R&S®ETH
Handheld TV Analyzer
Quick Reference Guide

ROHDE&SCHWARZ

The Quick Reference Guide describes the following R&S®ETH models:

- 2114.1508.04
- 2114.1508.08
- 2114.1508.14
- 2114.1508.18

The firmware of the instrument makes use of several valuable open source software packages. the most important of them are listed below, together with their corresponding open source license. The verbatimlicense texts are provided on the user documentation CD-ROM (included in delivery).

Package	Link	License
OpenSSL	http://www.openssl.org	OpenSSL/SSLeavy
BOOST Library	http://www.boost.org	Boost Software, Version 1.0
ONC/RPC	http://www.plt.rwth-aachen.de	SUN

Rohde&Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

The following abbreviations are used throughout this manual:
R&S®XYZ is abbreviated as R&S XYZ.

Table of Contents

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.

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.

Basic Safety Instructions

Symbols and safety labels

Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal

Be careful when handling electrostatic sensitive devices	ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

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

⚠ DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE 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.

Basic Safety Instructions

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. 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. 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 indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.

3. 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. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.

Basic Safety Instructions

3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

4. 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.

5. 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.

6. 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).

7. 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.

8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

10. 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.

11. 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.

Basic Safety Instructions

12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.

13. 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.

14. 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.

15. 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.

16. 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.

17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

18. 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".

Basic Safety Instructions

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.

7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

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.

Basic Safety Instructions

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. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

Basic Safety Instructions

2. 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.

3. 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.

2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

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.

Informaciones elementales de seguridad

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.

Símbolos y definiciones de seguridad

Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Adver-tencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa

Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)	Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Informaciones elementales de seguridad

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.

⚠ PELIGRO	PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.
⚠ ADVERTENCIA	ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.
⚠ ATENCIÓN	ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.
AVISO	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 área 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.

Informaciones elementales de seguridad

1. 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 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.

2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.

3. 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. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.

3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

Informaciones elementales de seguridad

4. 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.

5. 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.

6. 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).

7. 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.

8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.

9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 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.).

10. 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.

11. 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.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. 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.

14. 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.

15. 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.

16. 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.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.

18. 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".

Informaciones elementales de seguridad

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 deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

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.

Informaciones elementales de seguridad

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. 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.

3. 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 (polvos 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.

2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Supplementary Safety Instructions

⚠ WARNING

Risk of explosion and fire

Batteries may be used only for their intended purpose. It is prohibited to use, store or charge the battery pack at impermissibly high temperatures. Maximum charging temperature is 40 °C. Maximum storage temperature is 70°C. Maximum temperature during battery-powered operation is 50°C.

Do not store or place batteries in direct sunlight. To avoid short-circuiting, do not store batteries together or close to other conducting materials. Danger of explosion if short-circuited!

The battery pack must not be burned, taken apart, opened, deformed or cut into pieces. Do not subject batteries to mechanical shock or stress.

Do not use any charging units other than those designed specifically for use with the R&S ETH (HA-Z201).

Maximum charging voltage is 8.4 V, maximum charging current is 3 A.

NOTICE

Observe the following safety instructions to protect your instrument from damage.

The R&S ETH is splash-proof and dust-proof (IEC60529 / IP 51). Operation with the R&S HA-Z201 AC power supply is restricted to indoors. With outdoor use, battery operation is permitted.

Operation with the R&S HA-Z201 AC power supply is permissible up to 2000 m above sea level; battery-powered operation is permissible up to 4600 m above sea level.

Electrostatic discharges via the connectors may damage the equipment. When handling and operating the instrument, protect it from electrostatic discharge. Operate the instrument only on electrostatic discharge-protected workstations equipped with an antistatic wrist strap and/or antistatic floor mat and ankle strap.

Safety Instructions

When returning or sending the instrument in for repair, it should be shipped in the original product packaging or in packaging that protects it against electrostatic charge/discharge and physical/mechanical damage.

The RF INPUT test input of the R&S ETH is a test circuit of test category I. The max. input voltage is +20 dBm / 80 V DC. It must be ensured that the transient overvoltages that occur in the test circuit are not greater than the max. permissible input peak voltages.

This instrument must not be used in the test categories II, III and IV.

> Test category I is intended for measurements on circuits that are not directly connected with the mains (see IEC / UL / CSA / 61010-1 – 6.7.4).

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).
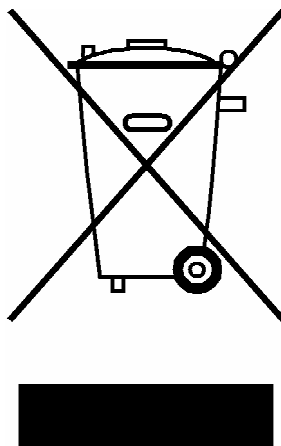
Product labeling in accordance with EN 50419

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.

ROHDE & SCHWARZ

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.
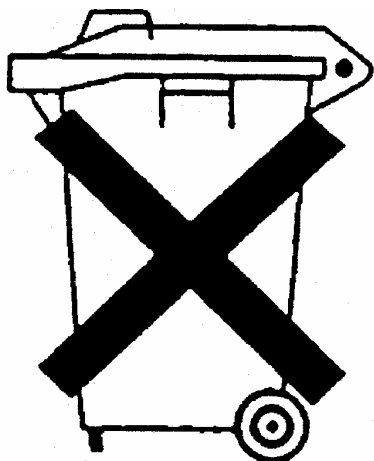
Normas de Seguridad para Baterías (Según BattV)

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 ménagéres.

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 Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish.
We will take care that you will get the right information.

Europe, Africa, Middle East	Phone +49 89 4129 12345 customersupport@rohde-schwarz.com
North America	Phone 1-888-TEST-RSA (1-888-837-8772) customer.support@rsa.rohde-schwarz.com
Latin America	Phone +1-410-910-7988 customersupport.la@rohde-schwarz.com
Asia/Pacific	Phone +65 65 13 04 88 customersupport.asia@rohde-schwarz.com

ROHDE & SCHWARZ

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

75 Years of Driving Innovation

ROHDE & SCHWARZ

1171.0500.11 V 04.00

ROHDE & SCHWARZ
EC Certificate of Conformity

C E

Certificate No.: 2009-02

This is to certify that:

Equipment type	Stock No.	Designation
ETH	2114.1508.04/ .08/ .14/ .18	Handheld TV Analyzer

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, Class B
EN 61000-3-2 : 2006
EN 61000-3-3 : 1995 + A1 : 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, 2010-07-14

Central Quality Management MF-QZ / Radde

Documentation Overview

For the R&S ETH, the following product manuals are provided:

- Quick Reference Guide
- Operating Manual
- Service Manual

Quick Reference Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD-ROM. The Quick Reference Guide includes general information (e.g. Safety Instructions) and the following chapters:

- Chapter 1: Putting into Operation
- Chapter 2: Software Options
- Chapter 3: Battery Operation
- Chapter 4: Switching Between External Reference/External Trigger Input
- Chapter 5: Controlling the RF Attenuator
- Chapter 6: RF Preselection (R&S ETH-K1 Option)
- Chapter 7: Setting Up a LAN or USB Connection to a PC
- Chapter 8: Basic Measurement Examples

Operating Manual

This manual is a supplement to the Quick Reference Guide and is available in PDF format on the CD-ROM delivered with the instrument.

In this manual, all instrument functions are described in detail. For additional information on default settings and parameters, refer to the data sheets. The manual includes the following chapters:

- Chapter 1: Operation
- Chapter 2: Menu Overview
- Chapter 3: DVB-T/H Receiver Mode
- Chapter 4: Spectrum Analysis Mode
- Chapter 5: Network Analysis Mode
- Chapter 6: Cable Measurements
- Chapter 7: Measuring with Transducer Factors
- Chapter 8: Field-Strength Measurement with Isotropic Antenna
- Chapter 9: Saving and Loading Instrument Settings

Service Manual

This manual is available in PDF format on the CD-ROM delivered with the instrument. It informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination.

CD-ROM

The CD-ROM delivered with the instrument contains the following:

● R&S ETH View software
● R&S ETH drivers
● Brochures and data sheets
● Manuals
● Adobe Reader

For using the contents of the CD-ROM, the following minimum system requirements must be met:

● Pentium$^{©}$ processor or equivalent at 133 MHz or higher
● 64 MB free memory space
● 50 MB free hard disk space
● Display resolution SVGA (800 x 600)
● 1 free communications port (LAN or USB)
● Windows$^{©}$ 2000 / XP / Vista operating system

Typographical Conventions

Key names and all names of graphical user interface elements are written in capital letters.

1   Putting Into Operation

The following section describes how to put the R&S ETH Handheld TV Analyzer into operation.

1.1   Unpacking the Instrument

The R&S ETH comes in formfitting packaging that consists of upper and lower shells. The two shells are held together by tape. The packaging contains all supplied accessories.

1. Undo the tape to unpack the analyzer.
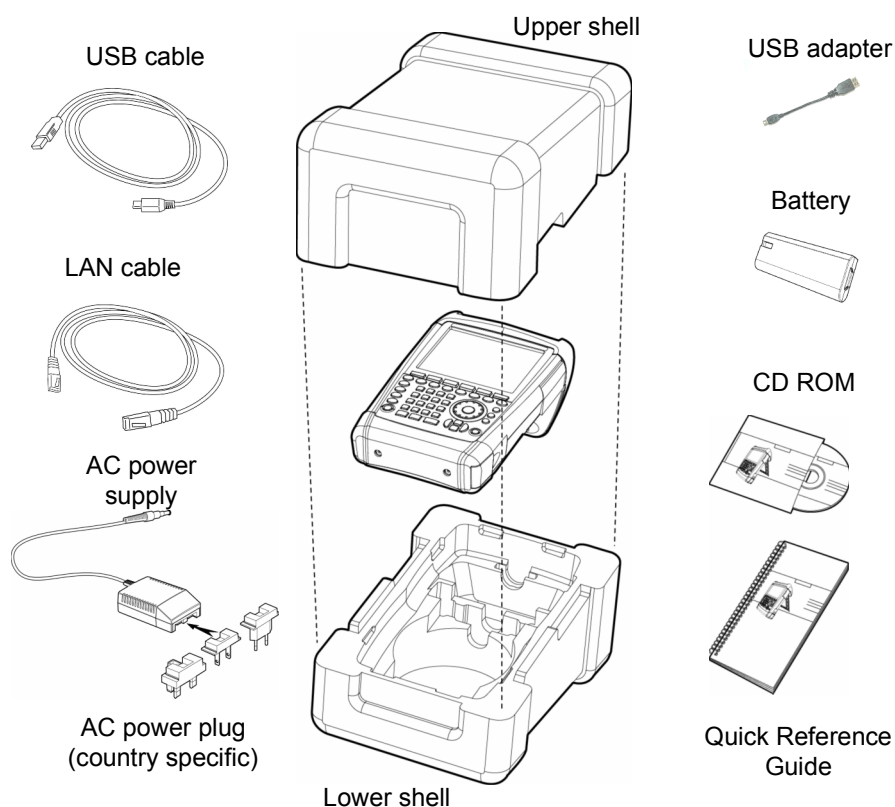
2. Remove the R&S ETH and the accessories.

3. Remove the protective foil from the screen.

1.2   Setting Up the Instrument

The R&S ETH portable TV analyzer has been designed for operation in labs as well as for on-site service and maintenance applications.

Depending on the application, the R&S ETH can be set up to optimize ease of operation and the viewing angle of the display.

When used as a desktop model, the R&S ETH can be laid flat on a surface or propped up using the fold-out support on the rear.

The R&S ETH can be laid flat on a surface for operation from above. Because the grip is raised at the back, the R&S ETH is tilted slightly forward to provide an optimal viewing angle for the display.

For use on a desktop, fold out the rear support for easy operation from the front and to make the display easy to read (see figure).

For on-site installation and service measurements, it is best to hold the instrument in both hands. All the controls are easy to reach (e.g. with your thumbs). The R&S HA-Z222 carrying bag is recommended so that both hands are free to work on the device under test.

The carrying handle on top of the R&S ETH can also be used to hang it from cabinet doors, for example. The shape of the handle prevents the instrument from falling.

1.3   Switching On the TV Analyzer

The rechargeable lithium ion battery that is supplied must be inserted in the battery compartment before the R&S ETH is switched on. The battery compartment is located on the lower right corner of the instrument. To open the battery compartment, push the cover downward by pressing a finger against the recessed grip (1). Then open up the cover (2) and push the battery into the R&S ETH as far as it will go with the beveled side facing up and the grip on the right side (3). To close the cover, press it down (4) and then push it up until it clicks fully into place (5).
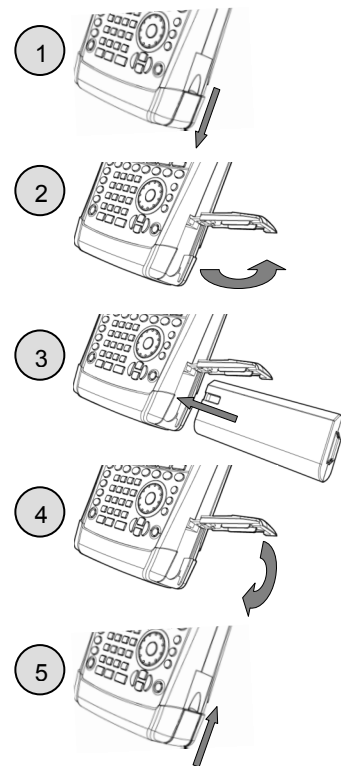
The R&S ETH can be operated with the AC power supply that is supplied or with the removable battery. The R&S ETH battery may not be fully charged when delivered. It must therefore be charged first before using it. Charging time is approximately 3 hours and 40 minutes when the instrument is switched off. If the instrument is switched on, charging time is extended up to 7 hours and 20 minutes depending on the operating mode. An R&S HA-Z203 external charger is available for charging a spare battery.

The power adapter jack should be plugged into the POWER ADAPTER socket on the left side of the instrument until it engages. Then connect the AC power supply unit to an AC outlet. The permissible voltage range of the AC power supply is 100 V AC to 240 V AC.

NOTICE

Risk of damage to the instrument

Use only the R&S HA-Z201 AC power supply to power the R&S ETH or to charge the battery in the instrument.

Prior to use, make sure that the AC supply voltage is compatible with the voltage specified on the power supply unit.

Before inserting the AC power supply into the AC power outlet, make sure the correct adapter is attached.

The R&S ETH can be charged with the R&S HA-Z202 car adapter which plugs into the car cigarette lighter socket.

⚠ CAUTION

Risk of accident

The R&S ETH must be switched off while driving or while the engine is on. Turn off the R&S ETH before starting the engine.

Operation of the R&S ETH via the cigarette lighter socket while driving or while the engine is on is prohibited.

► To switch on the R&S ETH, press the yellow button on the bottom left of the front panel:

The R&S ETH displays an arrow within the battery charge status indicator at the top right of the display to show that it is connected to the mains and is charging.

```
16/05/08  15:37  ◄─
250 ms   Trace: Clear/Write
Free Run Detect: Auto Peak
```
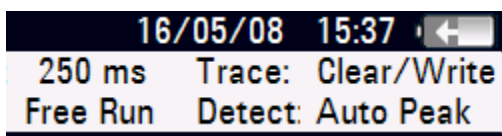
Figure 1-1: Battery is charging

If the battery is fully charged, a plug icon is displayed instead of the battery icon.

```
19/05/08  11:42  ⊐▭━
250 ms    Trace: Clear/Write
Free Run  Detect: Auto Peak
```
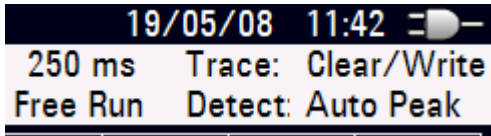
Figure 1-2: R&S ETH is being powered by the AC supply and the battery is fully charged.

When the R&S ETH is switched on, it recalls the settings that it was using when it was last switched off.

1.4 TV Analyzer Front View
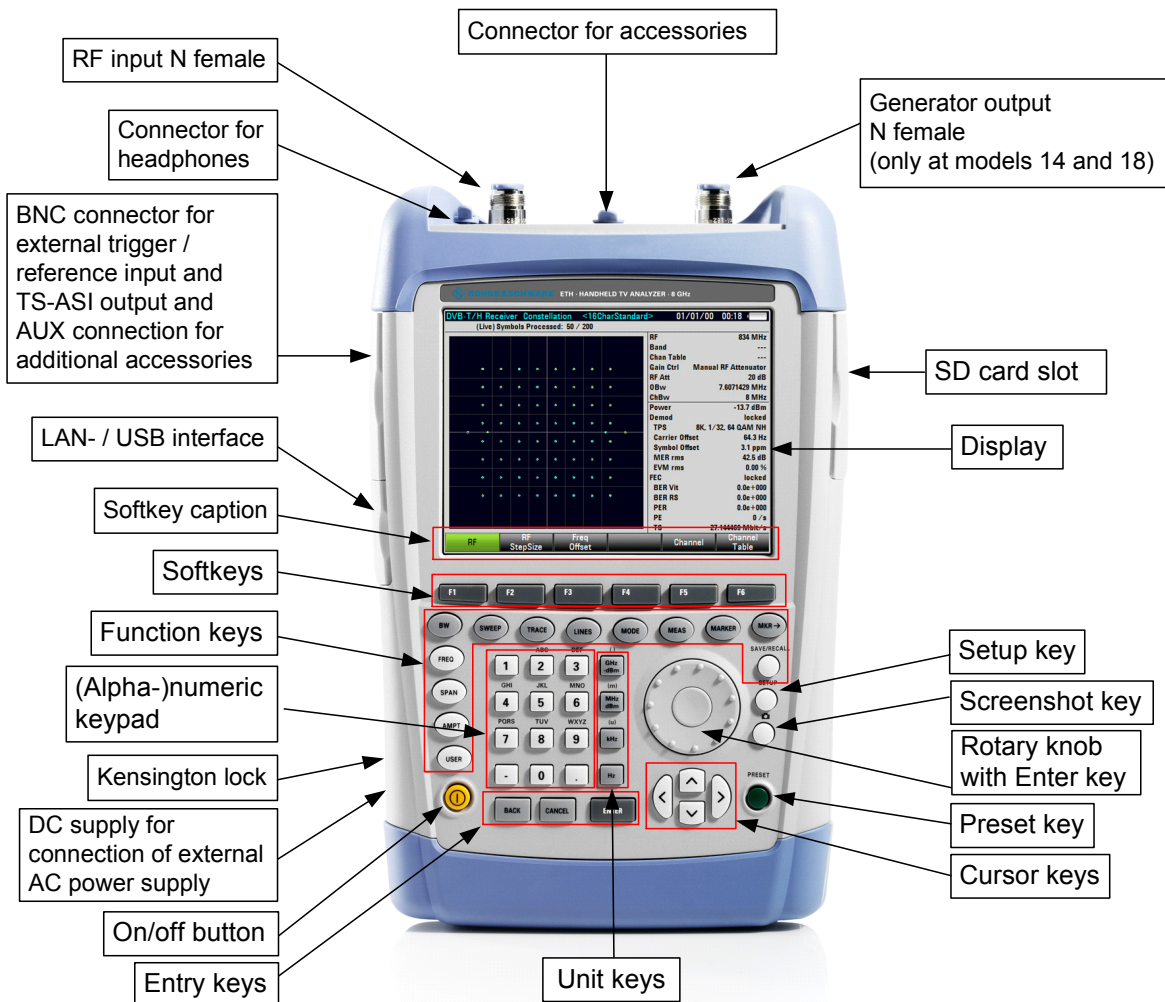
Figure 1-3: Front view

1.5   TV Analyzer Connectors

The R&S ETH has the following connectors on the top of the instrument:

RF input

The DUT is connected to the RF input of the R&S ETH via a cable with an N male. Make sure it is not overloaded.

The maximum permissible continuous power at the RF input is 20 dBm (100 mW). It can be loaded with up to 30 dBm (1 W) for a maximum of three minutes. Loading with 1 W for an extended period of time can damage the instrument.

⚠ **WARNING**

Shock hazard

Be careful not to cause short-circuits. Never exceed the value for the DC input voltage specified on the housing. Ensure that the instrument is switched off and disconnected from the power supply by removing the plug from the AC power connector before touching the RF input.

NOTICE

The RF input is AC-coupled. The DC voltage must never exceed the value specified on the housing since this can damage the instrument. The RF input is protected against static discharges and voltage pulses by limiting circuits.

Tracking generator output (Gen Output)

Only two models, the 2114.1508.14 and 2114.1508.18, have a tracking generator and corresponding output connector.

The nominal output level can be reduced in 1 dB steps.

NOTICE

Risk of damage to the instrument

The reverse voltage up to the voltage stated on the R&S ETH housing must not be exceeded.

Connector for accessories

This connector is specially configured for accessories. It can be used for power supply and for controlling external equipment, as well as for data transfer. It can be used to control the R&S FSH-Z1, Z18, Z14 and Z44 power sensors.

Headphone connector

A 3.5 mm headphone jack is provided. The internal impedance of the connector is approx. 10 Ω.

Input for external trigger or external reference frequency (Ext Trig/Ext Ref)

Either an external trigger signal to start a measurement or a 10 MHz reference signal for frequency synchronization is fed in via the Ext Trig/Ext Ref BNC female. The trigger threshold is similar to that of TTL signals. The reference signal level must be > 0 dBm. The selection is made in the SETUP menu (SETUP key, INSTRUMENT SETUP softkey).
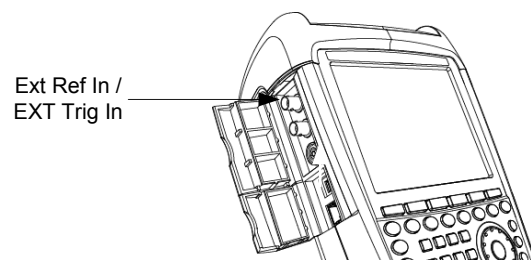
Ext Ref In / EXT Trig In

NOTICE

Risk of damage to the instrument

Never apply currents above 600 mA or voltages above 28 V to the BNC socket.

TS-ASI output (TS Out)

In TV demodulation mode, the R&S ETH supplies the transport stream signal (TS-ASI) of the TV signal being received over the BNC female shown in the figure on the right.

TS OUT
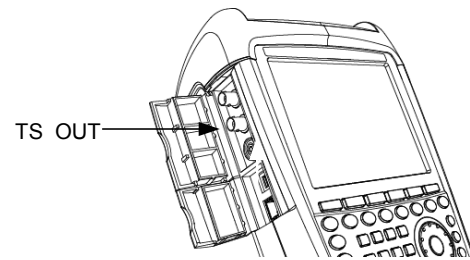
> The TS-ASI serial transport stream is available only in the following modes: DVB-T/H RECEIVER – MEASUREMENT LIST, DVB-T/H RECEIVER – CONSTELLATION DIAGRAM and DVB-T/H RECEIVER – TPS INFO.
>
> Use a suitable double shielded cable for the TS ASI output.

NOTICE

Risk of damage to the instrument

Never apply currents above 600 mA or voltages above 20 V to the BNC socket.

Connector for additional accessories (AUX)

The AUX connector is specially configured for additional accessories, for example GPS receiver (HA-Z240, order no. 1309.6700.02).

The R&S ETH uses this connector to control and supply accessories with power and to transfer data.

AUX
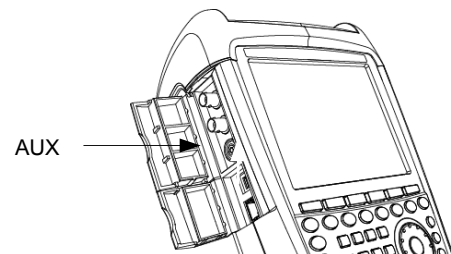
USB and LAN interface

To transfer data, the R&S ETH can be connected to a computer via a USB or a LAN interface. The interfaces are on the left-hand side under a protective cover (see figure on the right). A USB cable and a LAN connection cable for direct connection to the computer are supplied with the instrument. The LAN interface is configured via the SETUP key, softkey INSTRUMENT SETUP.

USB
LAN
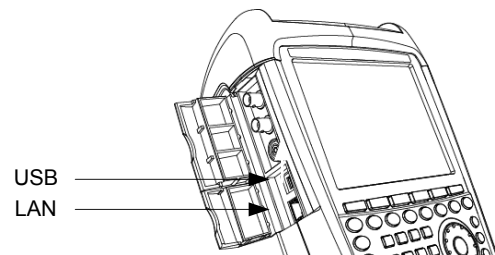
DC connector for the external AC power supply

The R&S ETH is supplied with current by the AC/DC power supply via the DC connector. The R&S ETH battery is automatically charged.

