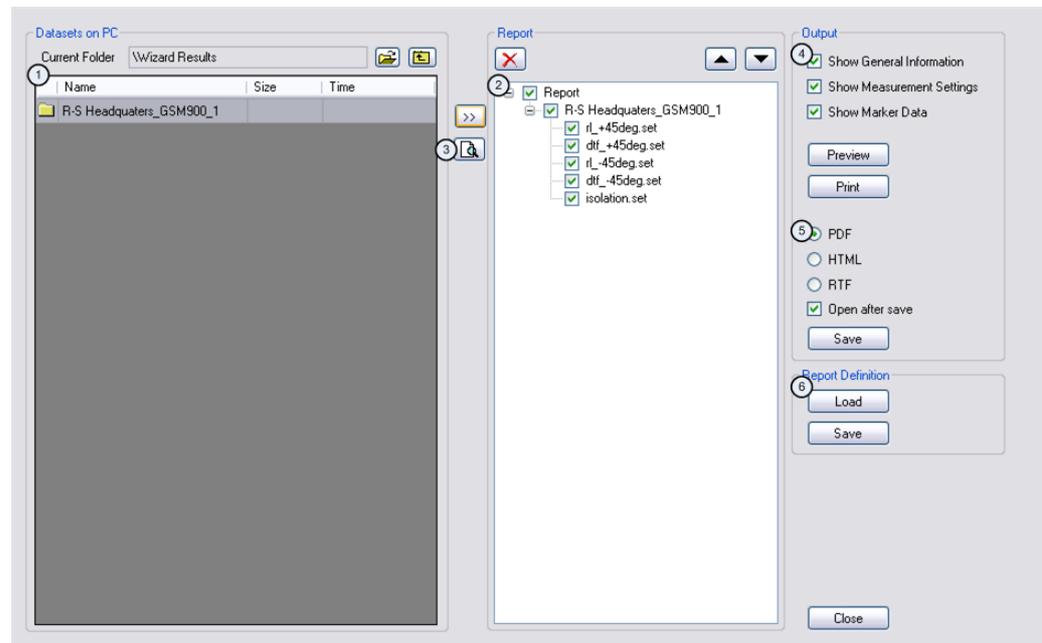
The R&S ZVH opens a dialog box to select the measurement set(s) to download.

- ▶ Select the measurement set you want to upload.
- ▶ Copy the files with the  button.

Now that the results are available, you can start to compile a measurement report with the R&S ZVHView.

- ▶ Select the "Report Generator" with the  button.

The R&S ZVH opens a dialog that provides all functionality to manage measurement sets.



- 1 Source folder of the datasets
- 2 Preview of a particular dataset
- 3 Data to be included in the report
- 4 Selection of the included information
- 5 Selection of the output format
- 6 Save/load a report

With the report editor, you can create measurement reports for the full measurement set or a selection of dataset only. You can also perform simple tasks like activating or deactivating markers that have been set during the measurement.

- ▶ Add the results you want to include in the report by setting a checkmark or removing the checkmark in the report pane.
- ▶ Select the report format you would like.
- ▶ Create the report with the "Save" button.

## 4 Working with Power Sensors (R&S ZVH-K9)

For highly accurate power measurements, you can connect a power sensor to the R&S ZVH and perform measurements.

### 4.1.1 Measuring the Power with a Power Sensor

A power sensor measures the power in the frequency range defined in the data sheet of the power sensor. This means that you can measure both sine signals and modulated signals precisely over a large dynamic range.

The R&S ZVH supports the following power sensors. The information in brackets indicates if the power sensor is connected via the power sensor port or via the USB interface.

- R&S FSH-Z1 (power sensor port)
- R&S FSH-Z18 (power sensor port)
- R&S NRP-Z11 (USB)
- R&S NRP-Z21 (USB)
- R&S NRP-Z22 (USB)
- R&S NRP-Z23 (USB)
- R&S NRP-Z24 (USB)
- R&S NRP-Z31 (USB)
- R&S NRP-Z51 (USB)
- R&S NRP-Z55 (USB)
- R&S NRP-Z56 (USB)
- R&S NRP-Z57 (USB)
- R&S NRP-Z81 (USB)
- R&S NRP-Z91 (USB)
- R&S NRP-Z92 (USB)

If you are using one of the NRP power sensors you also need a passive USB adapter (R&S NRP-Z4) to connect the power sensor to the R&S ZVH.