The internal battery can also be charged from a car cigarette lighter socket. The required adapter is available as an accessory for the R&S ETH (R&S HA-Z202, Order No. 1309.6117.00).

DC connector ─
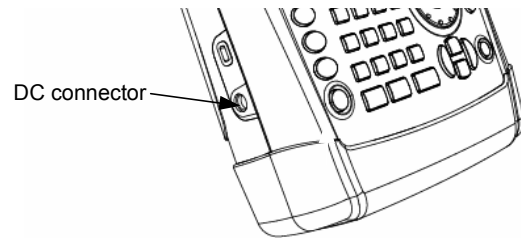
Mechanical locking device

A Kensington Lock can be anchored in the R&S ETH housing to mechanically secure it to a workstation.

Kensington Lock ─►
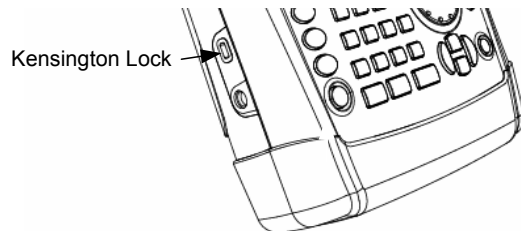
1.6   Setting Accessory Detection

A wide range of accessories are available for the R&S ETH. The R&S ETH supplies and controls the accessories via the ACCESSORIES or AUX connectors. In the setting AUTO ACCESSORY DETECTION, the connected accessory is automatically detected.

Setting the Accessory Detection

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

3. Select the AUTO ACCESSORY DETECTION menu item below the heading HARDWARE with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

   A submenu opens in which the automatic detection of accessories is set ON or OFF.

> If the connected accessory is detected the item is displayed in the field DETECTED ACCESSORY below the heading HARDWARE.

1.7   Screen Settings

The R&S ETH has a TFT-LCD color screen. The brightness depends on the intensity of the backlighting. To strike a balance between battery operating time and screen display quality, set the backlighting to the minimum brightness required. The screen can be switched from color to black-and-white for maximum contrast. Under extreme lighting conditions, the high-contrast monochrome screen provides the best display.

Setting brightness

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

    The R&S ETH opens a list of general settings.

Display	
Display Backlight	75 %
Display Color Scheme	Color

3. Select DISPLAY BACKLIGHT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    An input field opens in which the current background lighting ratio is displayed in percent. 100 % is the maximum brightness.

4. Enter the desired brightness value with the rotary knob in 1 % steps or the cursor keys in 10 % steps or enter the value directly via the numeric keys and confirm with the ENTER key. The input range is between 0 % and 100 %.

Setting the screen color

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

3. Select the DISPLAY COLOR SCHEME menu item below the heading DISPLAY with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    A submenu appears.

Display	
Display Backlight	100 %
Display Color Scheme	Color
Audio	Color
Key Click Volume	Black/White

4. Select COLOR (color screen display) with the rotary knob or the cursor keys (∧ or ∨) or BLACK/WHITE (monochrome display) and confirm with ENTER.

1.8   Setting the Volume

The R&S ETH has a built-in loudspeaker. It uses this to acknowledge key clicks with a short beep and to emit an acoustic warning signal (beeper) when a system violation occurs, e.g. when limit values are exceeded. The volume is set in the SETUP menu.

Setting the key clicks volume

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

Audio	
Key Click Volume	30%
System Beeper Volume	30%

3. Select the KEY CLICKS VOLUME menu item below the heading AUDIO with the rotary knob or the cursor keys ($\wedge$ or $\vee$) and confirm with ENTER.

   An input field appears. The currently set volume appears as percent value.

Audio	
Key Click Volume	10 %
System Beeper Volume	30%

4. Change the volume with the rotary knob, cursor keys or the numeric keys and confirm with ENTER.

   100 % means maximum volume. 0 % means no acoustic key click response.

Setting the beeper volume

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

Audio	
Key Click Volume	10%
System Beeper Volume	30%

3. Select the SYSTEM BEEPER VOLUME menu item below the heading AUDIO with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    An input field appears. The currently set volume appears as percent value.

Audio	
Key Click Volume	10 %
System Beeper Volume	39 %
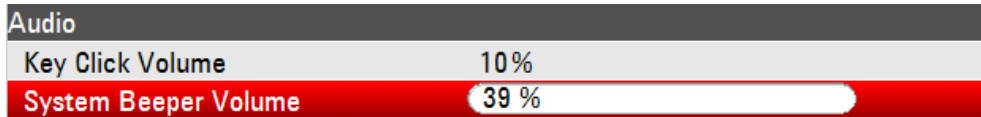
4. Change the volume with the rotary knob, cursor keys or the numeric keys and confirm with ENTER.

    100 % means maximum volume. 0 % means no acoustic key click response.

The emission of an acoustic warning signal requires activation in the LINES – LIMIT OPTIONS menu of the respective measurement.

1.9   Setting the Date and Time

The R&S ETH has an internal clock that can apply a date and time stamp to stored data records for instance. The user can reset the date and time.

Setting the date

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

Instrument Setup	
Date and Time	
Set Date	19/01/2009
Set Time	11:33:22

3. Select the SET DATE menu item below the heading DATE AND TIME with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

   An input field appears. The currently set date appears in the selected format in the input field (dd/mm/yyyy or mm/dd/yyyy).

4. Depending on the date format, change the day (dd) or month (mm) with the rotary knob, cursor keys or the numeric keys and confirm with ENTER. The cursor then automatically moves to the second field in the date (day or month, depending on the date format). Proceed with the next two fields in the same manner as the first.

Setting the time

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

Instrument Setup	
Date and Time	
Set Date	19/01/2009
Set Time	11:35:56

3. Select the SET TIME menu item below the heading DATE AND TIME with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    The currently set time appears in "hours:minutes:seconds" format in the input field.

4. Change the time by numeric input and confirm with ENTER.

After the time have been entered, the R&S ETH verifies the validity of the entered time.

1.10   Self Alignment of the Network Analyzer

The self alignment calibrates in NETWORK ANALYZER mode the default setting of the network analyzer and overrides the manufacturer's calibration stored in the instrument.

For the self alignment a short circuit (Short), an open circuit (Open) and 50 ohm match (Load) is required. In addition, a through connection must be established with an appropriate cable.

1. Press the MODE key.

2. Press the NETWORK ANALYZER softkey.

3. Press the SETUP key.

4. Press the INSTRUMENT SETUP softkey.

    The R&S ETH opens a list of general settings.

Self Alignment	
Self Alignment	
Last Alignment Date	22/01/2009

5. Select the SELF ALIGNMENT menu item below the heading SELF ALIGNMENT with the rotary knob or the cursor keys and confirm with ENTER.

    A warning is shown:

! Warning !
Self Alignment overwrites the factory calibration data.
Are you sure?
Press YES to continue. press NO to cancel
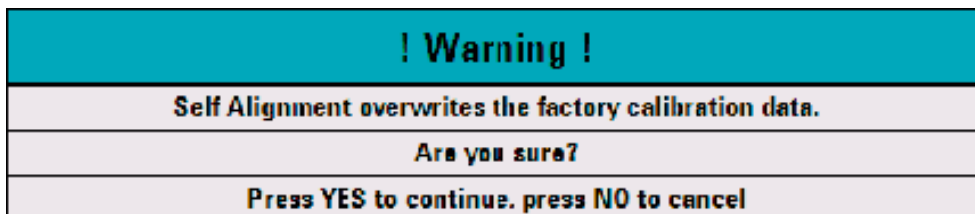
    Pressing YES will perform the self alignment. Pressing NO discards this action.

6. Follow the instructions displayed on the screen.

1.11   Preset Function

The PRESET key sets the R&S ETH to the default setup of the selected mode. This allows a new configuration based on defined measurement parameters to be entered, without parameters from a previous setting still being inadvertently active.

► Press the "Preset" key .

The R&S ETH is set to the default setup of the selected mode.

1.12   Reset to Factory Settings

RESET TO FACTORY SETTINGS set the R&S ETH to factory defaults. All settings in the different menus are set to the original factory settings and all saved data sets, measurement profiles, measurement limits, user defined transducer factors, limit lines, standards, channel tables and cable models will be deleted. Only the factory default files will be reinstalled.

NOTICE

Risk of data loss
All saved data sets will be lost.

---

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

3. Select RESET TO FACTORY SETTINGS with the rotary knob or the cursor keys.

4. Confirm with ENTER.

   Reset
   Reset to Factory Settings

A warning is shown.

! Warning !
Reset to Factory Defaults?
(All saved datasets will be lost)
Press YES to continue, press NO to cancel
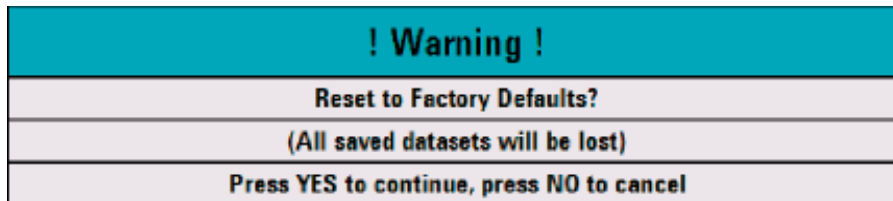
Pressing YES will perform the reset. Pressing NO discards this action. If YES is pressed, an information window is shown during the device rebooting.

2 Software Options

2.1 Enabling Options

The R&S ETH can be fitted with options (e.g. RF Preselection) which are enabled by entering a key code. The key code is based on the unique serial number of the instrument. To add an option, enable it with a key code.

Operation

1. Press the SETUP key.

2. Press the INSTALLED OPTIONS softkey.

3. Select the Install Option... menu item from the list with the rotary knob or the cursor keys (∧ or ∨) and end the selection with ENTER.

4. Enter the key code (32-digit number) for the option with the numeric keys and confirm with ENTER.

   − If the correct key code is entered, the R&S ETH displays

   Installation successful!

   − If an invalid key code is entered, the R&S ETH displays

   Invalid key code!

   − The correct key code can then be entered.

2.2   Checking the Installed Options

The R&S ETH displays the installed options in the INSTALLED OPTIONS menu so you can check them:

1. Press the SETUP key.

2. Press the INSTALLED OPTIONS softkey.

    The R&S ETH displays all available options with the appropriate status below the heading INSTALLED OPTIONS.
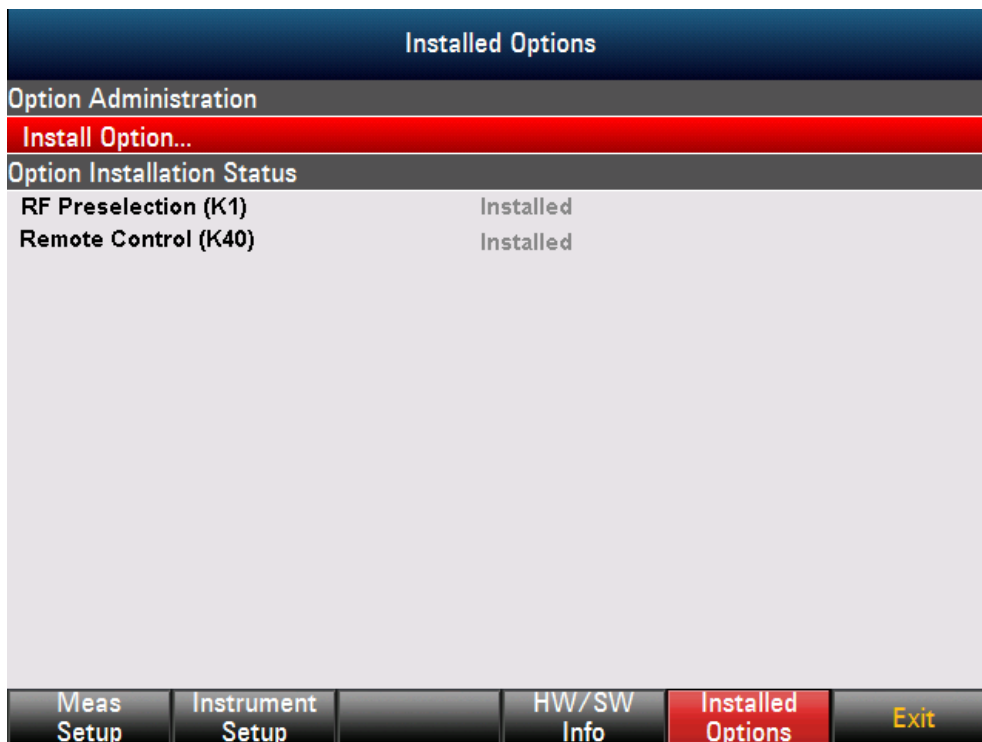
If an option is installed, the installation status differs for permanent or temporary installed options.

3   Battery Operation

The R&S ETH comes with a removable lithium ion battery. The lithium ion battery supplied with the instrument has a capacity of approximately 6.75 Ah. The operating time for the battery depends on how fully it is charged, the ambient temperature and the R&S ETH operating mode. The operating time for a fully charged battery at room temperature is shown in the following table:

Operating Mode	Battery operating time
TV Demodulation	approx. 2 h 30 min
Spectrum Analysis	approx. 4 h 30 min
Network Analysis	approx. 4 h 10 min

The R&S ETH battery is not fully charged when it leaves the factory. It must therefore be charged upon delivery.

When stored over an extended period of time, the battery will discharge on its own. If it is disconnected from the mains for an extended period of time, it should be charged again.

The battery's charge status is shown at the top right of the screen next to the date and time.
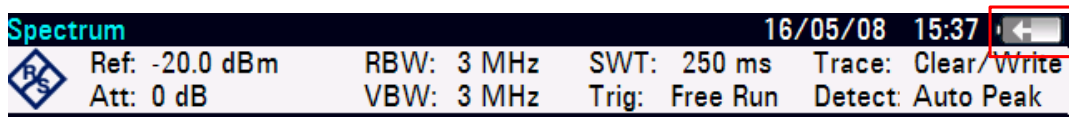
If the battery is fully charged, the battery icon is filled in white. As the battery discharges, the white coloring disappears in ten steps until.

For rapid charging, be sure to switch off the R&S ETH during charging. If the R&S ETH is switched on, the charging current is reduced by the current drain of the instrument. Battery charging therefore takes longer. Charging time is approximately 3 hours and 40 minutes when the instrument is switched off. If the instrument is switched on, charging time is extended up to 7 hours and 20 minutes depending on the operating mode.

3.1 Charging the Battery Using the Supplied AC Power Supply or the R&S HA-Z202 Car Adapter

The battery is charged with the supplied AC power supply or the R&S HA-Z202 car adapter, Order No. 1309.6117.00.

The AC power supply or the car adapter connects to the jack on the left-hand side of the carrying handle.

If required, equip the AC power supply with the country-specific plug. Pull the plug from the AC power supply toward the front and firmly connect the appropriate plug to the AC power supply.
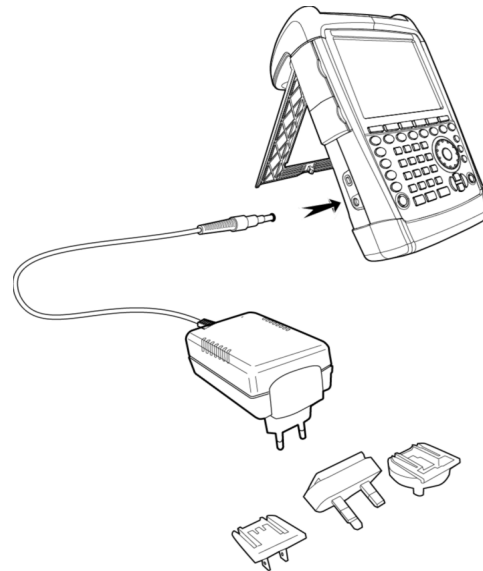
3.2 Charging the Battery Using the R&S HA-Z203 Battery Charger

For external charging, the lithium ion battery is plugged into the R&S HA-Z203 battery charger (available as an accessory: Order Number 1309.6123.00) and supplied with current via the AC power supply. The charging process is indicated by the orange LED (CHARGE) on the charger. As soon as the battery is fully charged, the orange battery LED extinguishes and the green battery LED comes on. Power can also be supplied to the external charger via the R&S HA-Z202 car adapter.

External battery charger
R&S HA-Z203

Li-Ion Battery
R&S HA-Z206

AC power supply
R&S HA-Z201
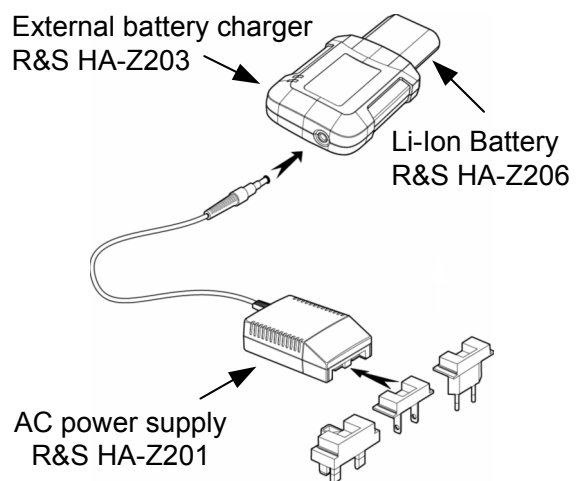
4   Switching Between External Reference/External Trigger Input

The REF IN / TRIG IN BNC female on the left-hand side of the R&S ETH can be used as an input for an external trigger signal or an external 10 MHz reference signal.

Switching is performed via the SETUP menu.

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

    The R&S ETH opens a list of general settings.

Hardware	
BNC 1	Trigger Input
BNC 2	TS-ASI Output

3. Select menu item BNC 1 below the heading HARDWARE with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    A selection list opens.

Hardware	
BNC 1	Trigger Input
BNC 2	Trigger Input
LAN Port	Reference Input

4. Select the desired function for the BNC 1 female with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

The TRIGGER INPUT setting only configures the input. Utilization of the external trigger must be configured in the SWEEP menu (SWEEP key, TRIGGER softkey). The external trigger function is not available in the TV demodulation operating mode.

If the input for an external reference has been configured and no 10 MHz reference frequency signal is applied to the input, a warning is displayed. This is intended to prevent a measurement without a valid reference signal from being carried out.

5   Controlling the RF Attenuator

The RF attenuator can be controlled at the RF input either automatically or manually. The automatic control depends on what operating mode the R&S ETH is set to.

5.1   Automatic Control in TV Receiver Mode

Depending on the power level received at the RF input, the R&S ETH sets the attenuation value accordingly. It offers two modes; one for maximum sensitivity (AUTO LOW NOISE) and one for the lowest possible intermodulation products (AUTO LOW DISTORTION). The two modes differ in that the R&S ETH sets the RF attenuation up to 10 dB higher for LOW DISTORTION than for LOW NOISE. The received power level is measured based on a bandwidth of approx. 30 MHz.

1. Press the AMPT key.

2. Press the RF ATT/GAIN CTRL softkey.

3. Select the desired AUTO LOW NOISE or AUTO LOW DISTORTION mode with the rotary knob or the cursor keys.

4. End the selection with the ENTER key or the RF ATT/GAIN CTRL softkey.

The current attenuation value for the RF attenuator is displayed on the measurement screen.

5.2 Manual Control in TV Demodulation Mode

As an alternative to automatic control, the RF input attenuator can be manually set.

1. Press the AMPT key.

2. Press the RF ATT/GAIN CTRL softkey.

3. Select the MANUAL RF ATTENUATOR menu item with the rotary knob or the cursor keys and confirm with ENTER.

4. The current attenuation value of the attenuator is displayed in the input field. This value can be changed with the rotary knob or the cursor keys in 5 dB steps. The desired value can also be entered directly via the numeric keypad. End input of the attenuation value with ENTER.

The current attenuation value for the RF attenuator is displayed in the upper portion of the measurement screen.

To reactivate the automatic attenuator setting as described, select either AUTO LOW NOISE or AUTO LOW DISTORTION.

5.3 Automatic Control in Spectrum Analysis Mode

Depending on the selected reference level, the R&S ETH sets the RF input attenuation value accordingly. It offers two modes; one for maximum sensitivity (AUTO LOW NOISE) and one for the lowest possible intermodulation products (AUTO LOW DISTORTION). The two modes differ in that the R&S ETH sets the RF attenuation up to 10 dB higher for LOW DISTORTION than for LOW NOISE. The default setting is AUTO LOW DISTORTION.

1. Press the AMPT key.
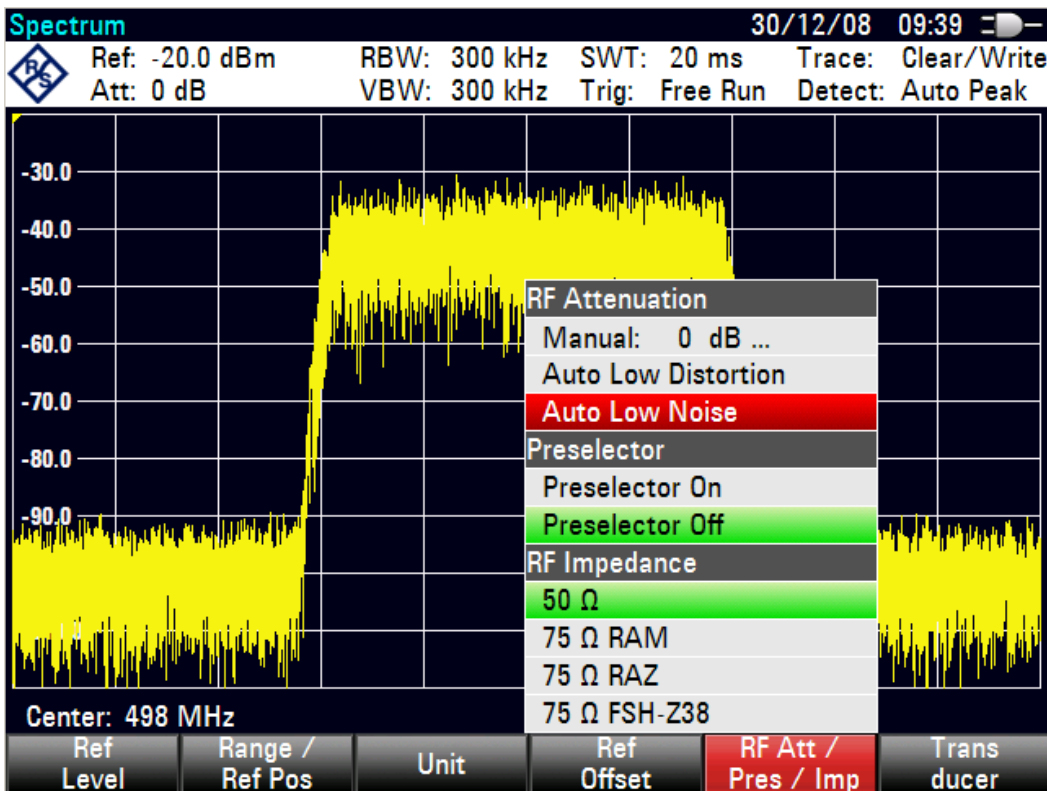
2. Press the RF ATT/AMP/IMP softkey.

3. Select the desired AUTO LOW NOISE or AUTO LOW DISTORTION mode with the rotary knob or the cursor keys under the RF ATTENUATION menu item.

4. End the selection with the ENTER key or the RF ATT/AMP/IMP softkey.

The current attenuation value for the attenuator is displayed in the status bar at the upper edge of the screen following the "Att:" indicator.

To reactivate the automatic attenuator setting as described, select either AUTO LOW NOISE or AUTO LOW DISTORTION.

5.4   Manual Control in Spectrum Analysis Mode

As an alternative to automatic control, the RF input attenuator can be manually set.