For more information on the characteristics of the supported power sensors see

- the datasheet of the R&S ZVH
- the [website](#) for R&S power sensors.

The power sensor function turns the R&S ZVH into a wideband power meter. It then always measures the power of the whole signal in the frequency range of the power sensor. In most cases the signal shape has no effect on the measurement.

- ▶ Press the MODE key.
- ▶ Press the "Power Meter" softkey

The R&S ZVH activates the mode for power measurements.

## Screen layout of the power meter mode



- 1 Connected power sensor model
- 2 Reference for relative power measurements
- 3 Power offset
- 4 Measurement time
- 5 Readout of the measured power
- 6 Analog readout of the measured power
- 9 Measurement frequency
- 10 Power sensor softkey menu

#### 4.1.1.1 Connecting a Power Sensor

The R&S ZVH controls and powers the power sensors via a special interface on the top of the instrument. You can also connect a power sensor via the USB interface on the right.

If you are using the R&S FSH-Z1 and -Z18 power sensors, connect the power sensor cable to the power sensor interface and screw it into position. Power sensors of the R&S NRP-Z product line are controlled via the USB interface with a passive USB adapter.

After connecting the power sensor to the R&S ZVH, you can connect the DUT to the N-connector of the power sensor.

### NOTICE

#### Risk of damage to the power sensor

The continuous power applied to the power sensor's input must not exceed 400 mW (26 dBm). Higher input powers may destroy the sensor. Short ( $\leq 10 \mu\text{s}$ ) power peaks up to 1 W (30 dBm) are however permissible.

An attenuator pad must be used to ensure that the maximum permissible power for the sensor is never exceeded when measurements are made on high-power transmitters.

If the R&S ZVH recognizes a power sensor, it sets up a connection via the interface and after a few seconds shows the measured power. It displays the type of the power sensor in the display header.

If no power sensor has been connected or is not connected appropriately, the R&S ZVH shows nothing.

If there are communication problems between the R&S ZVH and the power sensor, the R&S ZVH displays one of the following error messages that indicate the possible cause.

Message	Cause	Remedy
Error in zeroing: signal at sensor	A signal was present at the power sensor when zeroing was performed.	Unscrew the power sensor from the device under test and repeat zeroing.
Warning: Input overloaded	The power at the input of the power sensor exceeds the permitted power (23 dBm = 200 mW).	Reduce the power at the sensor input.
Power sensor hardware error	Communication error between the R&S ZVH and the power sensor.	Unscrew the sensor from the R&S ZVH and check the connectors. If the problem persists, contact a Rohde & Schwarz service center.
Power sensor error	The power sensor signals an error to the R&S ZVH.	Contact a Rohde & Schwarz service center.
Unknown power sensor model connected	The R&S ZVH cannot identify the device connected to the power sensor interface.	

#### 4.1.1.2 Performing Measurements

The power sensor has a memory containing frequency-dependent correction values. Therefore the highest accuracy is reached for signals whose frequency is known.

Note that if the R&S ZVH switches over to the power measurement mode from another operating mode, it uses the center frequency set in that mode as the frequency for the power sensor.

If you want to perform measurements on another known signal, the power sensor can be "told" what the center frequency is.

- ▶ Press the MEAS key
- ▶ Press the "Freq" softkey.

An input field to define the frequency opens.

- ▶ Enter the frequency you want.

The R&S ZVH transfers the new frequency to the power sensor which then corrects the measured power readings.

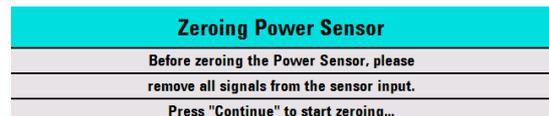
### Zeroing the power sensor

Offset voltages and currents have most effect on the power readout when low powers are being measured. Zeroing is used to compensate for these offsets. The power sensor zeroes itself automatically when instructed to do so.

Do not apply power during the zeroing process, as the power sensor cannot distinguish between external powers and internal offsets.

- ▶ Press the "Zero" softkey.

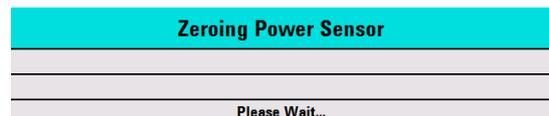
The R&S ZVH asks you not to apply any signals to the power sensor during the zeroing process.



- ▶ Disconnect the power sensor from any signal sources.
- ▶ Press the "Continue" softkey to start zeroing.
- ▶ Press "Cancel" to abort zeroing, for example, if you cannot disconnect the signal source.

The R&S ZVH immediately starts power sensor zeroing.

While zeroing is in progress, the R&S ZVH shows the message "Zeroing power sensor, please wait..".



When zeroing is over, the R&S ZVH shows the message **Power Sensor Zero OK!** and switches back to the softkey menu for the power sensor.

### Selecting the unit for the power readout

The R&S ZVH can display measured power in relative units (dBm) or in absolute units (W, mW,  $\mu$ W, nW and pW). A reference level in dB is also provided by the R&S ZVH.

- ▶ Press the "Unit" softkey.

The R&S ZVH opens a submenu to select the unit.

- ▶ Select the unit you want.

### Setting the Reference Level

If you have selected the unit dB Rel, the R&S ZVH opens an input field to set the reference level. The R&S ZVH shows the currently set reference level in the diagram header.

- ▶ Enter the reference level.

Alternatively, you can set the current level reading as the reference level.

- ▶ Press the "▶Ref" softkey.

The R&S ZVH adjusts the reference level to the currently measured power level.

It then displays the measured level relative to the reference level in dB. The unit is automatically set to dB Rel...

### Setting the averaging time

The averaging time determines for how long the signal will be measured. The longer the averaging time, the more stable the display, particularly if signals are at the lower end of the measurement range or are noisy. You can perform "Short", "Normal" or "Long" averaging.

Stationary sine signals with a high level ( $>-40$  dBm) require only a short measurement time to produce stable, accurate results. "Short" averaging is recommended to obtain a high repetition rate for the measurement. Use "Normal" averaging to increase the stability of the display for signals with low levels or for modulated signals. The "Long" mode is recommended for signals with very low power levels ( $<-50$  dBm to  $<-60$  dBm).

The R&S FSH-Z1 averages out the noise most effectively and the effect of noise on the measurement is minimal.

- ▶ Press the "Meas Time" softkey.
- ▶ Select the measurement time you need.

### Taking Additional Loss or Gain into Account

At high powers that cause the R&S FSH-Z1's maximum input level to be exceeded or at very low levels that are below the R&S ZVH minimum sensitivity, the R&S ZVH can take additional loss or gain between the DUT and the power sensor into account. These are defined in terms of an offset in dB relative to the measured level. A positive offset corresponds to a loss and a negative offset to a gain.

The R&S ZVH shows the current offset in the diagram header.

- ▶ Press the AMPT/SCALE key.
- ▶ Press the "Ref Offset" softkey.

The R&S ZVH opens an input field to define the reference offset.

- ▶ Enter the required offset.

The offset is taken into account in the power or level display.

## 4.1.2 Measuring Forward and Reflected Power

With the directional power sensors R&S FSH-Z14 and R&S-FSH-Z44 (order numbers 1120.6001.02 and 1165.2305.02) you can measure the power in both directions.

When you connect the directional power sensor between the source and the load, the R&S ZVH measures the power from source to load (forward power) and from load to source (reverse power).

The ratio between forward and reverse power is a measure of the load matching. The R&S ZVH displays it as the return loss or standing wave ratio.