1. Press the AMPT key.

2. Press the RF ATT/AMP/IMP softkey.
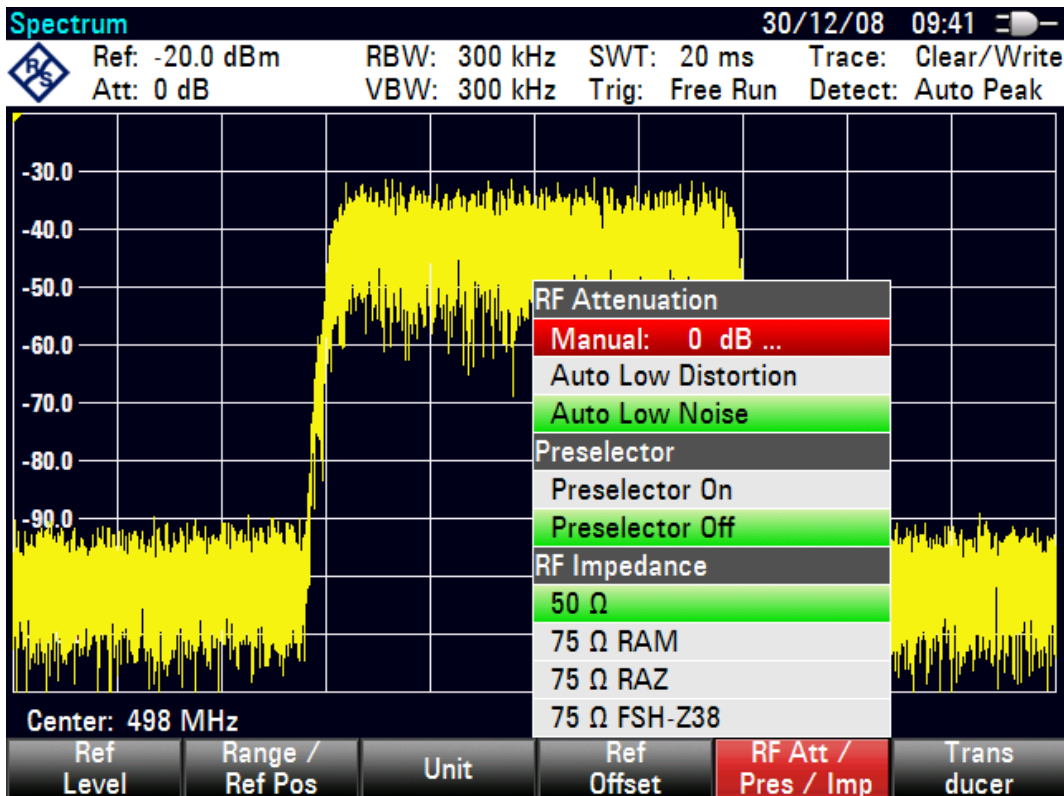
3. Select the MANUAL: subitem below the heading RF ATTENUATION with the rotary knob or the cursor keys and confirm with ENTER.

4. The current attenuation value of the attenuator is displayed in the input field. This value can be changed with the rotary knob or the cursor keys in 5 dB steps. The desired value can also be entered directly via the numeric keypad. End input of the attenuation value with ENTER.

The current attenuation value for the RF attenuator is displayed in the status bar at the upper edge of the screen following the Att: indicator.

To reactivate the automatic attenuator setting as described, select either AUTO LOW NOISE or AUTO LOW DISTORTION.

6   RF Preselection (R&S ETH-K1 Option)

The R&S ETH features internal RF preselection for the suppression of unwanted signals. In contrast to no preselection, the level of the useful RF signal can be set higher, thus leading to a higher dynamic range. RF preselection is located behind the RF attenuator and in front of the input mixer. The filter bandwidth depends on what frequency the receiver has been set to. The table below illustrates the typical lower and upper 3 dB cutoff frequencies depending on the set receiver frequency.

RF	up to 75 MHz	75 MHz to 200 MHz	0.2 GHz to 1.5 GHz	1.5 GHz to 3.6 GHz	3.6 GHz to 8 GHz
Lower 3 dB cutoff frequency	500 kHz	RF – 15 MHz	0.9 x RF	1.3 GHz	3.2 GHz
Upper 3 dB cutoff frequency	80 MHz	RF + 15 MHz	1.1 x RF	3.7 GHz	8 GHz

To improve sensitivity, signals are passed through a low-noise amplifier after preselection. This 15 dB amplifier improves sensitivity by approx. 8 dB.

6.1 Activating RF Preselection in TV Demodulation Mode

1. Press the AMPT key.

2. Press the RF IMP/PRESELECTION softkey.

   The R&S ETH opens the RF preselection configuration submenu.

DVB-T/H	Meas List	DVB-T 8MHz		17/07/09 19:12
	RF		498 MHz	
	Channel / Band		24 / UHF 4/5	
	Channel Table		TV Europe	
RF Preselection	Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
	OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz	

Measurement Parameter	Result
Power	-41.42 dBm
Crest Factor	11.94 dB
Demodulator	locked
Sideband Position	normal
Transmission Parameter Signaling	8K 1/32 64 QAM NH
Carrier Frequency Offset	10.8 Hz
Symbol Rate Offset	RF Impedance
Modulation Error Ratio	rm: 50 Ω dB
Error Vector Magnitude	rm: 75 Ω RAM %
FEC Decoder	75 Ω FSH-Z38
BER before Viterbi / Reed Solomon	75 Ω RAZ
Packet Error Ratio	RF Preselection
Packet Errors	[X] RF Preselection
MPEG TS Bitrate	

| | RF Att / Gain Ctrl | Unit | Ref Offset | RF Imp / Preselection | Trans ducer |

3. Select the RF PRESELECTION subitem with the rotary knob or the cursor keys.

4. End the selection with the ENTER key or the RF IMP/PRESELECTION softkey. A cross in front of the subitem RF PRESELECTION is shown in case of the RF Preselection is switched on.

6.2   Activating RF Preselection in Spectrum Analysis Mode

1. Press the AMPT key.

2. Press the RF ATT/PRES/IMP softkey.

    The R&S ETH opens the RF preselection configuration submenu. The green selection bar displays the current setting.
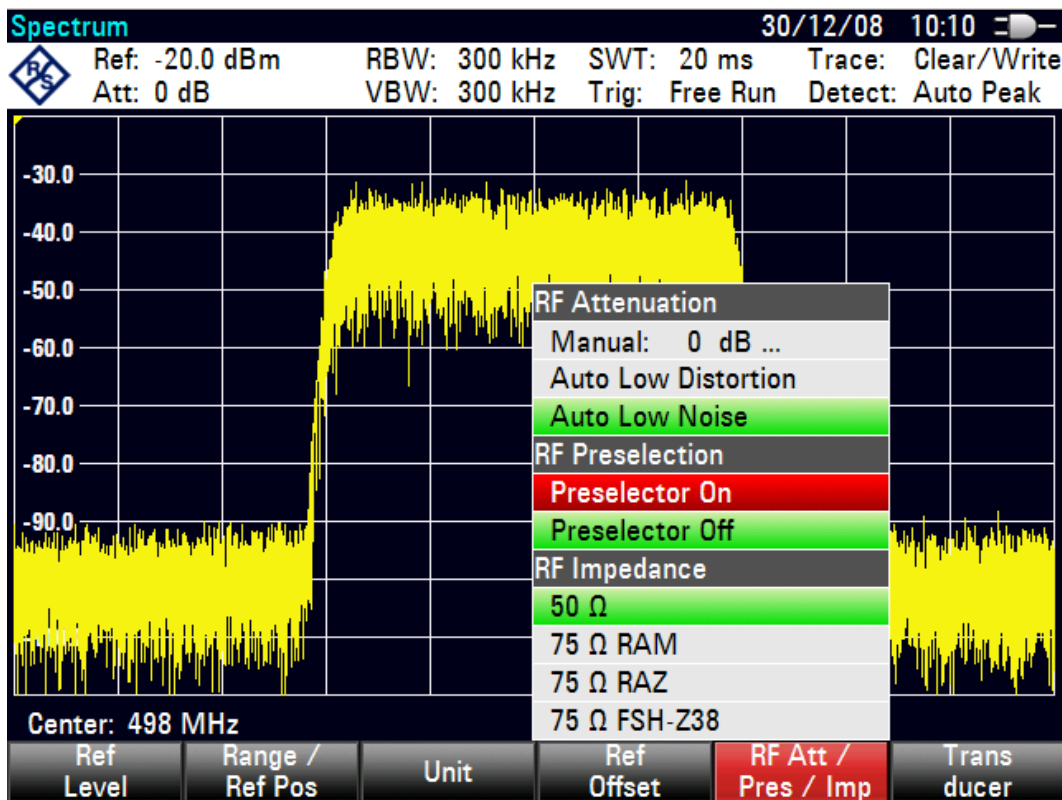
3. Select the desired setting in the RF PRESELECTION submenu with the rotary knob or the cursor keys (Preselection On or Preselection Off).

4. End the selection with the ENTER key or the RF ATT/PRES/IMP softkey.

7   Setting Up a LAN or USB Connection to a PC

The powerful R&S ETH View software is available for tasks such as documenting measurement results and creating limit lines and channel tables. The software is supplied with the R&S ETH. Connection to a PC is possible via LAN or USB. The following description covers the main steps for setting up the connection between the R&S ETH and the R&S ETH View software.

The R&S ETH View software must be installed on the PC before the connection is established. To do this, place the CD-ROM with the R&S ETH View software into the CD drive. As soon as the Autostart menu appears on the screen, select menu item ETH View and follow the instructions on the screen.

> If no connection can be established between the R&S ETH View software and the R&S ETH following successful configuration, please check the firewall settings on your PC.

7.1   Direct Connection via LAN

► Connect the R&S ETH directly to the PC with the supplied LAN cable. The R&S ETH LAN interface is located on the left-hand side underneath a protective cap (refer to section 1.5).

DHCP is switched on by default. For a direct connection, DHCP must be switched off.

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

LAN Port	
MAC Address	00-90-b8-18-81-aa
DHCP	Off
IP Address	172.29.26.63
Subnet Mask	255.255.255.0

3. Select the DHCP MODE menu item below the heading LAN PORT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

   A selection list opens.

4. Select OFF with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER. DHCP is now deactivated.

To establish the connection, the IP address of the PC and the R&S ETH must be identical except for the digits following the last period. This means that the digits following the last period must be different.

Setting the IP address on the R&S ETH

Example: R&S ETH IP address: 172.29.26.63

LAN Port	
MAC Address	00-90-b8-18-81-aa
DHCP	Off
IP Address	172.29.26.63
Subnet Mask	255.255.255.0

1. Select the IP ADDRESS menu item from the list under the heading LAN PORT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

   An input field opens.

2. Enter the IP address of the R&S ETH (e.g. 172.29.26.63) with the numeric keys and confirm with ENTER.

Setting a default gateway address on the R&S ETH

LAN gateway settings for LAN connections with firewall can be set.

LAN Port	
MAC Address	00-90-b8-18-aa-f6
DHCP	Off
IP Address	172.29.26.63
Subnet Mask	255.255.255.0
Gateway	172.0.0.1

1. Select the GATEWAY menu item from the list under the heading LAN PORT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

   An input field opens.

2. Enter the gateway of the R&S ETH (e.g. 172.29.00.01.) with the numeric keys and confirm with ENTER.

Setting the IP address on the PC

Example: PC IP address: 172.29.26.1

Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
◉ Use the following IP address:

IP address:	172 . 29 . 26 . 1
Subnet mask:	255 . 255 . 255 . 0
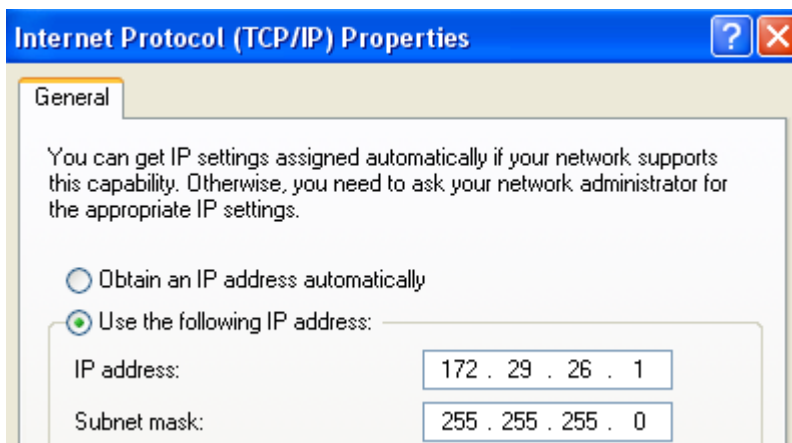
The PC and the R&S ETH subnet masks must also match before a connection can be established.

Setting the subnet mask on the R&S ETH

Example: Subnet mask R&S ETH: 255.255.255.0

LAN Port	
MAC Address	00-90-b8-18-81-aa
DHCP	Off
IP Address	172.29.26.63
Subnet Mask	255.255.255.0

1. Select the SUBNET MASK menu item from the list under the heading LAN PORT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    An input field opens.

2. Enter the R&S ETH's subnet mask (see above) with the numeric keys and confirm with ENTER.

Setting the subnet mask on the PC

Example: Subnet Mask PC 255.255.255.0

Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically
◉ Use the following IP address:

IP address: 172 . 29 . 26 . 1

Subnet mask: 255 . 255 . 255 . 0
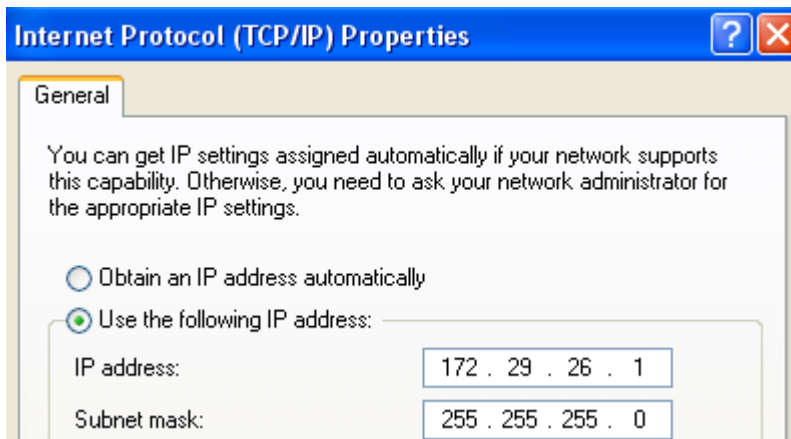
R&S ETH View software configuration:

1. Start the R&S ETH View software on the PC.

2. Select the LAN tab in the open input dialog.
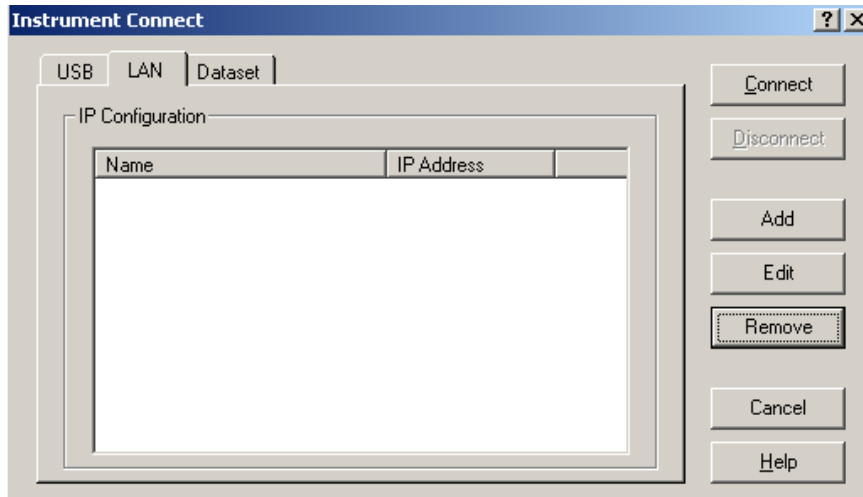
3. Create a new network connection with ADD.

4. Enter the name for the new network connection in the open dialog, e.g. R&S ETH.
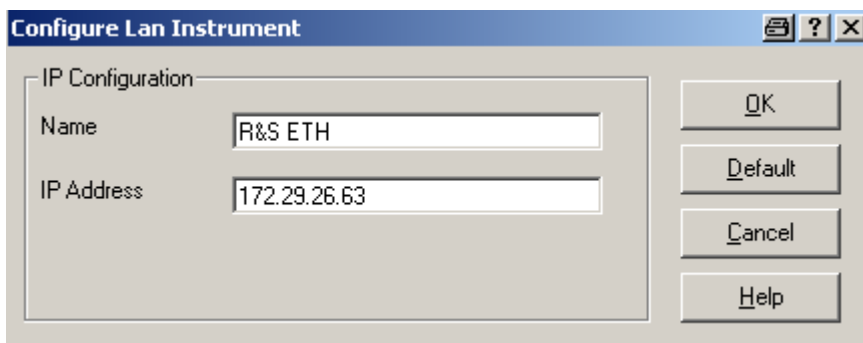
5. Enter the IP address set for the R&S ETH in the IP Address input field, in this case 172.29.26.63, and confirm with OK.

   The connection is now configured and appears in the IP CONFIGURATION dialog.
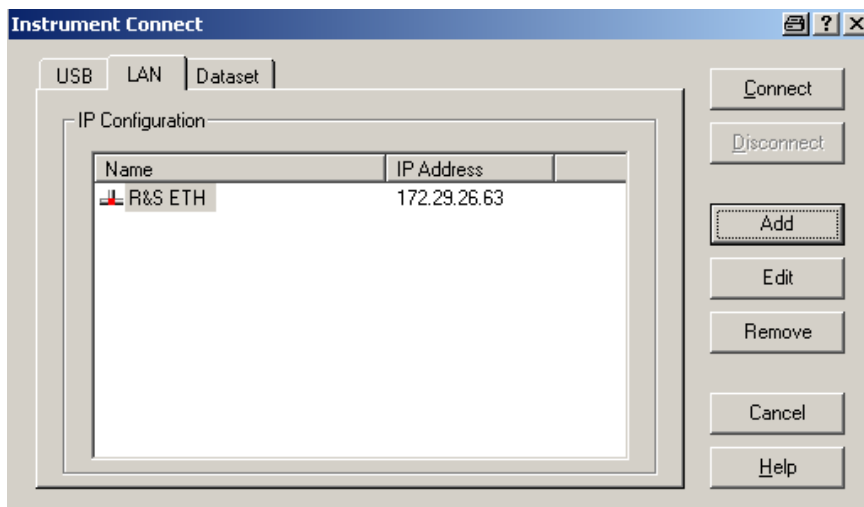
6. Select the new connection named "R&S ETH" and establish the connection to the R&S ETH with CONNECT.

7.2   Connection via an Existing LAN Network

The R&S ETH IP address can be automatically acquired from the DHCP server, or a fixed address can be defined manually. With manual allocation, a fixed IP address and subnet mask must be assigned to the R&S ETH as described in the section 7.1. The R&S ETH View software must then be configured as described with the assigned IP address.

NOTICE

Please contact your IT system manager to obtain a free IP address.

In networks with a DHCP server, the **Dynamic Host Configuration Protocol** (DHCP) allows the network configuration to be automatically allocated to the R&S ETH that is connected via LAN cable. For this purpose, DHCP must be activated on the R&S ETH.

DHCP is switched on by default in the R&S ETH. If the setting has been altered, proceed as follows.

1. Press the SETUP key.

2. Press the INSTRUMENT SETUP softkey.

    The R&S ETH opens a list of general settings.

3. Select the DHCP MODE menu item under the heading LAN PORT with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER.

    A selection list opens.

LAN Port	
MAC Address	00-90-b8-18-81-aa
DHCP	Off
IP Address	Off
Subnet Mask	On

4. Select ON with the rotary knob or the cursor keys (∧ or ∨) and confirm with ENTER. DHCP is now active.

The DHCP server now allocates an IP address and a subnet mask to the R&S ETH. This process can take several seconds. The values then appear under IP ADDRESS and SUBNET MASK under the LAN PORT heading.

The R&S ETH View software must then be configured as described in the section 7.1. Note: the IP address and subnet mask assigned by the DHCP server must then be used to create a new LAN connection.

7.3   Connection via USB

1. Switch on the R&S ETH.

2. Connect the R&S ETH directly to the PC with the supplied USB cable. The R&S ETH USB interface is located on the left side underneath a protective cap (refer to the section 1.5).

   When connected for the first time, the wizard for finding new hardware appears on the PC screen.
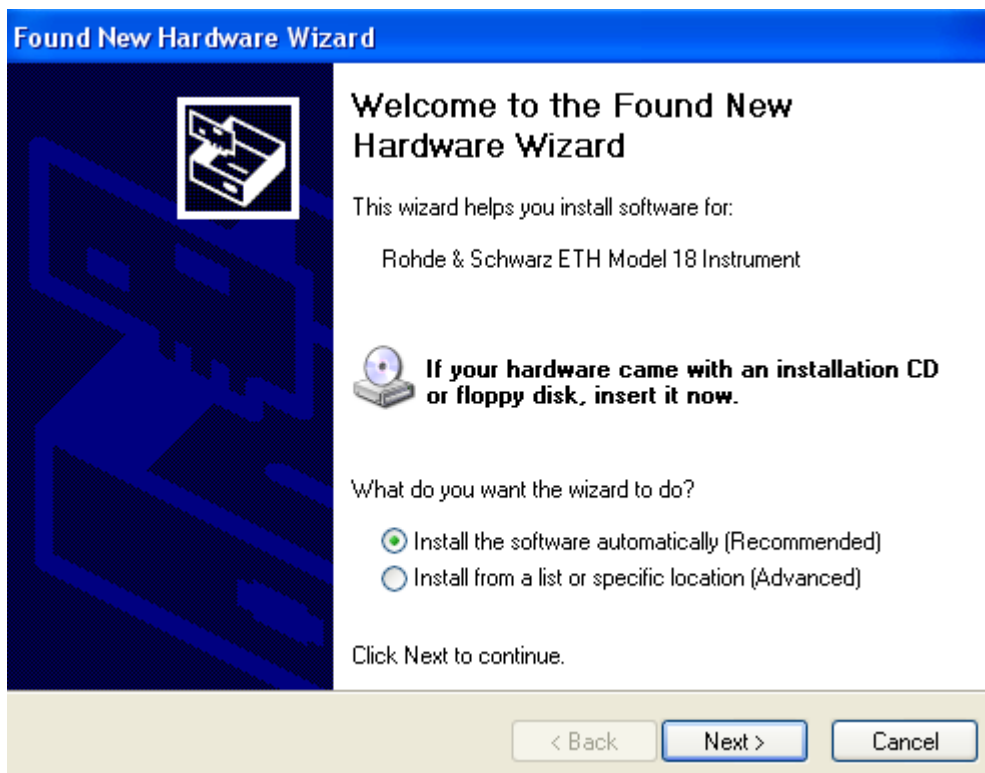
3. Select "Automatically install software" and confirm with "Next".

   Note: The R&S ETH View software must be installed on the PC. Only then can the hardware wizard find the necessary drivers for the USB connection.

After a few seconds, the wizard indicates that the software for the new hardware has been installed.
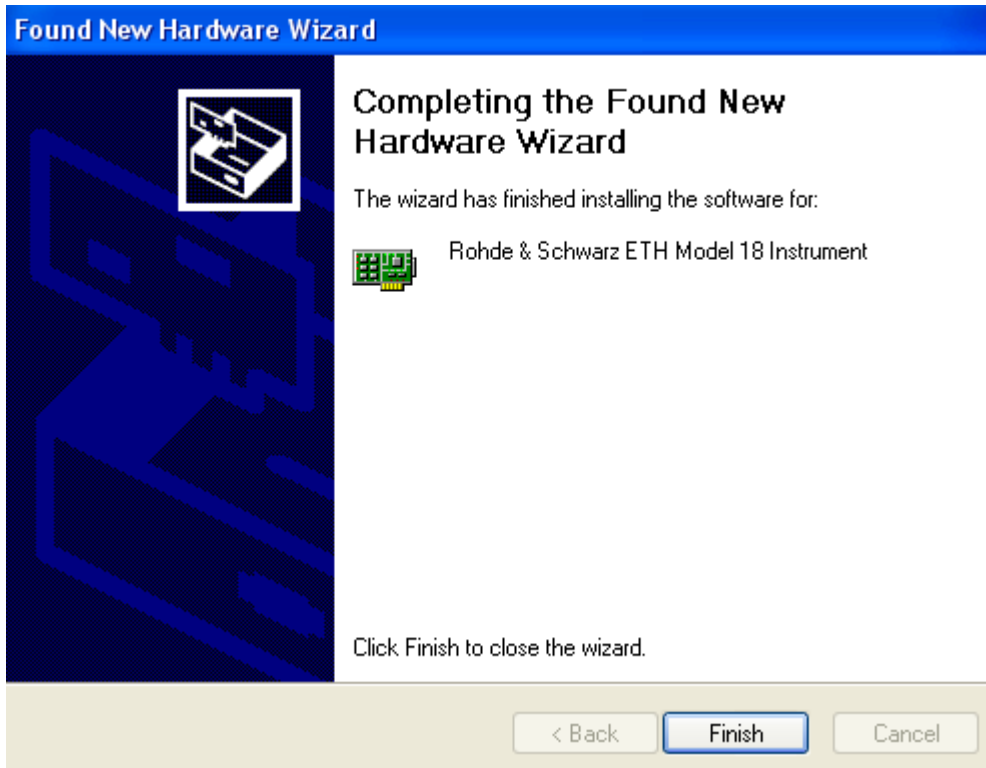
4. Complete the installation with "Finish".