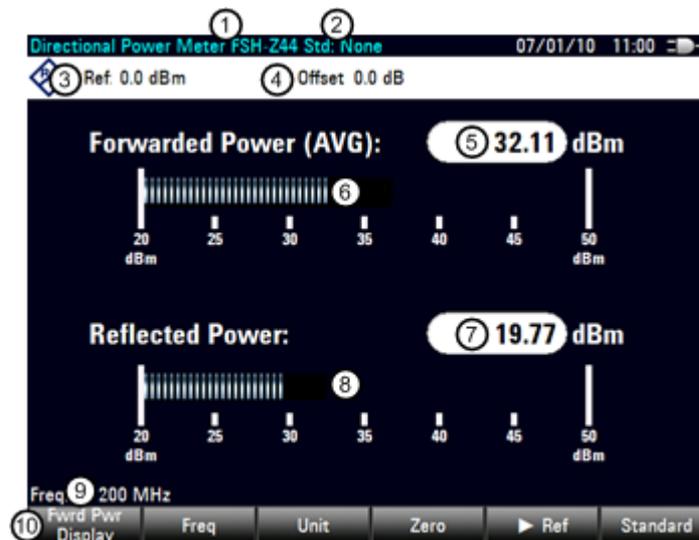
The power sensors for the R&S ZVH have an asymmetrical design. Therefore, they have to be inserted into the test setup in such a way that the "Forward" arrow ( $1 \Rightarrow 2$ ) on the sensor points toward the load (= in the direction of the power flux).

- ▶ Press the MODE key.

- ▶ Press the "Power Meter" softkey

The R&S ZVH activates the mode for power measurements.

#### Screen layout of the power meter mode with a directional power sensor

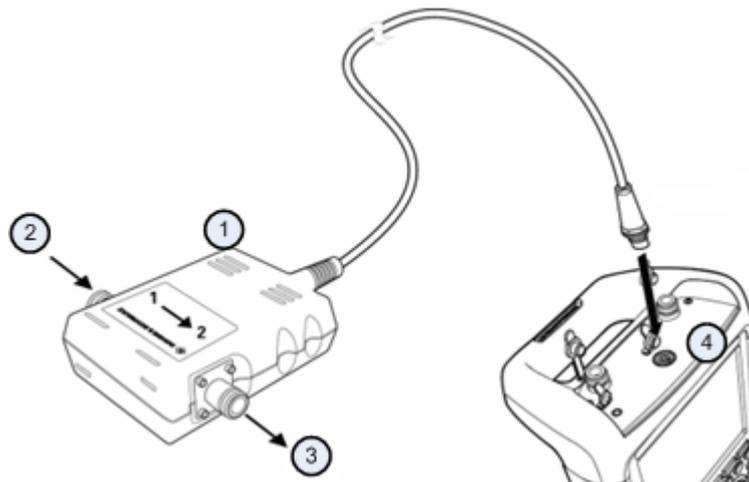


- 1 Connected power sensor model
- 2 Selected transmission standard
- 3 Reference for relative power measurements
- 4 Power offset
- 5 Readout of the forward power
- 6 Analog readout of the forward power
- 7 Readout of the matching value
- 8 Analog readout of the matching value
- 9 Measurement frequency
- 10 Directional power sensor softkey menu

#### 4.1.2.1 Connecting a Directional Power Sensor

The R&S ZVH controls and powers the directional power sensors R&S FSH-Z14 and -Z44 via a special interface.

Connect the power sensor cable to the R&S ZVH's power sensor interface and screw it into position. The sensor is connected between the source and the load.



- 1 Directional Power Sensor R&S FSH-Z14 or -Z44
- 2 Source
- 3 Load
- 4 Power sensor jack

When measuring high powers, pay strict attention to the following instructions to avoid personal injury and to prevent the power sensor from being destroyed

### **CAUTION**

#### **Danger of skin burns or damage to the instrument**

- Never exceed the permissible continuous power.
- See diagram on the rear of the sensor for the permissible continuous power.
- Turn off the RF power to connect the sensor.
- Screw the RF connectors tightly.

After connecting the directional power sensor, the R&S ZVH should recognize the power sensor and start the measurement. If not, it may show an error message.

For more information, see "[Connecting a Power Sensor](#)".

#### **4.1.2.2 Performing Measurements with Directional Power Sensors**

To get the most accurate results, you should adjust the frequency to that of the signal.

Note that if the R&S ZVH switches over to the power measurement mode from another operating mode, it uses the center frequency set in that mode as the frequency for the power sensor.

- ▶ Press the MEAS key
- ▶ Press the "Freq" softkey.

An input field to define the frequency opens.

- ▶ Enter the frequency you want.

The R&S ZVH transfers the new frequency to the power sensor which then corrects the measured power readings.

### Zeroing the power sensor

For more information see "[Zeroing the power sensor](#)".

### Setting the power measurement weighting mode

For forward power display, the R&S ZVH provides both average power and peak envelope power.

- ▶ Press the "FwrD Pwr Display" softkey.
- ▶ Select the weighting mode you require with the rotary knob or the cursor keys.
- ▶ Confirm the selection with the ENTER key.

The R&S ZVH indicates the weighting mode at the Forward Power heading.

- Forward power (AVG) = average power
- Forward power (PEP) = peak envelope power

### Selecting the unit for the power readout

When using a directional power sensor, the R&S ZVH displays the forward power as a logarithmic level value in dBm (relative value) or as a linear value in W or mW (absolute value). In addition you can define a reference level relative to which the R&S ZVH indicates the level difference in dB. Load matching is indicated as return loss in dB or as voltage standing wave ratio (VSWR). In addition, the absolutely reflected power can be displayed in W, or the reflected level in dBm.

For more information see "[Selecting the unit for the power readout](#)".

### Setting the reference level

If you have selected the unit dB Rel for the forward power, the R&S ZVH opens an input field to set the reference level. The R&S ZVH shows the currently set reference level in the diagram header.

For more information see "[Setting the Reference Level](#)".

### Selecting a standard

To ensure that true results are output when measuring modulated signals, the R&S ZVH offers the possibility of taking correction values into account for a number of common telecommunications standards.

- ▶ Press the "Standard" softkey.  
A menu to select a standard opens.
- ▶ Select the required standard with the rotary knob or the cursor keys.

- ▶ Confirm the selection with the ENTER key.

The R&S ZVH takes the selected standard into account. The currently active standard is displayed in the display header.

#### **Taking additional attenuation into account**

When the directional power sensor is connected to a test point not directly but via a cable, the influence of cable attenuation can be taken into account. For this purpose, the cable attenuation for the measurement frequency in question is to be entered, i.e. as a positive dB value if the power and matching are to be measured at the source and the cable is connected between the source and the power sensor, and as a negative dB value if the power and matching are to be measured at the load and the cable is connected between the load and the power sensor. The directional power sensor then corrects the power and matching values to produce the results that would have been obtained if it had been directly connected to the test point.

- ▶ Press the AMPT/SCALE key.
- ▶ Press the "Ref Offset" softkey.
  - The input field to enter the reference offset opens.
- ▶ Enter the offset with the rotary knob, the cursor keys or the number keys.
- ▶ Confirm the entry with the ENTER key.

The selected offset is displayed in the diagram header and is taken into account in the power (level) and matching results.

If high powers are applied that exceed the maximum input level of the R&S FSH-Z14 or R&S FSH-Z44, a directional coupler or an attenuator has to be connected ahead of the power sensor. In such cases, the coupling attenuation of the directional coupler or the attenuation value of the attenuator are to be entered as positive dB values (see above) into the R&S ZVH to ensure true measured power readout. In both cases, a termination or an attenuator of sufficient power-handling capacity has to be connected to the power sensor at the load end. The matching readout is irrelevant in such case since it is likewise corrected by taking into account the attenuation value of the termination or attenuator.

## 5 Saving and Loading Instrument Settings and Measurement Results

For documentation purposes or further analysis, you can save and store measurement settings and results to the internal memory, SD card or a memory stick and recall them later. With the R&S ZVHView software package, you can also transfer these data sets from the R&S ZVH to a PC or transfer them from a PC to the R&S ZVH.

Results and settings, including the measurement function, are always saved en bloc so that when the results are recalled the measurement context is clear. The R&S ZVH can store at least 100 datasets and assigns a unique name to each of the datasets.

If you save a setup for scalar or transmission measurements, the R&S ZVH also saves the calibration data for these measurements. Therefore you can immediately perform measurements without prior calibration. Data sets that include calibration data require twice as much memory as data sets without this information. This reduces the maximum number of data sets that can be stored by the number of data sets stored with calibration data.

If cable models or channel tables are stored simultaneously, the maximum number of data sets will be reduced. In addition, the size of the data sets can vary as a function of the selected measurement function. A complete data set uses approximately 100 kb of memory.