A new LAN connection appears in the network connections overview with the device name "RS USB Remote NDIS Network Device".
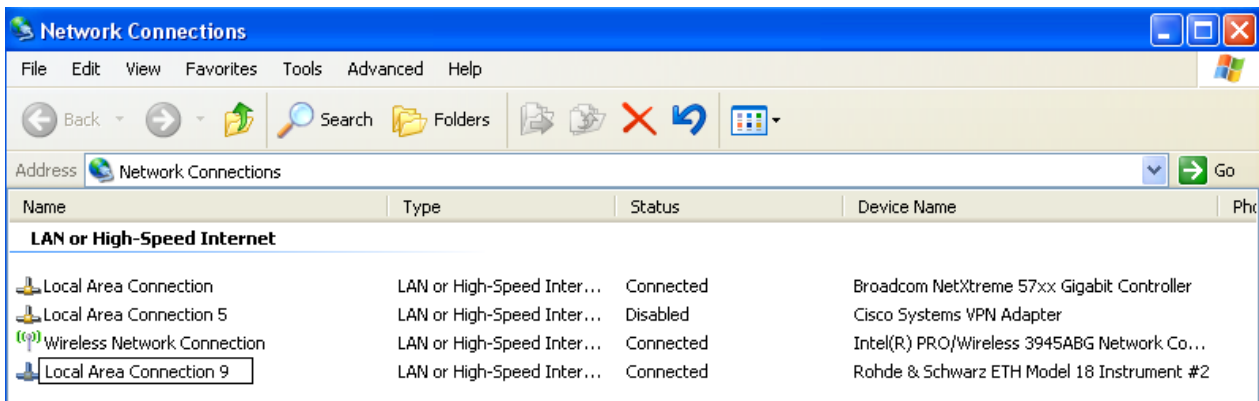
A fixed IP address and a subnet mask must be manually assigned to the PC for this LAN connection. The R&S ETH uses a fixed IP address for the USB connection: **172.16**.10.10. The subnet mask is 255.255.0.0.

The PC and R&S ETH subnet masks must be identical. The last two numbers of the PC IP address must be different from those of the R&S ETH IP address as shown above.

For example, the PC could have the following IP address: **172.16**.66.5. The first two number sets are fixed.
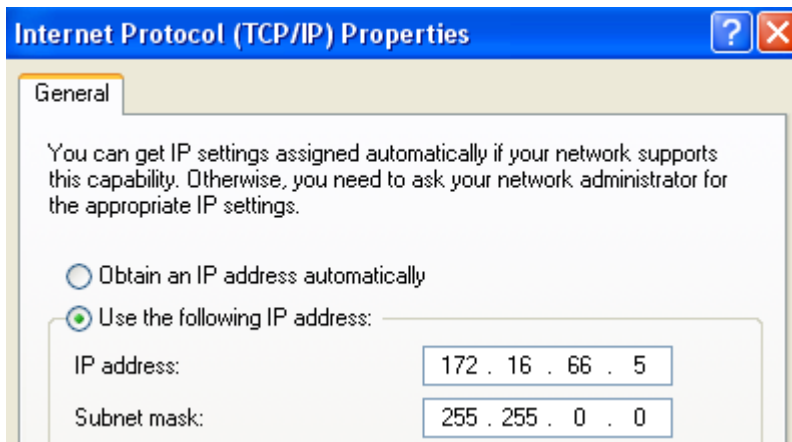
1. Start the R&S ETH View software on the PC.

2. Select the USB tab in the open input window.

3. The USB connection is preconfigured and cannot be modified. The USB connection is established via a predefined IP address.

4. Select the R&S ETH connection and establish a link to the R&S ETH by clicking connect.

8 Basic Measurement Examples

This section provides a brief introduction on operating the R&S ETH portable TV analyzer using a few simple measurements as examples. A more detailed description of operations and functions, such as selecting menus and setting measurement parameters, the layout of the screen and the information displayed on the screen is provided in Operating Manual on the CD ROM.

8.1 TV Analyzer

Using a TV analyzer, the basic measurements carried out on TV signals are the RF power, the crest factor, the carrier frequency, the modulation bandwidth, the modulation error ratio, bit error ratio, echo paths, and the spectrum emission. The following measurement examples show how to efficiently perform these measurements with the portable R&S ETH TV analyzer.

8.1.1 Using Measurement Profile

To simplify operation, the R&S ETH provides measurement profiles. The measurement profile contains the setting parameters which the R&S ETH uses to perform the measurement in the "TV Analyzer" mode.

The measurement profile defines the following parameters:

- Power unit
- Demodulator settings (channel bandwidth[*], channel adaptation, symbol loop, lock condition, bitstream[*])
  [*] only for DVB-T/H standard
- Spectrum measurement (frequency span, resolution bandwidth, video bandwidth, sweep time)

The R&S ETH provides several measurement profiles with typical settings for transmitter, single frequency network and mobile applications. To define your own measurement profiles, use the Profile Editor of the R&S ETH View software for editing.

For examples how to set the measurement profile for a selected standard see the following sections:

- DVB-T/H: "Setting the measurement profile" on page 8-5
- ISDB-T: "Setting the measurement profile" on page 8-26

Copying measurement profiles to the R&S ETH

1. Install the supplied R&S ETH View software on a PC or laptop.

2. Connect the R&S ETH to the PC or laptop using the LAN or USB cable.

3. Make the PC settings as described in section 7.

4. Start the R&S ETH View software.

5. Set up the connection between the R&S ETH and R&S ETH View.

6. Using PROFILE CONTROL, copy the desired measurement profile to the R&S ETH. In this example, DVB-TH_8MHz.DVBSTD.

An in-depth instruction is described in the operating manual supplied with the ETH View software.
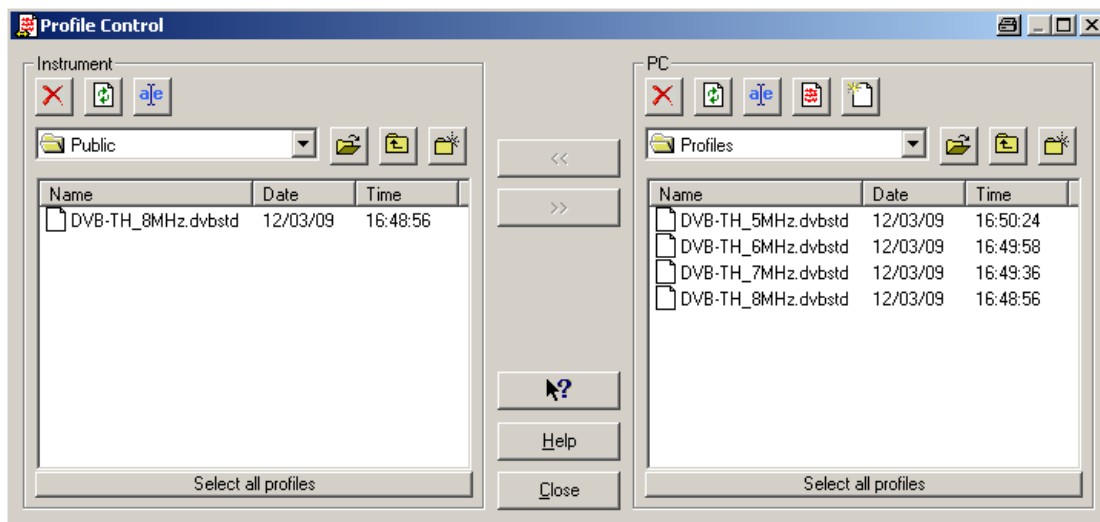
Activating the measuring profile in R&S ETH

1. Press the MEAS key.

2. Press the MEAS PROFILE softkey.

   The R&S ETH opens the browser.

3. Navigate using the cursor keys or the rotary knob in order to select the desired measuring profile.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

   The R&S ETH set the setting parameters according to the measurement profile.

8.1.2   Using Channel Tables

For selecting the receive channel, the R&S ETH offers the channel input as an alternative to frequency input. The most common channel tables are supplied by the R&S ETH and the R&S ETH View software, too. R&S ETH View allows you to modify existing tables, generate new tables and copy them to the R&S ETH.

Copying channel tables to the R&S ETH

1. Install the supplied R&S ETH View software on a PC or laptop.

2. Connect the R&S ETH to the PC or laptop using the LAN or USB cable.

3. Make the PC settings as described in section 7.

4. Start the R&S ETH View software.

5. Set up the connection between the R&S ETH and R&S ETH View.

6. Using CHANNEL TABLE CONTROL, copy the desired channel table to the R&S ETH. In this example, TV EUROPE.CHNTAB.

An in-depth instruction is described in the operating manual supplied with the ETH View software.
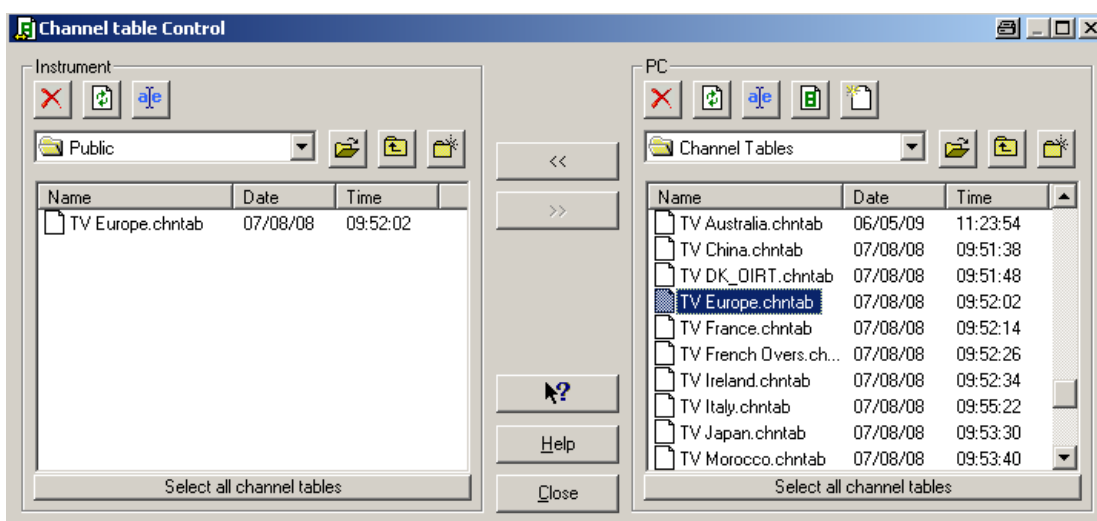
Selecting and activating channel table

1. Press the FREQ key.

2. Press the CHANNEL TABLE softkey.

   The R&S ETH opens the browser.

3. Select the 'TV EUROPE.CHNTAB' channel table using the cursor keys and the rotary knob.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

    In the status area of the measurement window, the R&S ETH now displays the channel number together with the frequency band and the name of the selected channel table in addition to the set receive frequency.

Entering the channel

1. Press the CHANNEL softkey.

2. Enter the required channel number using the numeric keypad or set the channel number using the rotary knob or the cursor keys, and confirm the entry by pressing the ENTER key or the CHANNEL softkey

8.1.3   DVB-T/H Analysis

Use a DVB-T/H signal generator, such as the R&S SFU broadcast test system, as a signal source.

Test Setup

► Connect the RF output of the DVB-T/H signal generator to the RF input of the R&S ETH.

Signal generator settings:

Frequency	498 MHz*
Level	-10 dBm
Modulation	DVB-T
Channel bandwidth	8 MHz

* 498 MHz corresponds to channel 24 in TV Europe channel table.

Setting up the R&S ETH for DVB-T analysis

1. Press the MODE key.

2. Press the TV ANALYZER softkey.

3. Press the PRESET key.

4. Press the MEAS key.

5. Press the MEAS MODE softkey.

6. Select the TV standard DVB-T/H using the rotary knob or the cursor keys.

7. Confirm with the ENTER key or the MEAS MODE softkey.

Setting the receive frequency

1. Press the FREQ key.

2. Press the CHANNEL TABLE softkey.

   The R&S ETH opens the browser.

3. Select the desired channel table ('TV EUROPE.CHNTAB' in this example) using the cursor keys and the rotary knob.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

5. Press the CHANNEL softkey.

6. Enter the channel number (24 in this example), and confirm the entry by pressing the ENTER key.

   In the status area of the measurement window, the R&S ETH now displays the channel number together with the frequency band and the name of the selected channel table in addition to the set receive frequency.

Setting the measurement profile

1. Press the MEAS key.

2. Press the MEAS PROFILE softkey.

   The R&S ETH opens the browser.

3. Select the desired measuring profile ('\Public\Standard\DVB-TH 8MHz Transmitter.dvbstd' in this example) using the cursor keys or the rotary knob.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

   In the title bar of the measurement window, the R&S ETH displays the selected 'DVB-TH 8MHz Transmitter' measurement profile.

The measurement profile defines the following setting parameters.

8.1.3.1   Measuring the Transmission Parameters

When carrying out the Measurement List and Constellation Diagram measurements in the DVB-T/H analysis mode, the R&S ETH demodulates the DVB-T/H signal in real-time and measures the most important parameters such as carrier frequency offset, signal level, crest factor, modulation error ratio and bit error ratio, both before and after error correction.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select MEASUREMENT LIST using the rotary knob or the cursor keys, and confirm with the ENTER key or the MEAS MODE softkey.

The R&S ETH synchronizes with the DVB-T/H signal, measures the most important parameters and lists them on the screen.

Parameterization of the demodulator occurs automatically in accordance with the "Transmission Parameter Signaling" (TPS) information.

DVB-T/H Meas List DVB-TH 8MHz Tran	09/09/10 13:32				
RF	498 MHz				
Channel / Band	24 / UHF 4/5				
Channel Table	TV Europe				
Gain Control / RF Attenuation	Auto Low Noise / 20 dB				
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz				
Measurement Parameter	**Result**				
Power			-10.87	dBm	
Crest Factor			12.66	dB	
Demodulator	locked				
Sideband Position	normal				
Transmission Parameter Signaling	8K	1/32	QAM64 NH		
Carrier Frequency Offset			184.1	Hz	
Symbol Rate Offset			0.4	ppm	
Modulation Error Ratio	rms	45.0	dB	peak	31.9 dB
Error Vector Magnitude	rms	0.37	%	peak	1.66 %
FEC Decoder	locked				
BER before Viterbi / Reed Solomon	0.0E-09		0.0E-09		
Packet Error Ratio	0.0E-06				
Packet Errors	0	/s			
MPEG TS Bitrate	27.144395	Mbit/s			

The TS ASI transport stream of the incoming DVB-T/H signal is available using the TS OUT BNC female.

8.1.3.2 Transmission Parameter Signaling (TPS)

The R&S ETH detects the transmission parameter signaling (TPS) information sent by the DVB-T/H broadcast transmitter and configures the demodulator accordingly. The TPS Information measurement screen shows all TPS parameters. The following example describes the steps for carrying out the measurements.

The example is based on the previous example.

1. Press the MEAS key.

2. Press the TPS INFO softkey.

    The R&S ETH displays all TPS parameters on the screen.

DVB-T/H TPS Info	DVB-TH 8MHz Tran	09/09/10 13:34
RF	498 MHz	
Channel / Band	24 / UHF 4/5	
Channel Table	TV Europe	
Gain Control / RF Attenuation	Auto Low Noise / 20 dB	
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz	

TPS Parameter	Value	
FFT	8K	
Guard Interval	1/32	
Constellation	QAM64 NH	
Code Rate High Priority	3/4	
Code Rate Low Priority	3/4	
Cell ID	0x0000	
TPS-reserved (frame 1 to 4)	0x0, 0x0, 0x0, 0x0	
Interleaver	Native	
MPE-FEC High Priority	Off	
MPE-FEC Low Priority	Off	
Time Slicing High Priority	Off	
Time Slicing Low Priority	Off	
Length Indicator	0x1F	

To return to the Measurement List measurement screen, press the TPS INFO EXIT softkey.

> The TS ASI transport stream of the incoming DVB-T/H signal is available using the TS OUT BNC female.

8.1.3.3   Displaying the I/Q Constellation

The R&S ETH displays the complex baseband signal in relation to the sampling times in the I/Q constellation diagram, a Cartesian coordinate system.

The following measurement example is based on the previous example.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select CONSTELLATION DIAGRAM with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

   The R&S ETH displays the I/Q constellation diagram on the left-hand side of the measurement screen. The most important transmission parameters are displayed on the right-hand side. The parameter descriptions are abbreviated to save space on the screen.
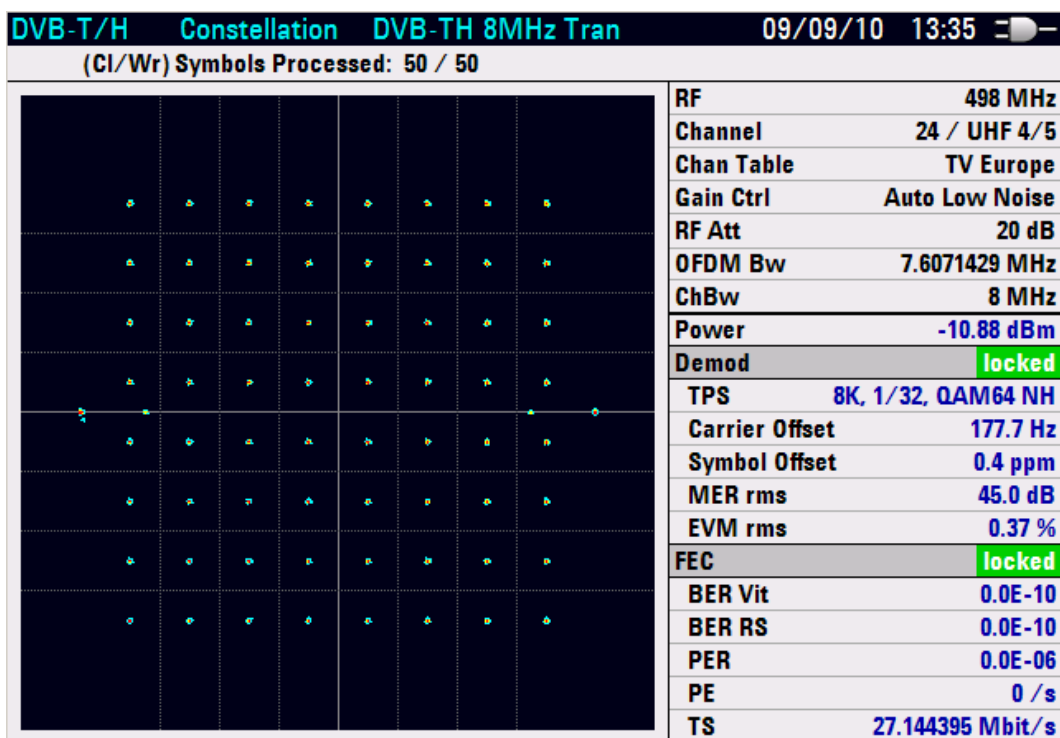
The TS ASI transport stream of the incoming DVB-T/H signal is available using the TS OUT BNC female.

8.1.3.4   Measuring the Echoes

This Echo Pattern measurement shows the echo profile of the transmission channel.

> ℹ️ The TS ASI transport stream of the incoming DVB-T/H signal is available using the TS OUT BNC female.

The following measurement example is based on the previous examples. For better explanation, a few echoes are added for this measurement example using the fading option of the R&S SFU broadcast test system.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select ECHO PATTERN with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.
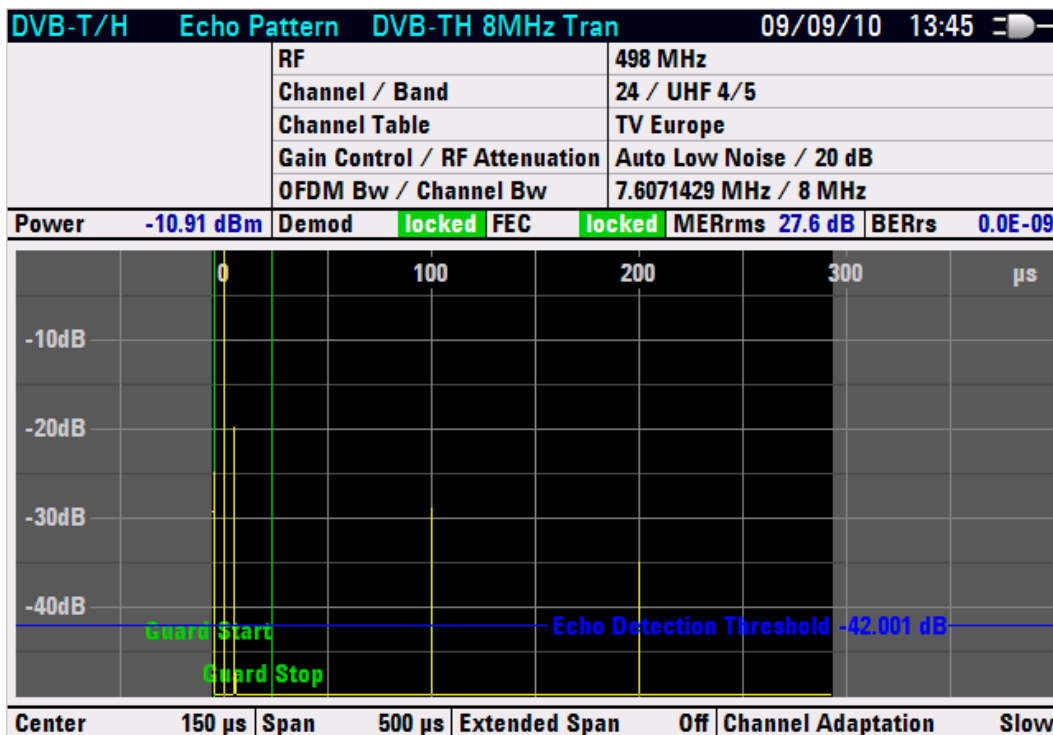
The R&S ETH references the largest receive signal to 0 dB and 0 µs. The echoes can now be read out with markers. In the default setting, the R&S ETH displays the entire measurement range. For a more precise assessment, the display range can be zoomed.

Echo Pattern Zoom

For setting of the desired zooming range the CENTER = MARKER marker function is recommended.

1. Press the MARKER -> key.

   The R&S ETH activates a marker and set it to the main path.

2. Move the marker to the center position of the desired zooming range using the rotary knob, the cursor keys, the numeric keypad, the MARKER TO PEAK, or MARKER TO NEXT PEAK function.

3. Press the CENTER = MARKER softkey.

   The R&S ETH sets the marker position to the center of the Echo Pattern screen.

4. Press the SPAN key.

5. Press the MANUAL SPAN softkey.

6. Set the desired span using the rotary knob, the cursor keys or the numeric keypad.

   The R&S ETH displays the zoomed range.
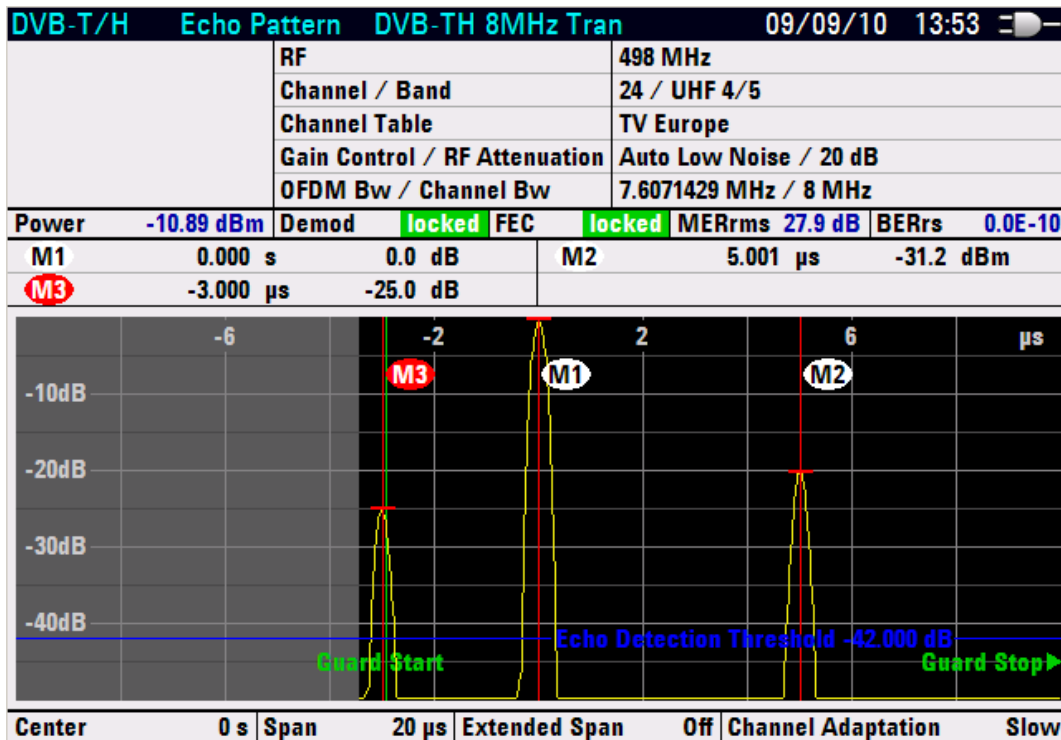
You can set up to 6 markers to get further information about the echoes.

Echo Pattern Peak List

In addition to the Echo Pattern measurement screen, the R&S ETH displays the 13 greatest echoes in the Echo Pattern Peak List. The echoes are sorted according to their level. To shorten the list, you can set a peak list threshold.

The Echo Pattern Peak List is independent from the span settings of the Echo Pattern measurement screen.

In the example, all echoes shall be listed which are greater than -30 dB.

1. Press the MEAS key.

2. Press the PEAK LIST THRESHOLD softkey.

3. Enter the desired peak list threshold using the rotary knob, the cursor keys or the numeric keypad (in this example '-30'), and confirm with the PEAK LIST THRESHOLD softkey or the ENTER key.

4. Press the VIEW PEAK LIST softkey.

   The R&S ETH displays the echoes up to the set peak list threshold.

DVB-T/H	Peak List	DVB-TH 8MHz Tran	09/09/10 14:18

RF	498 MHz	
Channel / Band	24 / UHF 4/5	
Channel Table	TV Europe	
Gain Control / RF Attenuation	Auto Low Noise / 20 dB	
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz	

Power	-10.89 dBm	Demod	locked	FEC	locked	MERrms 27.9 dB	BERrs	0.0E-10

Echo	Relative Level	Absolute Level	Time
1	0.0 dB	-10.9 dBm	0.000 s
2	-19.9 dB	-30.7 dBm	5.002 µs
3	-24.9 dB	-35.8 dBm	-3.000 µs
4	-28.9 dB	-39.8 dBm	100.002 µs
Threshold	-30.0 dB	-40.9 dBm	

Scale Unit

Alternatively, the R&S ETH rescales the time axis into a distance axis.

1. Press SPAN key.

2. Press SPAN UNIT softkey.

3. Set the desired unit using the rotary knob or the cursor keys, and confirm the entry by pressing the ENTER key or the SPAN UNIT softkey.

The unit selection applies to the x axis, markers and peak list.

8.1.3.5   Measuring the MER over the OFDM Carriers

In the MER(k) screen, the R&S ETH displays the MER over the OFDM carriers of the received DVB-T/H signal.

> The TS ASI transport stream of the incoming DVB-T/H signal is available using the TS OUT BNC female.

The following example shows the individual steps for efficiently measuring the MER over the OFDM carriers. It is based on the previous examples. The fading profile of the R&S SFU broadcast test system is switch off again.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select MER(k) with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

DVB-T/H	MER (k)	DVB-TH 8MHz Tran	10/09/10 14:24	←

	RF	498 MHz
	Channel / Band	24 / UHF 4/5
	Channel Table	TV Europe
	Gain Control / RF Attenuation	Auto Low Noise / 20 dB
	OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz

Power	-10.88 dBm	Demod	locked	FEC	locked	MERrms 45.0 dB	BERrs	0.0E-09

```
0       MER (rms) 45.0 dB                                              6816
  45dB
  40dB
  35dB
  30dB
  25dB
  20dB
  15dB
  10dB
   5dB
```

Center:	Carrier 3408	Span:	6817 Carriers	Detector:		RMS	Trace Mode:	Clear / Write

Adjusting the residual carrier of the transmitter

In the measurement screen, the OFDM carriers are evenly distributed among the 631 pixel columns. The selected trace detector determines the display of the MER value. In the RMS setting, the root-mean-square value per pixel column is determined and displayed. In the MIN and MAX settings, the minimum or maximum MER value per pixel column is displayed. In the AUTO PEAK setting, the minimum and maximum MER values are displayed; in this display, the marker value is always equal to the minimum MER value of the pixel column.

The measurement of the minimum MER value for the carrier frequency is especially helpful, since this value corresponds to the residual carrier of the modulator. Thus, this reading can be used to adjust the modulator's residual carrier.

The measurement example is based on the previous examples.

1. Press the TRACE key.

2. Press the DETECTOR softkey.

3. Select AUTO PEAK using the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the DETECTOR softkey.

5. Press the MARKER-> key to use a marker for reading out the numerical value.

    The R&S ETH sets the marker to the pixel position with the minimum MER value.
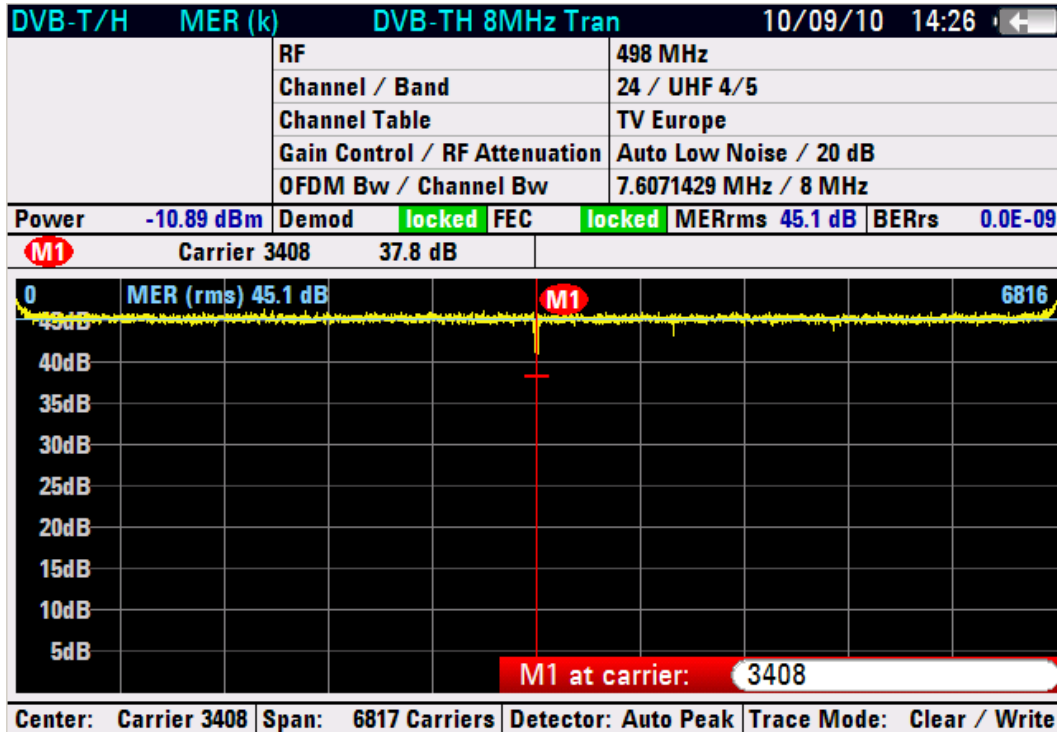
Detecting disturbing signals

The display of the OFDM carriers always corresponds to the frequency.

The markers are pixel-column-oriented and refer to the carrier number in the baseband or the carrier frequency, or the absolute frequency is output. In the frequency spectrum, the reference to disturbances can thus easily be established.

You can set up to 6 markers to get further information about the echoes. Especially helpful are the SET TO PEAK and SET TO NEXT PEAK marker functions for setting the marker.

The measurement example is based on the previous examples. For better explanation, a CW carrier at 500 MHz with an power of -70 dBm is added for this measurement example.

Use a marker to determine the absolute frequency of the disturbance carrier and its influence to the OFDM signal.

1. Press the MARKER key.

2. Press the NEW MARKER softkey.

    The R&S ETH activates a 2nd marker and set it to the second worst pixel value.

3. Press the MARKER TYPE softkey.

4. Select ABSOLUTE FREQUENCY with the rotary knob or the cursor keys.

5. Confirm the selection with the ENTER key or the MARKER TYPE softkey.

6. Press the MARKER -> key.

7. Press the SET TO PEAK softkey.

8. Confirm the SELECTED MARKER selection with the ENTER key or the SET TO PEAK softkey.
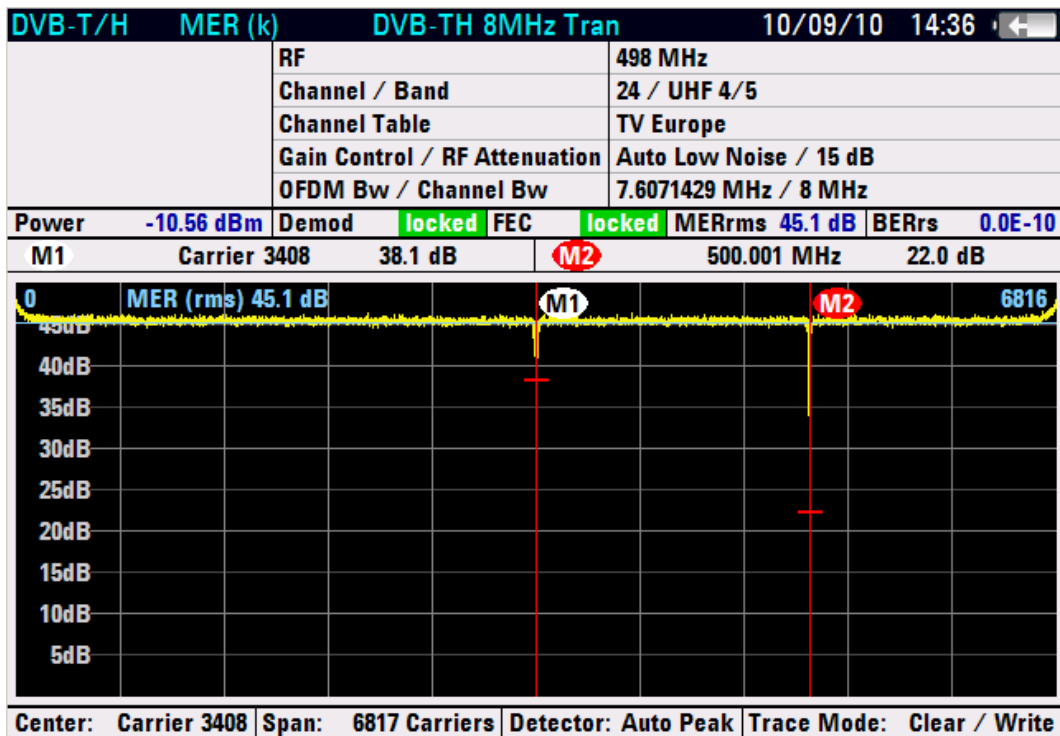
8.1.3.6   Measuring the Shoulder Attenuation

When performing a DVB-T/H SPECTRUM measurement, the R&S ETH measures the shoulder attenuations, the channel power and the peak-to-peak in-channel amplitude frequency response.

Shoulder attenuation provides information about the amplitude dynamic range of the DVB-T/H signal. The R&S ETH measures the lower and upper shoulder attenuation in line with ETSI TR 101290 recommendations. The resolution bandwidth must not be set lower or equal to 30 kHz in order to get correct measurement results.

Beside the shoulder attenuation, the R&S ETH provides the channel power in the DVB-T/H Spectrum measurement. For the channel power measurement, the RMS trace detector is used to get correct measurement results, independent from the trace detector setting.

The TS ASI transport stream of the incoming DVB-T/H signal is **not** available in the DVB-T/H SPECTRUM measurement.

The following example shows the individual steps for efficiently measuring the shoulder attenuation with the R&S ETH.

The following measurement example is based on the previous example. The fading profile of the R&S SFU broadcast test system is switched off again.

1. Press the MEAS MODE softkey.

2. Select DVB-T/H SPECTRUM using the rotary knob or the cursor keys.

3. Confirm the selection with the ENTER key or the MEAS MODE softkey.

    The frequency ranges in which shoulder attenuations are measured are indicated by dark blue frequency lines. The position of the frequency lines depends on the channel bandwidth settings, respectively the OFDM bandwidth setting.

    The R&S ETH presents the measurement results above the measurement screen.
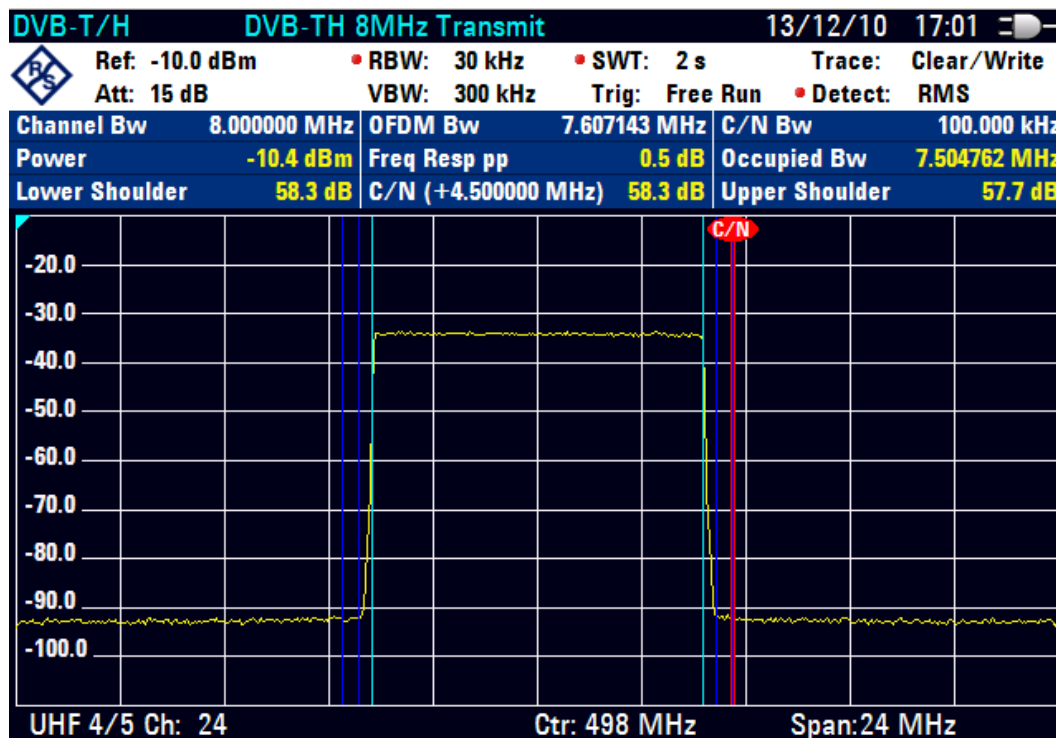
In addition, you can set up to 6 markers.
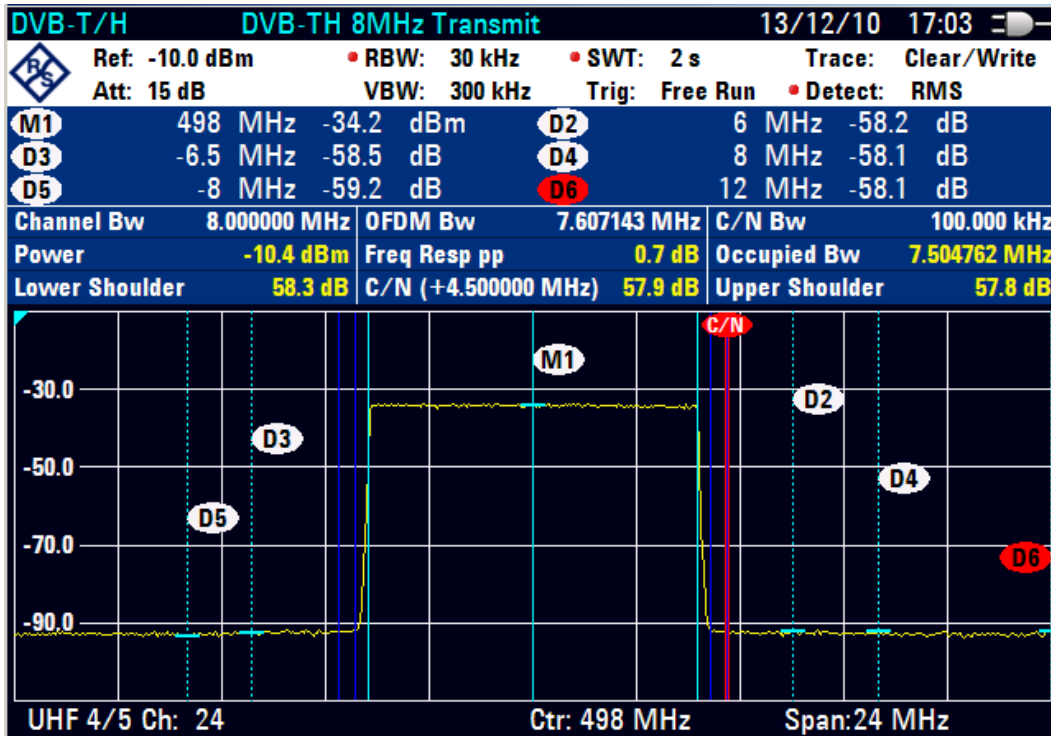
8.1.3.7   Measuring the In-Channel Frequency Response

When performing a DVB-T/H SPECTRUM measurement, the R&S ETH measures the shoulder attenuations, the channel power and the peak-to-peak in-channel amplitude frequency response.

In addition, the DVB-T/H Spectrum measurement provides the in-channel frequency response.

To calculate the peak-to-peak in-channel amplitude frequency response, the trace data within the OFDM bandwidth are used. This OFDM bandwidth is indicated by light blue frequency lines. Before the minimum and maximum trace pixel values within the OFDM bandwidth are determined, for each pixel value an average value is calculated using the 5 lower and 5 upper neighbor pixel values.

Using the RMS trace detector together with a high sweep time setting provides the best results. Due to a longer measurement time, a more stable and more accurate frequency response value is determined since there are more measurement data available for determining the RMS value.

Setting the sweep time to 10 seconds

1. Press the SWEEP key.

2. Press the MANUAL SWT TIME softkey.

3. Enter '10' using the numeric keypad and conform with the '( )' key.
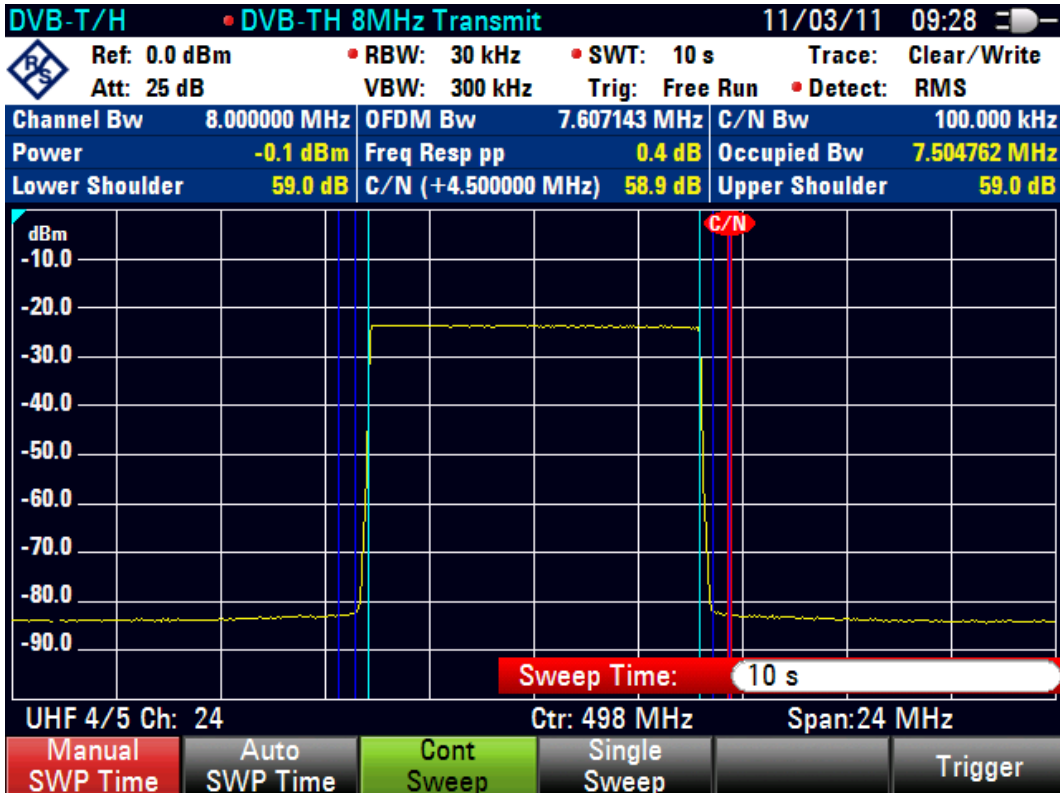
The R&S ETH provides the channel power in the DVB-T/H Spectrum measurement. For the channel power measurement, the RMS trace detector is used to get correct measurement results, independent from the trace detector setting.

The TS ASI transport stream of the incoming DVB-T/H signal is **not** available in the DVB-T/H SPECTRUM measurement.

8.1.3.8   Performing the TV Spectrum Emission Mask Measurement

The TV Spectrum Emission Mask (TV SEM) measurement is a method to detect spurious emissions or intermodulation products of a signal. When performing a TV SEM measurement, the R&S ETH checks the spectrum of the signal against a spectral mask in order to see whether the signal is in compliance to a specific standard or not.

Both the R&S ETH and the R&S ETH View software supply the most common emission standard masks. Furthermore, R&S ETH View allows you to modify existing masks, generate new masks and copy them to the R&S ETH.

In the following measurement example, the signal spectrum is compared to the 'DVB-T 8 MHz critical' spectrum emission mask. The emissions are presented relative to the signal spectrum. The example shows the individual steps for efficiently checking the transmission spectrum. It is based on the previous examples.

Selecting the spectrum emission mask measurement

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select SPECTRUM EMISSION MASK using the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

Selecting the emission mask

1. Press the MEAS SETTINGS softkey.

2. Under EMISSION MASK, select SELECT… using the rotary knob or the cursor keys.

3. Confirm the selection with the ENTER key or the MEAS SETTINGS softkey.

    The R&S ETH opens the browser.

4. Select the desired emission mask ('DVB-T 8 MHz critical' in this example) using the cursor keys or the rotary knob.

5. Confirm the selection with the ENTER key or the SELECT softkey.

Select the measurement profile

1. Press the MEAS PROFILE softkey.

   The R&S ETH opens the browser.

2. Navigate using the cursor keys or the rotary knob in order to select the desired measurement profile ('SEM DVB-T 8 MHz' in this example).