The R&S ZVH provides a total internal storage space of approx 20 MB. In addition data sets (cable models, channel tables etc.) can be stored on a SD card or an USB memory stick. In that case the number of datasets that you can manage depends on the size of the storage device.

### 5.1.1 Saving Datasets

- ▶ Press the SAVE/RECALL key.

The R&S ZVH opens the file manager.

- ▶ Press the "Save" softkey.

The R&S ZVH opens the "Save Dataset" dialog box.



- 1 Available datasets and folder structure
- 2 Dataset name input field
- 3 Remaining memory on selected data storage device
- 4 File manager softkey menu

The folder structure shows all available data storage devices. Possible storage devices are the internal memory of the R&S ZVH, an SD card or a USB storage device.

The internal memory provides approximately 20 MB of data, therefore the number of datasets you save on the R&S ZVH is limited. Each dataset needs about 100 kB of memory, but this value can vary.

If you are using an external storage device, the number of datasets you can save is limited only by the size of the storage device.

The R&S ZVH shows the available memory for the storage device in the dialog box.

- ▶ Select the storage device you want to save the data to.
- ▶ Confirm the selection with the ENTER key.
- ▶ Browse to the folder you want to save the data to.
- ▶ Enter a file name in the corresponding input field.

The default file name for datasets is "Dataset###.set" with a new number in ascending order for each new dataset. The file extension for datasets is \*.set.

If you enter another name, the R&S ZVH uses that name and assigns a new number to the file name if you save the data set the next time. This function allows you to assign consecutive dataset file names without entering a new name every time you want to save a dataset.

You can enter the file name with the alphanumeric keypad. Each key covers more than one character. To get the character you want, press the key in question the appropriate number of times.

- ▶ Press the "Save" softkey.

The R&S ZVH saves the dataset.

## 5.1.2 Loading Measurement Results

You can preview and load previously saved measurement results with the recall function of the R&S ZVH. This function also provides easy access to previous measurement settings so that you do not have to set up the R&S ZVH again.

Press the SAVE/RECALL key.

The R&S ZVH opens the file manager.

By default, the most recently saved dataset is highlighted. If you need another dataset browse the file manager and navigate to the folder or storage device that contains the dataset you need.

### 5.1.2.1 Previewing a Dataset

The R&S ZVH provides a preview of datasets. The preview is like a screenshot and lets you take a quick look at that measurement and its settings. The R&S ZVH does not yet activate the measurement settings of that dataset.

- ▶ Browse through the available dataset and select the one you want.
- ▶ Press the "Recall" softkey.

The R&S ZVH shows a preview of the measurement contained in the selected dataset. The preview shows the measurement results as well as the measurement settings.

- ▶ Use the rotary knob to browse the previews of all datasets available in the selected folder.
- ▶ Press the "Exit" softkey to return to the "Recall Dataset" dialog box.

### 5.1.2.2 Loading a Dataset

If you find a dataset whose settings you need for your current measurement task, you can load it.

- ▶ Press the "Activate" softkey.

The R&S ZVH loads the dataset in question and adjusts its measurement settings to those of the dataset.

### 5.1.2.3 Deleting Datasets

If you have to delete a dataset, you can do so with the file manager.

- ▶ Press the SAVE/RECALL key.
- ▶ Press the "File Manager" softkey.

The R&S ZVH opens the file manager.

- ▶ In order to delete a single dataset, press the "Select Action" softkey. Select "Delete" and the dataset currently selected is deleted after your confirmation.

In order to delete multiple data sets, the respective datasets have to be marked first.

- ▶ Press the "Mark" softkey to mark files for deletion
- ▶ Select the dataset you'd like to delete.
- ▶ Mark the data sets with the ENTER key.

The selected data sets should be checked in the "Status" column.

Repeat the selection by moving the cursor with the rotary knob or the cursor key and marking more data sets with the ENTER key.

- ▶ Press the "Select Action" softkey.
- ▶ Select the "Delete" menu item and confirm with the ENTER key or the "Select Action" softkey.

Before deleting the data set, the R&S ZVH shows a warning message that you need to confirm. After confirming the deletion process the R&S ZVH deletes the selected data sets from its memory.

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