3. End the selection with the ENTER key or the MEAS PROFILE softkey.

Setting the amplitude scaling relative to signal spectrum

1. Press the MEAS SETTINGS key.

2. Under SCALE UNIT, select dB using the rotary knob or the cursor keys.

3. Apply SCALE ADJUST to get a proper trace position.

4. Press the AMPT key.

5. Press the RANGE / REF POS softkey.

6. Select SCALE ADJUST.

   If the unit dB is set, the measurement trace as well as the marker results and display lines are referred to the signal spectrum within the set resolution bandwidth.
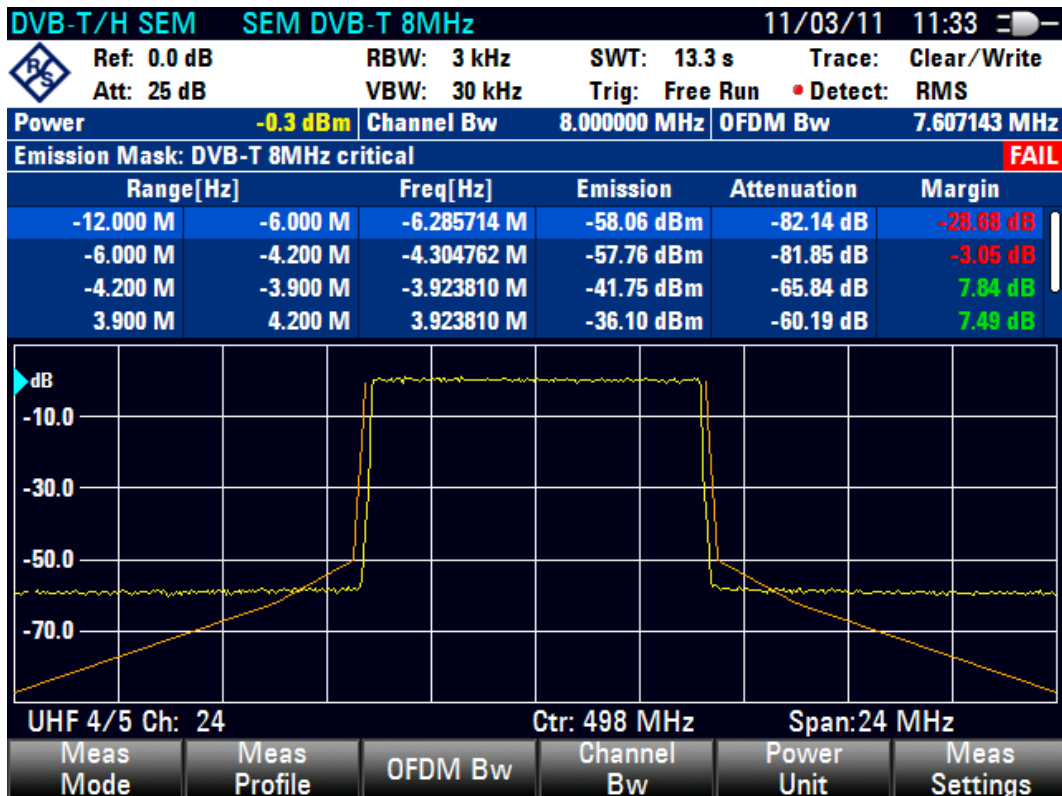
For presenting the measurement results relative to the signal power, the spectrum of the signal must be known first. The R&S ETH calculates the signal power, the trace data and all TV SEM measurement parameters at the end of the sweep.

In addition to the pass/fail information regarding the emission mask test, the R&S ETH presents the highest emission power together with its RF, the attenuation in respect to the signal power and the margin of the emission in each defined frequency range of the selected TV SEM.

For further detailed emission measurements, up to 6 markers are available.

In order to enlarge the measurement screen, you can hide the emission mask list (menu MEAS: MEAS SETTINGS: VIEW MASK LIST).

> The TS ASI transport stream at the TS output connector is **not** available in the TV SPECTRUM EMISSION MASK measurement.

8.1.3.9 Applying output filter characteristic for determination of the spectrum emissions

The dynamic requirements are so high that even high-end spectrum analyzers can only verify these emissions if the transmit signal is suppressed with a bandstop filter. Assistance is provided by the R&S ETH transducer function, which multiplies the measured spectrum by a transducer factor. The transducer factor represents the characteristic of the transmitter output filter.

The SAVE AS TRANSDUCER measurement function stores a measured frequency response as a transducer dataset for use in subsequent measurements. This function requires an R&S ETH with tracking generator (model .14 or .18). For detailed information refer to the R&S ETH operating manual, chapter 'Automatically Generating Transducers'.
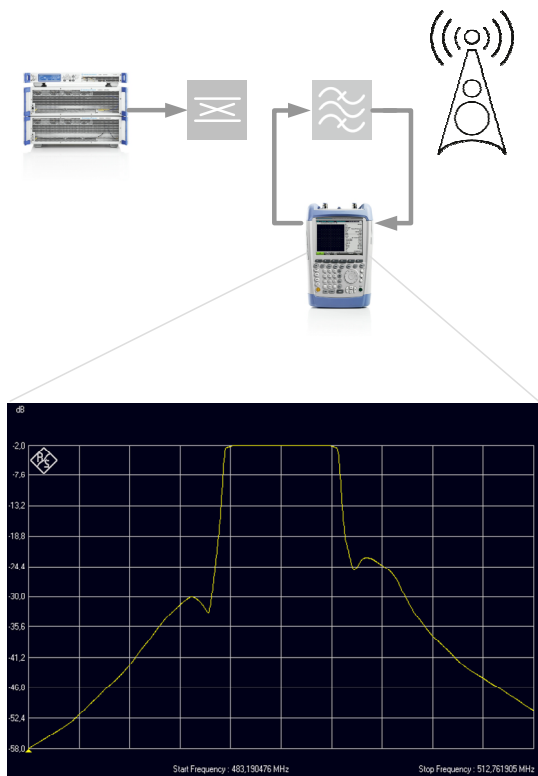
1st step: Measuring the amplitude frequency response of the transmitter output filter and save it as transducer
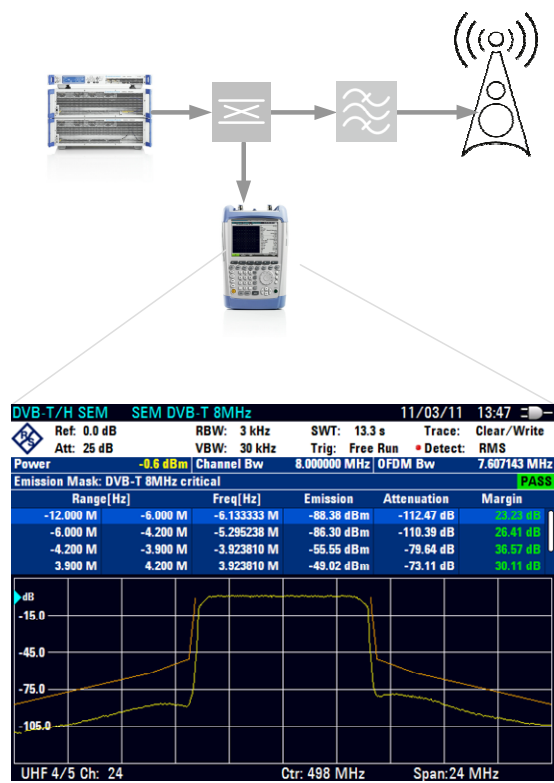
2nd step: Measuring the spectrum emissions in front of the transmitter output filter using a directional coupler and applying the output filter transducer data

In this example, the transducer dataset is already recorded and saved on the R&S ETH.

Enabling a transducer dataset

1. Press the AMPT key.

2. Press the TRANSDUCER softkey.

3. Select SELECT SECONDARY TRANSDUCER using the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the TRANSDUCER softkey.

   The R&S ETH opens the browser.

5. Select the 'MeasTransducer' dataset of the transmitter output filter using the cursor keys or the rotary knob.

6. Confirm the selection with the ENTER key or the SELECT softkey.

Setting a proper amplitude scaling

1. Press the AMPT key.

2. Press the RANGE / REF POS softkey.

3. Select SCALE ADJUST and confirm with the ENTER key or the RANGE / REF POS softkey.

DVB-T/H SEM	SEM DVB-T 8MHz			11/03/11	14:05
Ref: 0.0 dB		RBW: 3 kHz	SWT: 13.3 s	Trace:	Clear/Write
Att: 25 dB		VBW: 30 kHz	Trig: Free Run	● Detect:	RMS

Power	-2.5 dBm	Channel Bw	8.000000 MHz	OFDM Bw	7.607143 MHz

Emission Mask: DVB-T 8MHz critical   **PASS**

Range[Hz]		Freq[Hz]	Emission	Attenuation	Margin
-12.000 M	-6.000 M	-6.057143 M	-87.77 dBm	-111.86 dB	21.47 dB
-6.000 M	-4.200 M	-5.180952 M	-85.41 dBm	-109.50 dB	26.19 dB
-4.200 M	-3.900 M	-3.923810 M	-57.93 dBm	-82.02 dB	35.91 dB
3.900 M	4.200 M	3.923810 M	-46.24 dBm	-70.33 dB	30.10 dB

dB
-15.0

-45.0

-75.0

-106.0

UHF 4/5 Ch: 24   Ctr: 498 MHz   Span:24 MHz

Trace Mode	Detector	Select Trace	Trace ▶ Memory	Show	Trace Math

8.1.4 ISDB-T Analysis

An ISDB-T signal generator, such as the R&S SFU broadcast test system, is used as a signal source.

Test Setup

► Connect the RF output of the ISDB-T signal generator to the RF input of the R&S ETH.

Signal generator settings:

Frequency	803.142 857 MHz*
Level	-10 dBm
Modulation	ISDB-T

* 803.142 857 MHz corresponds to channel 69 in TV Brazil channel table.

Setting up the R&S ETH for ISDB-T analysis

1. Press the MODE key.

2. Press the TV ANALYZER softkey.

3. Press the PRESET key.

4. Press the MEAS key.

5. Press the MEAS MODE softkey

6. Select ISDB-T as TV standard using the rotary knob or the cursor keys

7. Confirm with the ENTER key or the MEAS MODE softkey.

Setting the receive frequency

1. Press the FREQ key.

2. Press the CHANNEL TABLE softkey.

    The R&S ETH opens the browser.

3. Select the desired channel table ('TV BRAZIL.CHNTAB' in this example) using the cursor keys and the rotary knob.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

5. Press the CHANNEL softkey.

6. Enter the channel number (69 in this example), and confirm the entry by pressing the ENTER key.

    In the status area of the measurement window, the R&S ETH now displays the channel number together with the frequency band and the name of the selected channel table in addition to the set receive frequency.

Setting the measurement profile

1. Press the MEAS key.

2. Press the MEAS PROFILE softkey.

   The R&S ETH opens the browser.

3. Select the desired measuring profile ('\Public\Standard\TRANSMITTER' in this example) using the cursor keys or the rotary knob.

4. Confirm the selection by pressing the ENTER key or the SELECT softkey.

   In the title bar of the measurement window, the R&S ETH displays the selected 'Transmitter' measurement profile.

The measurement profile defines the following setting parameters.

8.1.4.1   Measuring the Transmission Parameters

The R&S ETH measures the transmission parameters and displays it in the Measurement List screen, which provides an overview of the most important settings and measurement parameters.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select MEASUREMENT LIST using the rotary knob or the cursor keys, and confirm with the ENTER key or the MEAS MODE softkey.

    The R&S ETH displays the Measurement List screen.

ISDB-T	Meas List	Transmitter		10/09/10 08:36	
	RF		803.142857 MHz		
	Channel / Band		69 / UHF		
	Channel Table		TV Brazil ISDB-T		
	Gain Control / RF Attenuation		Auto Low Noise / 15 dB		

Measurement Parameter					
Power	-11.12 dBm		Crest Factor	12.31 dB	
OFDM Demodulator	locked		FEC Decoder	locked	
ISDB-T Mode	Mode 3 (8K)				
Guard Interval	1/16		MER (total,rms)	44.8 dB	
Sideband Position	normal		MER (total,peak)	20.6 dB	
RF Offset	308.9 Hz		MER TMCC	47.1 dB	
Symbol Rate Offset	0.4 ppm		MER AC	47.0 dB	
	Layer A	**Layer B**	**Layer C**		
MER (Layer,rms)	42.8	44.6	44.6	dB	
BER before Viterbi	0.0E-08	0.0E-09	0.0E-08		
BER before Reed Solomon	0.0E-08	0.0E-09	0.0E-08		
BER after Reed Solomon	0.0E-06	0.0E-08	0.0E-07		
Packet Errors	0	0	0	/s	
MPEG TS Bitrate	0.578239	19.081899	0.991267	Mbit/s	

Parameterization of the demodulator occurs automatically in accordance with the transmitted 'Transmission and Multiplexing Configuration Control' (TMCC) information.

> The TS ASI transport stream of the incoming ISDB-T signal is available using the TS OUT BNC female.

8.1.4.2   Transmission and Multiplexing Configuration Control (TMCC)

The R&S ETH detects the transmission and multiplexing configuration control (TMCC) information sent by the ISDB-T broadcast transmitter and configures the demodulator accordingly. The R&S ETH displays the complete TMCC information in the TMCC Information screen.

The following measurement example is based on the previous examples.

1. Press the MEAS key.

2. Press the TMCC INFO softkey.

    The R&S ETH displays all TMCC parameters together with the most important settings and measurement parameters on the screen.

To return to the Measurement List measurement screen, press the TMCC INFO EXIT softkey.

The TS ASI transport stream of the incoming ISDB-T signal is available using the TS OUT BNC female.

8.1.4.3 Displaying the I/Q Constellation

In the I/Q constellation diagram, a Cartesian coordinate system, the R&S ETH displays the complex baseband signal in relation to the sampling times. The I/Q constellation diagrams of layer A, B and C are displayed separately in a split screen view. The pilot and auxiliary carriers can be inserted.

The following measurement example is based on the previous examples.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select CONSTELLATION DIAGRAM with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

   The R&S ETH displays the I/Q constellation diagram on the left-hand side of the measurement screen. The most important transmission parameters and instrument settings are displayed in the pane on the right. The parameter descriptions are abbreviated to save space on the screen.
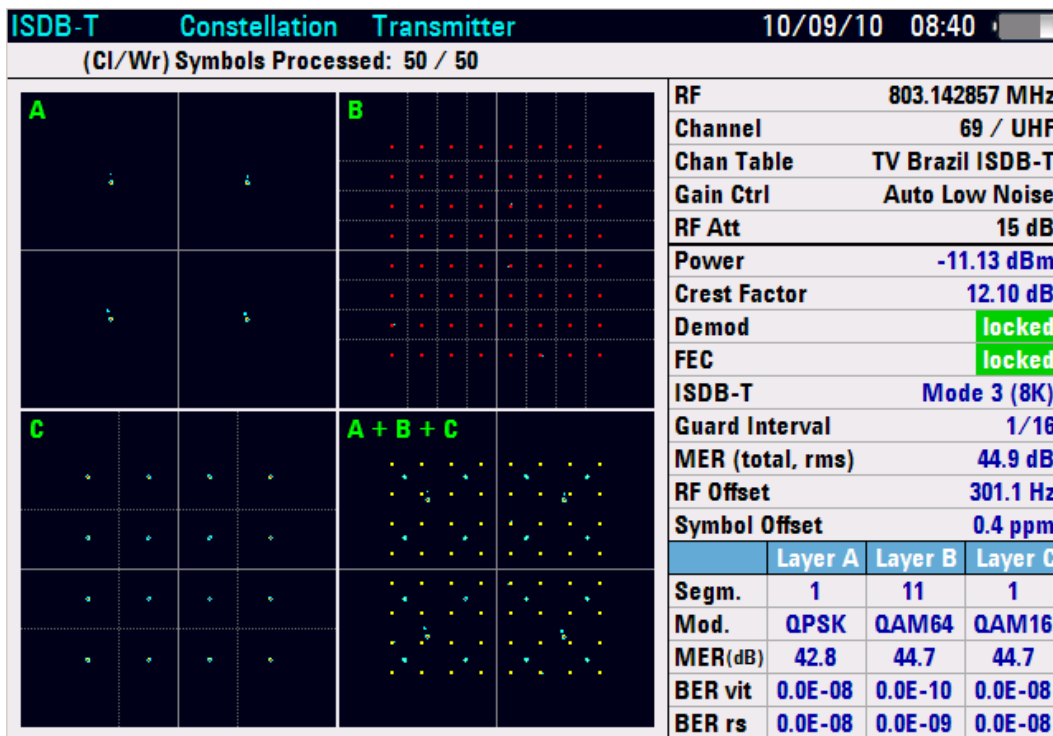
The TS ASI transport stream of the incoming ISDB-T signal is available via the TS OUT BNC female.

Displaying Pilot and Auxiliary Carriers

In addition to the I/Q constellation of the data carriers, the I/Q constellation of the pilot and auxiliary carriers can be displayed.

1. Press the TRACE key.

2. Press the PILOT CARRIERS softkey.
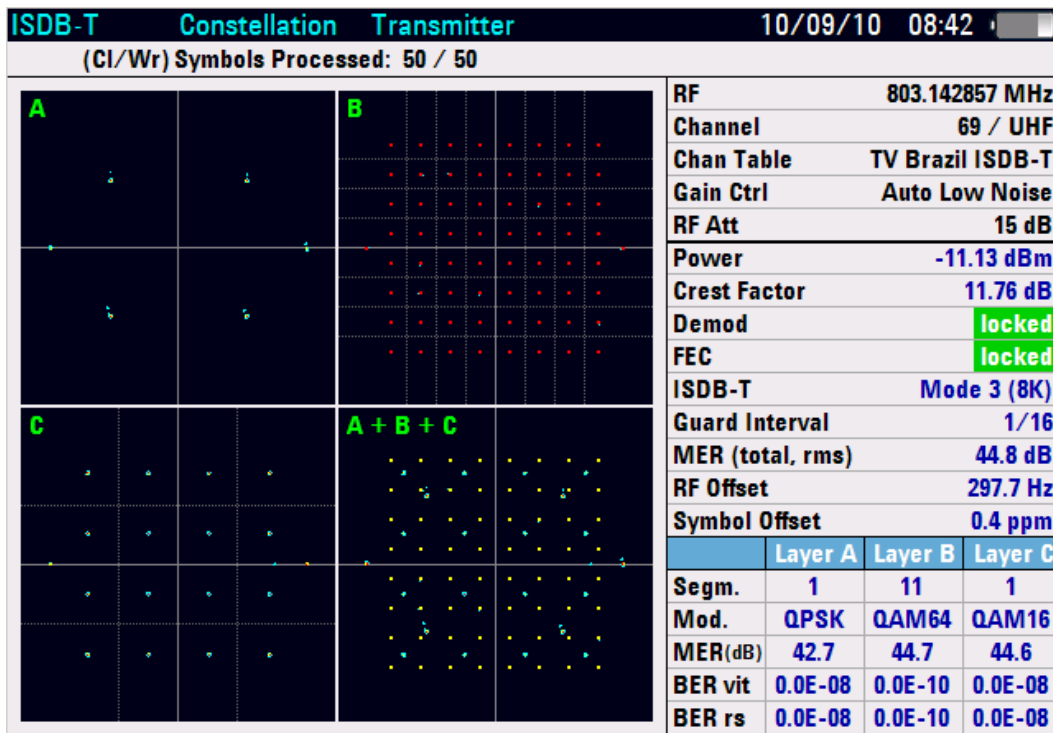
8.1.4.4   Measuring the Echoes

This Echo Pattern measurement shows the echo profile of the transmission channel.

> The TS ASI transport stream of the incoming ISDB-T signal is available using the TS OUT BNC female.

The following measurement example is based on the previous examples. For better explanation, a few echoes are added for this measurement example using the fading option of the R&S SFU broadcast test system.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select ECHO PATTERN with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.
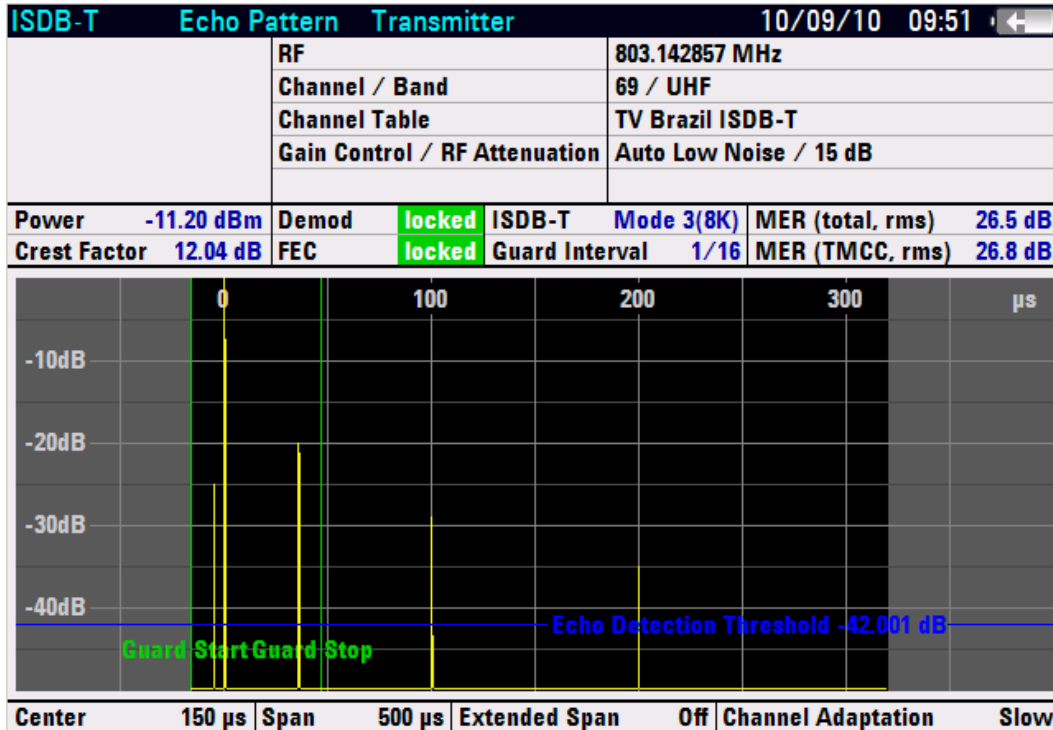
The R&S ETH references the largest receive signal to 0 dB and 0 µs. Read out the echoes using markers. In the default setting (AUTO SPAN), the R&S ETH displays the entire measurement range. For a more precise assessment, you can zoom into the display range.

Echo Pattern Zoom

For setting of the desired zooming range, the CENTER = MARKER marker function is recommended.

The measurement example is based on the previous examples.

1. Press the MARKER -> key.

   The R&S ETH activates a marker and set it to the main path.

2. Move the marker to the center position of the desired zooming range using the rotary knob, the cursor keys, the numeric keypad, the MARKER TO PEAK or MARKER TO NEXT PEAK function.

3. Press the CENTER = MARKER softkey

   The R&S ETH sets the marker position to the center of the Echo Pattern screen.

4. Press the SPAN key.

5. Press the MANUAL SPAN softkey.

6. Set the desired span using the rotary knob, the cursor keys or the numeric keypad.

    The R&S ETH displays the zoomed Echo Pattern screen which allows a more detailed analysis.

Marker

You can set up to 6 markers to get further information about the echoes. Especially helpful are the SET TO PEAK and SET TO NEXT PEAK marker functions for setting the marker.

The measurement example is based on the previous examples.

1. Press the MARKER key.

2. Press the NEW MARKER softkey.

    The R&S ETH activates a 2nd marker and set it to the second largest echo.

3. Press the NEW MARKER softkey.

    The R&S ETH activates a 3rd marker and set it to the third largest echo.

Note: The SET TO PEAK and SET TO NEXT PEAK marker functions detect all echoes within the complete measurement range, independent from the span setting.
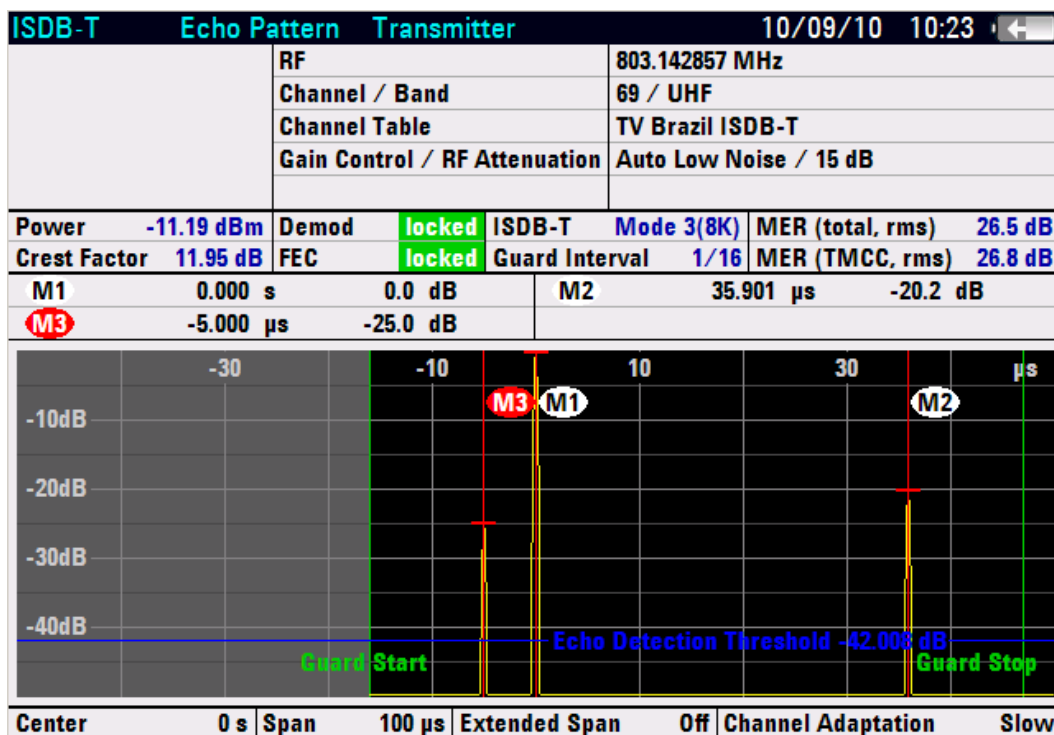
Setting the FFT Window Position

In the default setting, the OFDM demodulator automatically positions the FFT window depending on the received OFDM signal. If desired, you can set the FFT window position manually in a range of ±50 % with respect to the main pulse.

The measurement example is based on the previous examples.

1. Press the MEAS key.

2. Press the DEMOD SETTINGS softkey.

3. Under FFT WINDOW POSITION, select MANUAL using the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the DEMOD SETTINGS softkey.

   The R&S ETH opens the entry box with the current offset setting. As indication for manual FFT window position setting, in the status field, FFT POSITION is displayed.

5. Enter the desired FFT window position using the rotary knob, the cursor keys or the numeric keypad.

6. Confirm with the DEMOD SETTINGS softkey or the ENTER key.
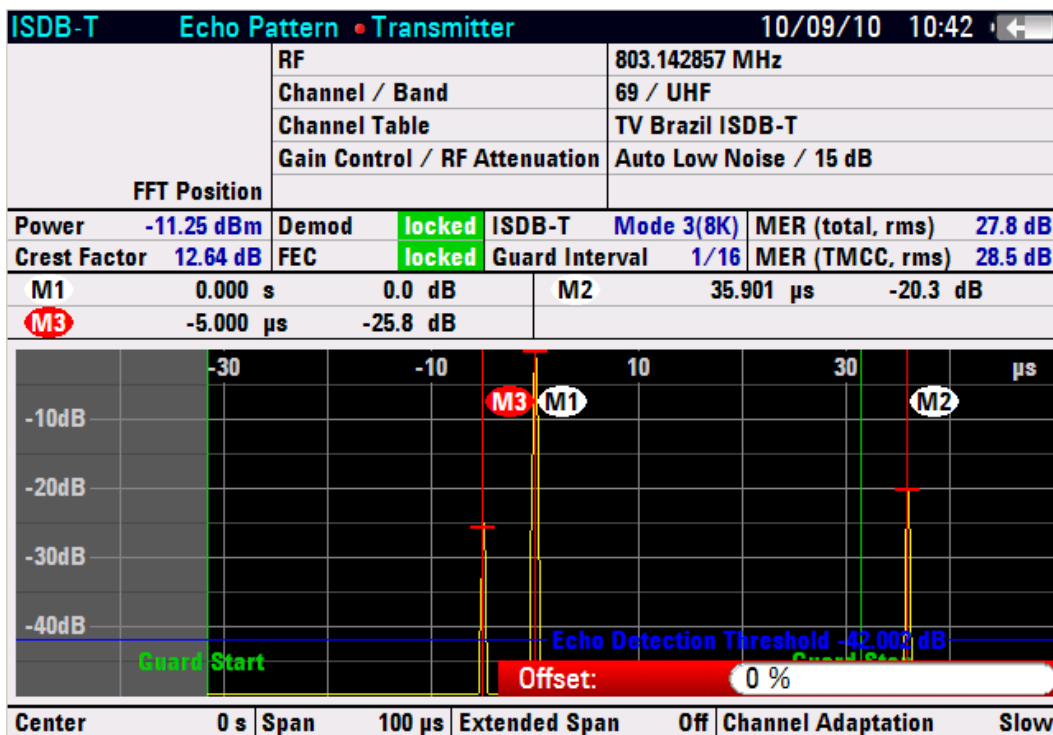
Because the setting of the selected measurement profile is changed, in front of the 'Transmitter' measurement profile name, a red dot is added as indication.

Echo Pattern Peak List

In addition to the Echo Pattern measurement screen, the R&S ETH displays the 12 greatest echoes in the Echo Pattern Peak List, sorted according to the level. To shorten the list, you can set a peak list threshold.

The Echo Pattern Peak List is independent from the span settings of the Echo Pattern measurement screen.

In the example, all echoes shall be listed which are greater than -30 dB. The measurement example is based on the previous examples. The FFT window position is set back to automatic mode as specified in the 'Transmitter' measurement profile.

1. Press the MEAS key.

2. Press the PEAK LIST THRESHOLD softkey.

3. Enter the desired peak list threshold using the rotary knob, the cursor keys or the numeric keypad (in this example '-30'), and confirm with the PEAK LIST THRESHOLD softkey or the ENTER key.

4. Press the VIEW PEAK LIST softkey.

    The R&S ETH displays the echoes up to the set peak list threshold.

Scale Unit

Alternatively, the R&S ETH rescales the time axis into a distance axis.

1. Press SPAN key.

2. Press SPAN UNIT softkey.

3. Set the desired unit using the rotary knob or the cursor keys, and confirm the entry by pressing the ENTER key or the SPAN UNIT softkey.

The unit selection applies to the x axis, markers and peak list.

8.1.4.5   Measuring the MER over the OFDM carriers

In the MER(k) screen, the R&S ETH displays the MER over the OFDM carriers of the received ISDB-T signal.

> The TS ASI transport stream of the incoming ISDB-T signal is available using the TS OUT BNC female.

The following example shows the individual steps for efficiently measuring the MER over the OFDM carriers. It is based on the previous examples. The fading profile of the R&S SFU broadcast test system is switch off again.

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select MER(k) with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

ISDB-T	MER (k)	Transmitter		10/09/10 11:10
	RF		803.142857 MHz	
	Channel / Band		69 / UHF	
	Channel Table		TV Brazil ISDB-T	
	Gain Control / RF Attenuation		Auto Low Noise / 15 dB	

| Power | -11.03 dBm | Demod | locked | ISDB-T | Mode 3(8K) | MER (total, rms) | 44.8 dB |
| Crest Factor | 12.41 dB | FEC | locked | Guard Interval | 1/16 | MER (TMCC, rms) | 47.0 dB |

```
0     MER (rms) 44.3 dB                                              5616
 45dB
 40dB
 35dB
 30dB
 25dB
 20dB
 15dB
 10dB
  5dB
   11   9   7   5   3   1   0   2   4   6   8   10  12
```

| Center: | Carrier 2808 | Span: | 5617 Carriers | Detector: | | RMS | Trace Mode: | Clear / Write |

Adjusting the residual carrier of the transmitter

In the measurement screen, the OFDM carriers are evenly distributed among the 631 pixel columns. The selected trace detector determines the display of the MER value. In the RMS setting, the root-mean-square value per pixel column is determined and displayed. In the MIN and MAX settings, the minimum or maximum MER value per pixel column is displayed. In the AUTO PEAK setting, the minimum and maximum MER values are displayed; in this display, the marker value is always equal to the minimum MER value of the pixel column.

The measurement of the minimum MER value for the carrier frequency is especially helpful, since this value corresponds to the residual carrier of the modulator. Thus, this reading can be used to adjust the modulator's residual carrier.

The measurement example is based on the previous examples.

1. Press the TRACE key.

2. Press the DETECTOR softkey.

3. Select AUTO PEAK with the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the DETECTOR softkey.

5. Press the MARKER-> key to use a marker for reading out the numerical value.

The R&S ETH sets the marker to the pixel position with the minimum MER value.
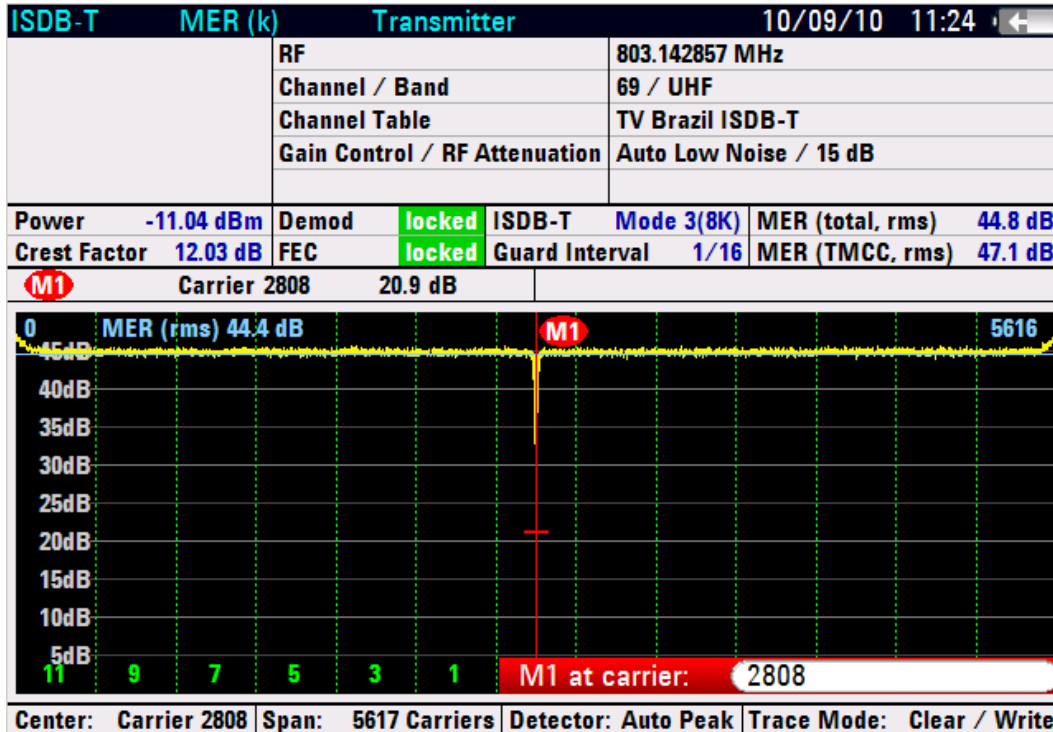
Detecting disturbing signals

The display of the OFDM carriers always corresponds to the frequency.

The markers are pixel-column-oriented and may refer to the carrier number in the baseband or the carrier frequency, or the absolute frequency is output. The reference to disturbances in the frequency spectrum can thus easily be established.

You can set up to 6 markers to get further information about the echoes. Especially helpful are the SET TO PEAK and SET TO NEXT PEAK marker functions for setting the marker.

The measurement example is based on the previous examples. For better explanation, a CW carrier at 805 MHz with an power of -74 dBm is added for this measurement example.

Use a marker for determination the absolute frequency of the disturbance carrier and its influence to the OFDM signal.

1. Press the MARKER key.

2. Press the NEW MARKER softkey.

The R&S ETH activates a 2nd marker and set it to the second worst pixel value.

3.   Press the MARKER TYPE softkey.

4.   Select ABSOLUTE FREQUENCY with the rotary knob or the cursor keys.

5.   Confirm the selection with the ENTER key or the MARKER TYPE softkey.

ISDB-T	MER (k)	Transmitter	10/09/10 14:15
	RF		803.142857 MHz
	Channel / Band		69 / UHF
	Channel Table		TV Brazil ISDB-T
	Gain Control / RF Attenuation		Auto Low Noise / 15 dB

Power	-10.85 dBm	Demod	locked	ISDB-T	Mode 3(8K)	MER (total, rms)	44.7 dB
Crest Factor	11.91 dB	FEC	locked	Guard Interval	1/16	MER (TMCC, rms)	47.1 dB

M1	Carrier 2808	20.7 dB	M2	805.006 MHz	26.6 dB

MER (rms) 44.3 dB   M1   M2   5616

45dB
40dB
35dB
30dB
25dB
20dB
15dB
10dB
5dB
11   9   7   5   3   1   0   2   4   6   8   10   12

Center:	Carrier 2808	Span:	5617 Carriers	Detector: Auto Peak	Trace Mode:	Clear / Write
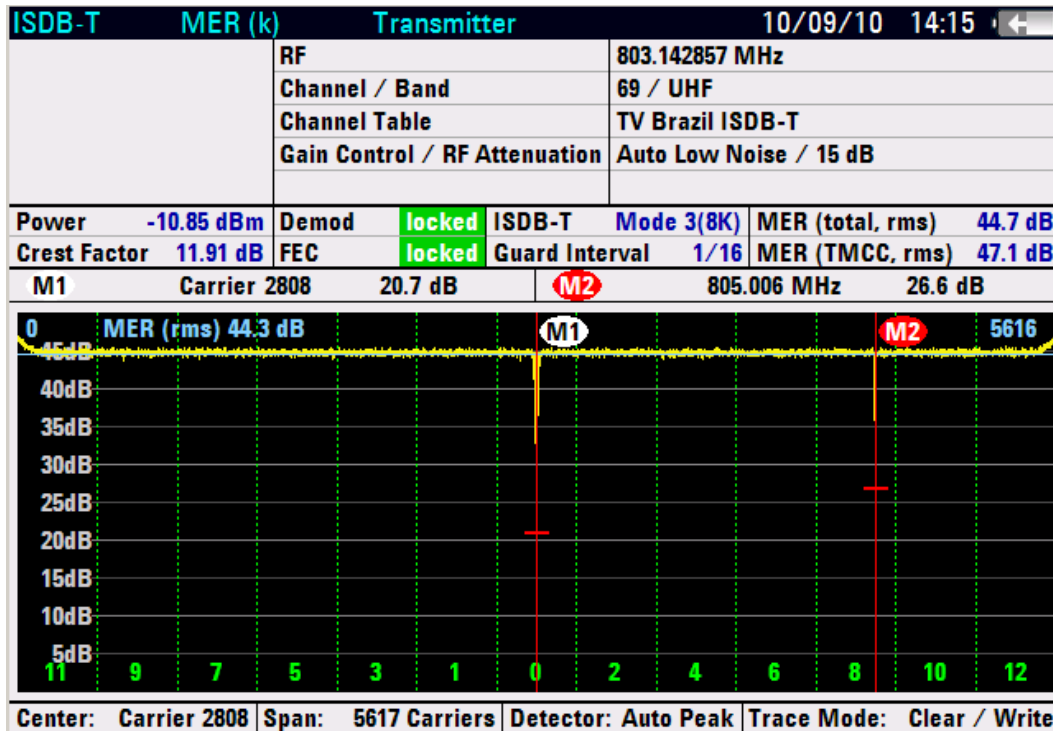
8.1.4.6   Measuring the Carrier to Noise Ratio

In addition, the TV Spectrum measurement provides the carrier to noise measurement parameter.

The following example shows the individual steps for efficiently measuring the carrier to noise ratio. In this example, the noise power shall be measured at a frequency offset of 3.5 MHz, the noise channel bandwidth shall be 200 kHz.

The example is based on the previous example.

1.   Press the MEAS key.

2.   Press the MEAS MODE softkey.

3.   Select SPECTRUM and confirm with the ENTER key or the MEAS MODE softkey.

4.   Press the MEAS SETTINGS softkey.

5. Select AUTO FREQUENCY OFFSET with the rotary knob or the cursor keys, and confirm the selection with the ENTER key or the MEAS SETTINGS softkey.

   The frequency offset is set to half channel bandwidth plus 0.5 MHz. For a other desired frequency offset use MANUAL FREQUENCY OFFSET.

6. Press the MEAS SETTINGS softkey.

7. Select NOISE BANDWIDTH with the rotary knob or the cursor keys, and confirm the selection with the ENTER key or the MEAS SETTINGS softkey.

8. Enter the desired channel bandwidth ('200' in this example), and confirm the entry with the kHz key.
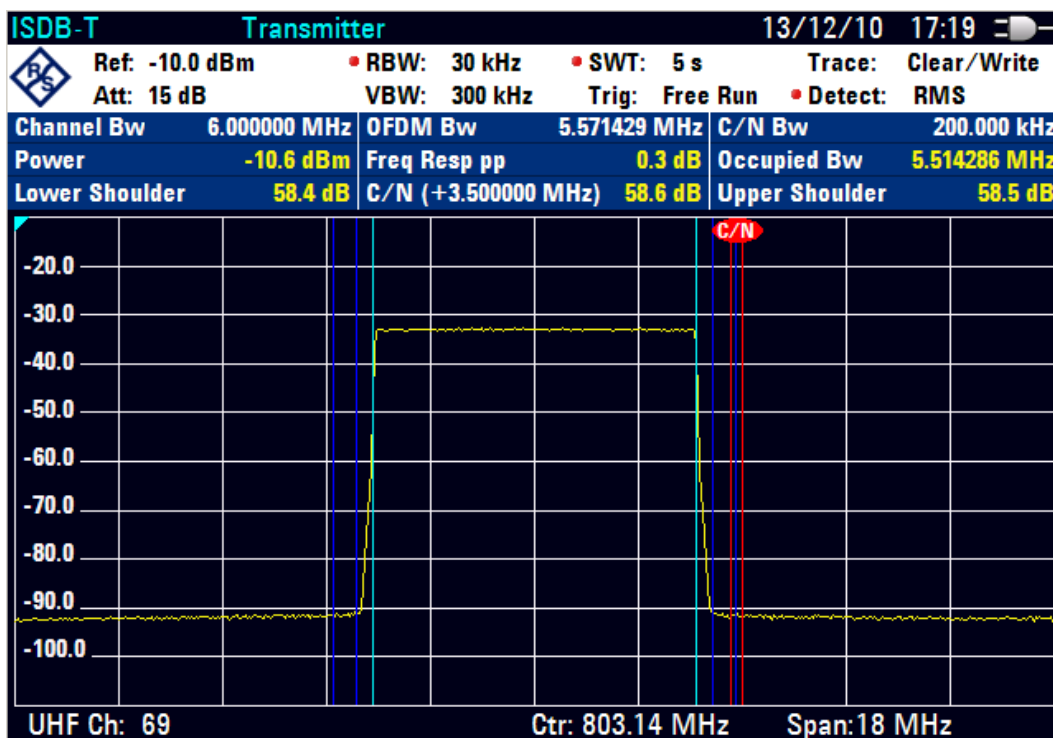
The R&S ETH measures the noise power and calculates the ratio to the channel power. The frequency range which is used for noise power measurement is indicated as blue frequency lines.

> The TS ASI transport stream of the incoming ISDB-T signal is **not** available in the TV ANALYZER SPECTRUM measurement.

8.1.4.7   Measuring the In-Channel Frequency Response and Occupied Bandwidth

When performing an ISDB-T Spectrum measurement, in addition to channel power, carrier to noise ratio and spectrum emission mask measurement, the R&S ETH also measures in-channel frequency response and occupied bandwidth.

To calculate the peak-to-peak in-channel amplitude frequency response, the trace data within the OFDM bandwidth are used. This OFDM bandwidth is indicated by light blue frequency lines. Before the minimum and maximum trace pixel values within the OFDM bandwidth are determined, for each pixel value, an average value is calculated using the 5 lower and 5 upper neighbor pixel values.

Using the RMS trace detector together with a high sweep time setting provides the best results. Due to a longer measurement time, a more stable and more accurate frequency response value is determined since there are more measurement data available for determining the RMS value.

The occupied bandwidth is defined as the bandwidth that contains 99 % of the entire power of the transmitter.

In addition, the R&S ETH provides the channel power in the ISDB-T Spectrum measurement. For the channel power measurement, the RMS trace detector is used to get correct measurement results, independent from the trace detector setting.

The following example shows the individual steps for efficiently measuring with the R&S ETH. To produce a stable and accurate frequency response measurement, set the measurement time to 10 seconds.

The example is based on the previous example.

1. Press the SWEEP key.

2. Press the MANUAL SWP TIME softkey.

3. Using the numeric keypad, enter '10', and confirm with the () key.
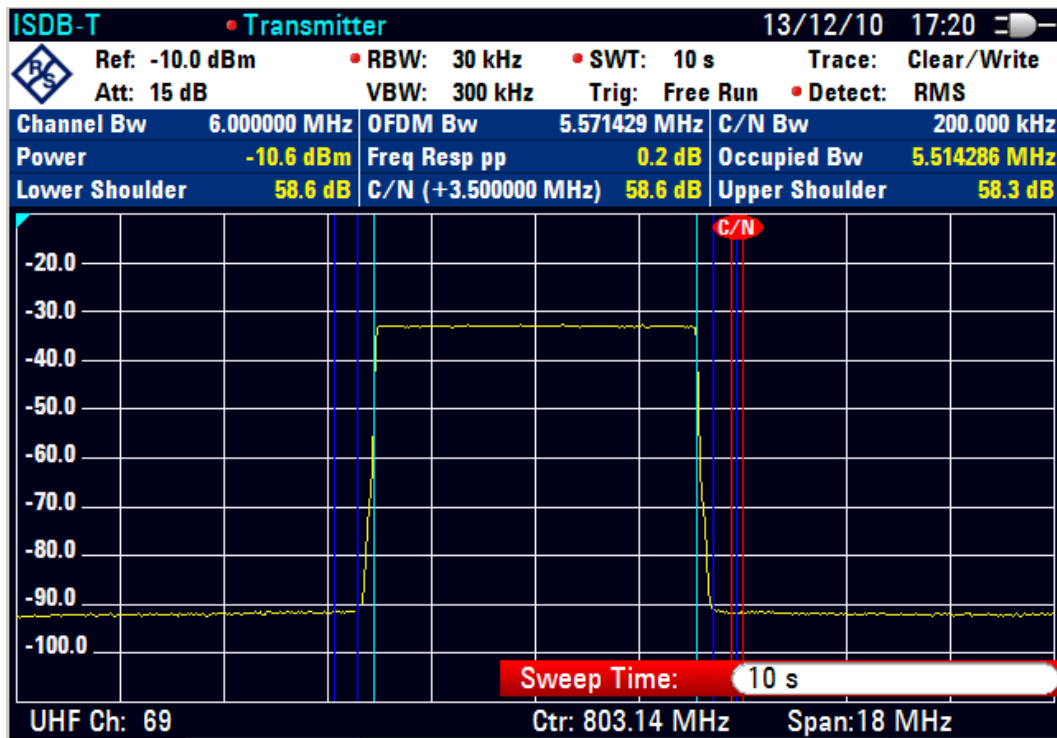
The R&S ETH displays the channel power, the peak to peak value of the amplitude frequency response within the OFDM bandwidth and the occupied bandwidth in the measurement line of the screen.

> The TS ASI transport stream of the incoming ISDB-T signal is **not** available in the TV ANALYZER SPECTRUM measurement.

8.1.4.8   Performing the TV Spectrum Emission Mask Measurement

The TV Spectrum Emission Mask (TV SEM) measurement is a method to detect spurious emissions or intermodulation products of a signal. When performing a TV SEM measurement, the R&S ETH checks the spectrum of the signal against a spectral mask in order to see whether the signal is in compliance to a specific standard or not.

Both the R&S ETH and the R&S ETH View software supply the most common emission masks. Furthermore, R&S ETH View allows you to modify existing masks, generate new masks and copy them to the R&S ETH.

In the following measurement example, the signal spectrum is compared with the 'ARIB STD-B31' spectrum emission mask. The measurement settings shall be according to the ARIB STD-B31 standard (Association of Radio Industries and Businesses). The emissions are presented relative to the signal power in the unit dBc/10 kHz. The example shows the individual steps for efficiently checking the transmission spectrum. The example is based on the previous example.

Selecting the emission mask

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select SPECTRUM EMISSION MASK using the rotary knob or the cursor keys.

4. Confirm the selection with the ENTER key or the MEAS MODE softkey.

Selecting the emission mask

1. Press the MEAS SETTINGS softkey.

2. Under EMISSION MASK, select SELECT… using the rotary knob or the cursor keys.

3. Confirm the selection with the ENTER key or the MEAS SETTINGS softkey.

    The R&S ETH opens the browser.

4. Select the desired emission mask ('ARIB STD-B31 more than 2.5W' in this example) using the cursor keys or the rotary knob.

5. Confirm the selection with the ENTER key or the SELECT softkey.

Select the measurement profile

1. Press the MEAS PROFILE softkey.

    The R&S ETH opens the browser.

2. Navigate using the cursor keys or the rotary knob in order to select the desired measurement profile ('SEM ARIB STD-B31' in this example).

3. End the selection with the ENTER key or the MEAS PROFILE softkey.

    The ARIB STD-B31 standard requires a filtering of the trace data by using a video filter of a bandwidth of 300 Hz or less or an averaging filter. The R&S ETH offers both possibilities. In this example, the RMS trace detector in combination with a high sweep time is used for trace filtering with the advantage of a correct signal power measurement result.

> Applying a video bandwidth of 300 Hz or less in combination with the peak trace detector results in an error of about 2.5 dB according the signal power measurement. The R&S ETH indicates this by a red dot in front of the measurement result.

Setting the amplitude scaling relative to signal spectrum

1. Press the MEAS SETTINGS softkey.

2. Under SCALE UNIT, select dBc/10 kHz using the rotary knob or the cursor keys.

    Apply SCALE ADJUST to get a proper trace position.

3. Press the AMPT key.

4. Press the RANGE / REF POS softkey.

5. Select SCALE ADJUST.

    If the unit dBc/10 kHz is set, the R&S ETH sets the resolution bandwidth to 10 kHz, the measurement trace as well as the marker results and display lines are referred to the signal power within a 10 kHz bandwidth.

For presenting the measurement results relative to the signal power, the spectrum of the signal must be known first. The R&S ETH calculates the signal power, the trace data and all TV SEM measurement parameters at the end of the sweep.

In addition to the pass/fail information regarding the emission mask test, the R&S ETH presents the highest emission power together with its RF, the attenuation with respect to the signal power and the margin of the emission in each defined frequency range of the selected TV SEM.

For further detailed emission measurements, up to 6 markers are available.

In order to enlarge the measurement screen, you can hide the emission mask list (menu MEAS: MEAS SETTINGS: VIEW MASK LIST).

> The TS ASI transport stream at the TS output connector is **not** available in the TV SPECTRUM EMISSION MASK measurement.

Setting the frequency span according to the spectrum emission mask definition

The spectrum emission mask is defined for a frequency range of ±15 MHz. Because of the 'SEM ARIB STD-B31' measurement profile is applied the frequency span is set to 20 MHz according the ARIB STD-B31 standard. Therefore the emission mask test is only applied for the set frequency span of 20 MHz. The R&S ETH indicates this by a red dot in front of the emission mask display line.

> The frequency span is set according to the emission mask definition if AUTO SPAN is set.

1. Press the SPAN key.

2. Press the AUTO SPAN softkey.

8.2   Spectrum Analyzer

A basic task performed by spectrum analyzers is measuring the level and frequency of sine wave signals. The following examples illustrate the most efficient way of performing these measurements with the R&S ETH portable TV analyzer in spectrum analyzer mode.

A signal generator such as the R&S SML signal generator is used as a signal source.

Test Setup

► Connect the RF output of the signal generator to the RF input of the R&S ETH.

Signal generator settings:

Frequency	700 MHz
Level	-30 dBm

8.2.1   Level Measurement

To show all of the operational steps required, restore the R&S ETH to its default settings in the spectrum analyzer mode.

1. Press the MODE key.

2. Press the SPECTRUM ANALYZER key.

3. Press the PRESET key.

The analyzer displays the frequency spectrum over its maximum frequency span. At 700 MHz, the generator signal is displayed as a vertical line.
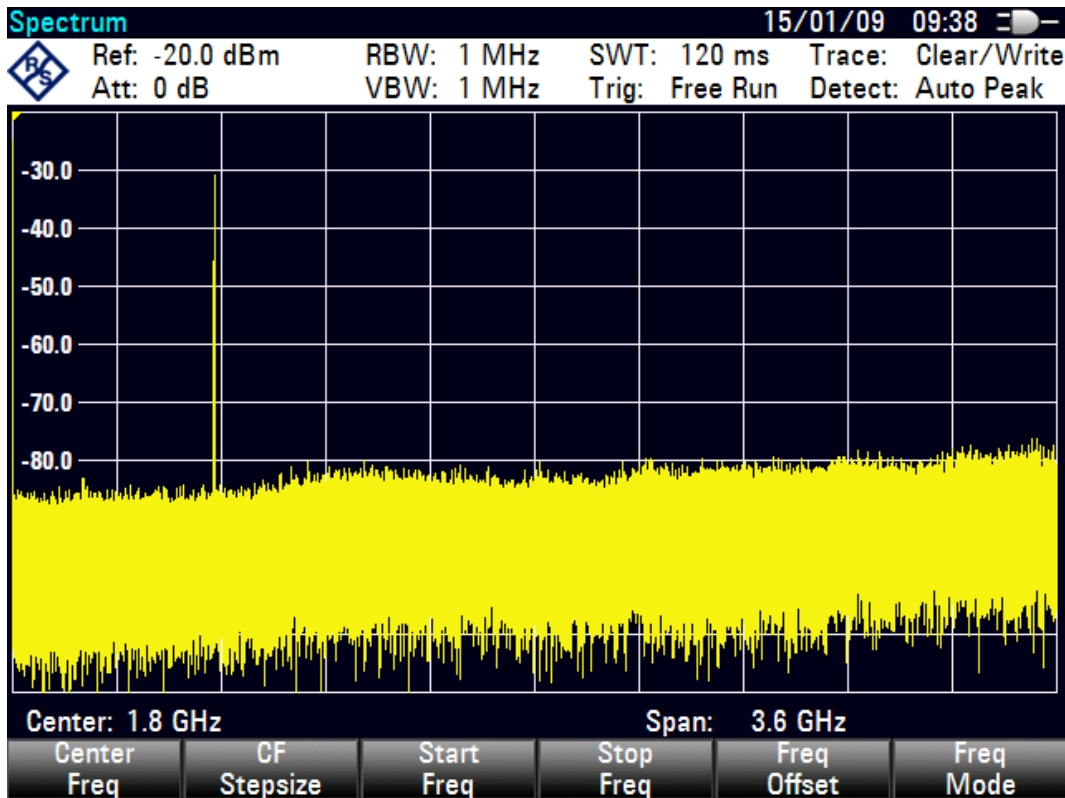
To analyze the generator signal at 700 MHz in more detail, reduce the frequency span of the R&S ETH. Set the center frequency of the R&S ETH to 700 MHz and reduce the span to 10 MHz.

1. Press the FREQ key.

2. Enter '700' using the numeric keypad, and confirm the entry with the MHz key.

3. Press the SPAN key.

4. Enter '10' using the numeric keypad, and confirm the entry with the MHz key.

The R&S ETH now displays the generator signal with a higher resolution.
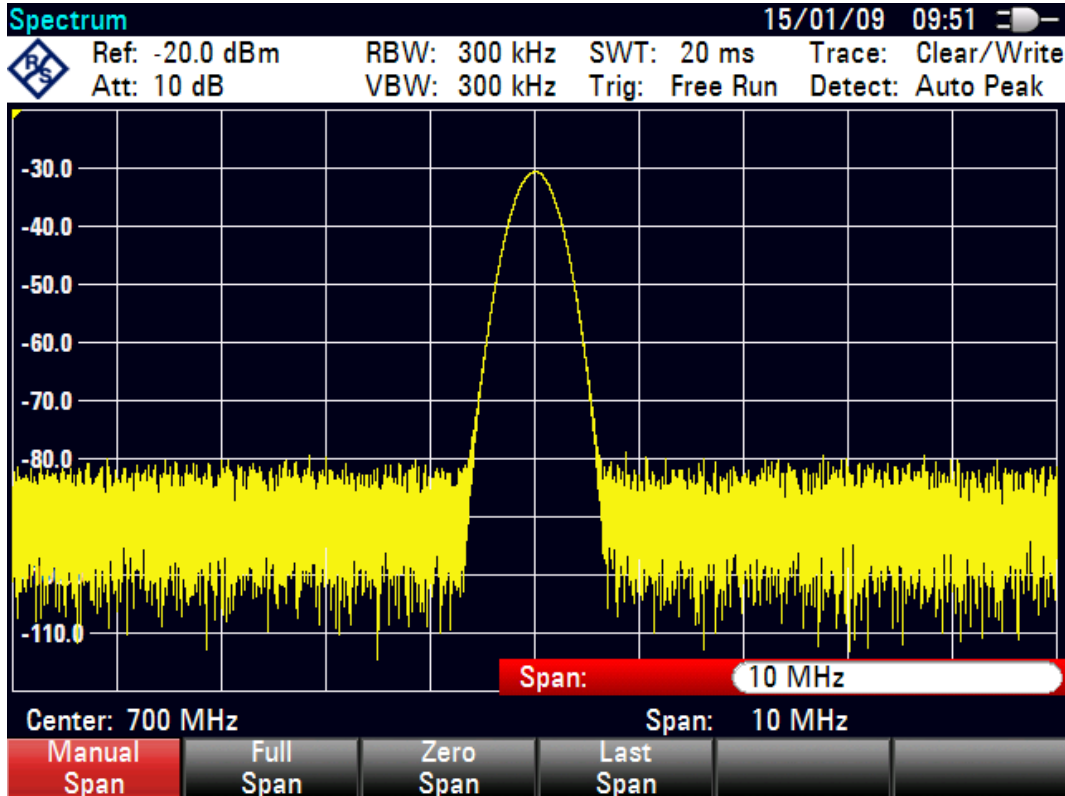
The R&S ETH has markers for identifying signal levels. Markers are always positioned on the trace. The level and frequency values are displayed on the screen at their respective positions.

► Press the MARKER key.

The marker is activated and automatically positioned at the maximum value of the trace. A vertical line on the measurement diagram indicates the marker frequency. The level is indicated by a short horizontal line on the trace.

The R&S ETH displays the level and frequency of the marker position numerically above the measuring screen.
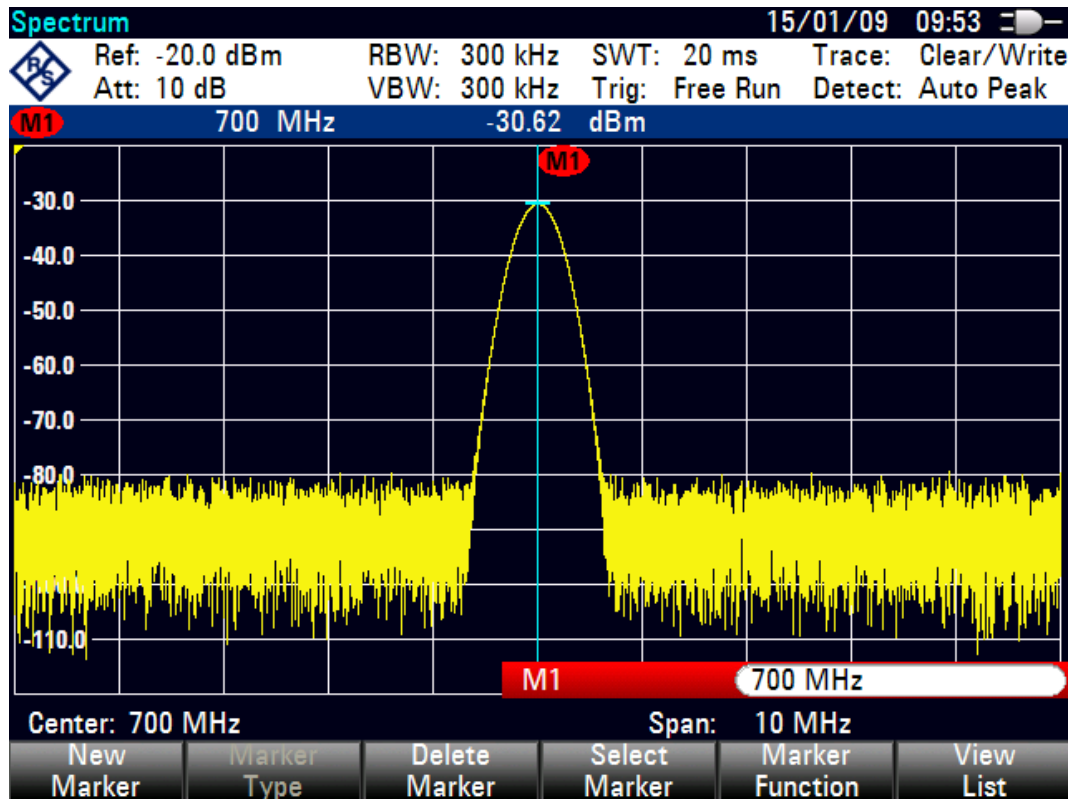
8.2.2   Setting the Reference Level

The level shown by spectrum analyzers at the top of the measurement diagram is called the reference level (REF LEVEL).To obtain the best dynamic range from a spectrum analyzer, its full level range should be used. This means that the maximum spectrum level should be at or close to the top of the measurement diagram (= reference level).The reference level is the maximum level on the level axis (y axis).

Reduce the reference level by 10 dB to increase the dynamic range.

1. Press the AMPT key.

   The softkeys for the AMPT menu are displayed and the REF LEVEL softkey label is highlighted in red, indicating that a value can be entered. The red value input field at the bottom right-hand corner of the measurement diagram displays the current reference level.

2. Using the numeric keypad, enter '30', and confirm the entry with the -dBm key.

   The reference level is now set to –30 dBm. The maximum trace value is close to the maximum scale value of the measurement diagram. The increase in the displayed noise floor is minimal. The difference between the signal maximum and the displayed noise (i.e. the dynamic range) has increased.

Using markers is also an efficient way to shift the trace maximum so that it coincides with the top of the measurement diagram. If the marker is positioned on the trace maximum (as in the example), the reference level can be set to the marker level by the following entries:

1. Press the MKR key.

2. Press the CENTER = MKR / LEVEL = MKR softkey.

3. Select LEVEL = MARKER LEVEL in the selection box by using the rotary knob or the cursor keys (∧ or ∨).

4. Press the ENTER key.

   The reference level is then set to the measured level indicated by the marker. Only a few keystrokes are needed to set the optimal reference level.

8.2.3   Frequency Measurements

The R&S ETH trace displays 631 measurement points (frequency points). The marker is always positioned on one of these measurement points. The R&S ETH calculates the marker frequency from the corresponding measurement point frequency, center frequency and frequency span. The measurement point resolution, and consequently the accuracy of the marker frequency readout, therefore depends on the frequency span that has been selected.

The R&S ETH has a frequency counter to increase the accuracy of the marker frequency readout. It stops the sweep at the marker position, counts the frequency and then continues the sweep.

The following measurement example is based on the previous example.

1. Press the MARKER FUNCTION softkey in the marker menu.

   The MARKER FUNCTION selection box opens.

2. Select FREQUENCY COUNT from the selection box using the rotary knob or the cursor keys (∧ or ∨). Press the ENTER key.

   The label M: at the upper left-hand corner of the measurement diagram changes to C: to indicate that the frequency counter has been switched on. The resolution of the frequency readout is now 0.1 Hz regardless of the span setting. The accuracy is determined by the R&S ETH internal reference frequency. It is significantly higher than the pixel-oriented marker-frequency readout.
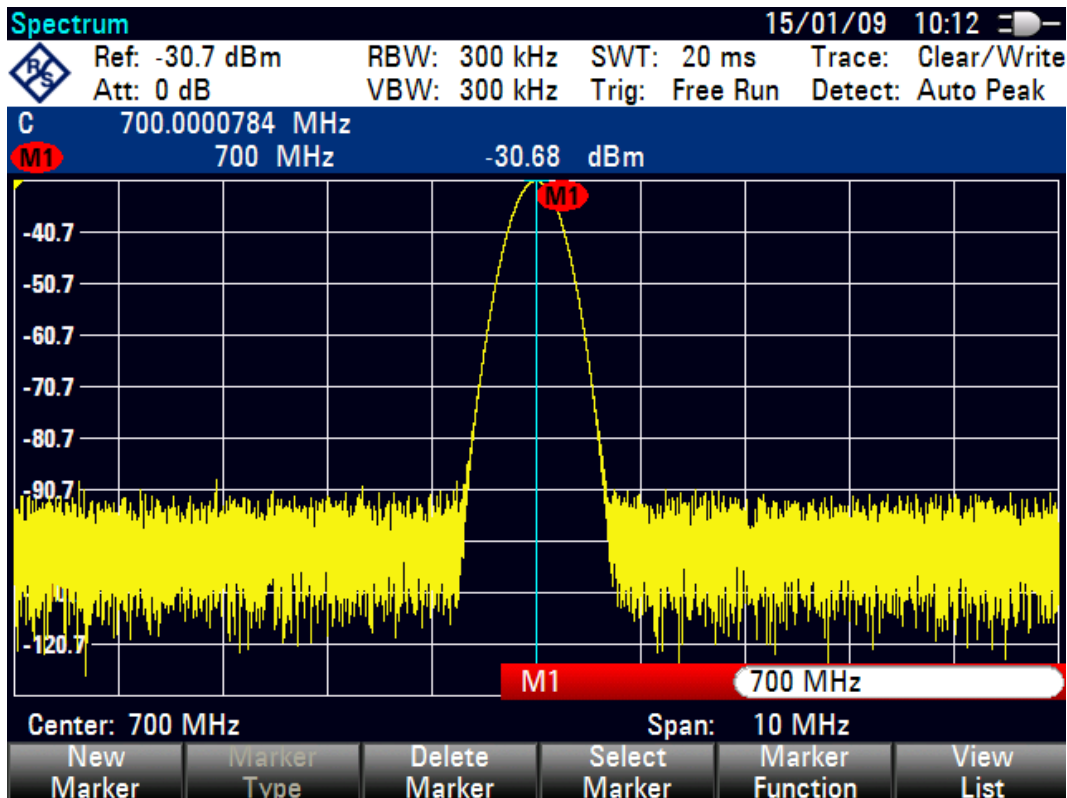
8.2.4   Harmonic Measurements of a Sinewave Signal

Since a spectrum analyzer can resolve different signals in the frequency domain, it is ideal for measuring harmonic levels or harmonic ratios. To speed up these operations, the R&S ETH has marker functions that deliver fast results with only a few keystrokes.

In the following measurement example, a signal generator with a 100 MHz output frequency and an output level of –20 dBm is used.

To show all of the operational steps required, restore the R&S ETH to its default settings.

1. Press the MODE key.

2. Press the SPECTRUM ANALYZER softkey.

3. Press the PRESET key.

    The spectrum analyzer displays the frequency spectrum from the largest available span. At 100 MHz, the generator signal is displayed as a line. The generator harmonics are also displayed as lines at frequencies that are multiples of 100 MHz.

To measure the second harmonic ratio, set the start and stop frequency as follows:

1. Press the FREQ key.

    The R&S ETH opens the frequency input menu.

2. Press the START FREQ softkey.

3. Using the numeric keypad, enter '80', and confirm the entry with the MHz key.

4. Press the STOP FREQ softkey.

5. Using the numeric keypad, enter '230', and confirm the entry with the MHz key.

    The R&S ETH now displays the spectrum from 80 MHz to 230 MHz and thus the fundamental at 100 MHz and its second harmonic at 200 MHz.

In order to improve the measurement dynamic the resolution bandwidth shall be reduced.

1. Press the BW key.

2. Press the MANUAL RBW softkey.

3. Reduce the resolution bandwidth with the rotary knob or the cursor keys until the second harmonic power is greater then the noise floor power.

To measure the harmonic ratio, set the marker on the fundamental and the delta marker on the second harmonic.

1. Press the MARKER key.

    The softkey menu opens for marker entry and automatically positions the main marker on the trace maximum (=fundamental).

2. Press the NEW MARKER softkey.

   The delta marker is activated (vertical dotted line) and automatically positioned on the next trace maximum (= second harmonic).

   The harmonic ratio is displayed at the top of the screen in dB.
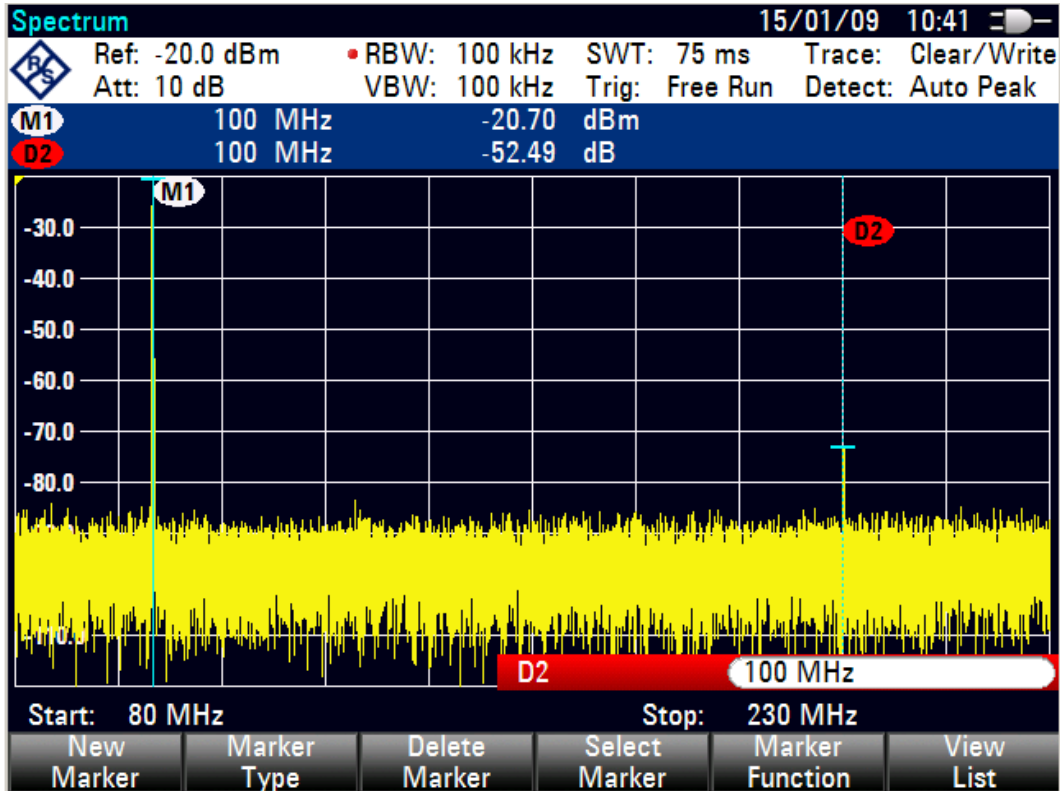
8.3 Power Measurements Using the R&S FSH-Z1 or R&S FSH-Z18 Power Sensors

For highly accurate power measurements, the R&S FSH-Z1 or R&S FSH-Z18 power sensors are available as options with the R&S ETH. They measure power in the 10 MHz to 8 GHz and 10 MHz to 18 GHz span respectively.

The power sensor is controlled and powered via a special RS-232-C interface at the top of the instrument.

Power sensor
connector

Power sensor
R&S FSH-Z1 or
R&S FSH-Z18

RF connector
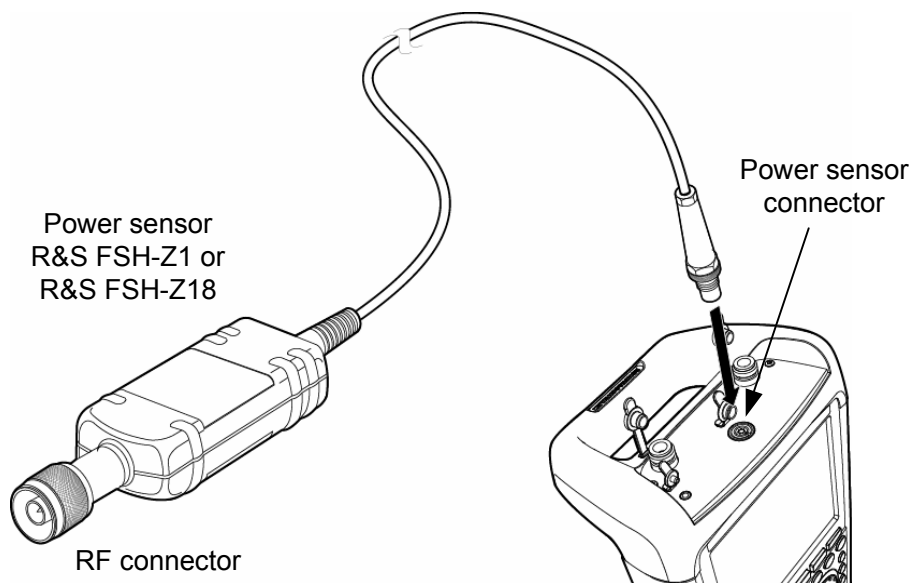
NOTICE

Continuous power applied to the power sensor's input must not exceed 400 mW (26 dBm). However, brief (≤10 µs) power peaks up to 1 W (30 dBm) are permissible. Higher input powers may damage the sensor. 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.

---

1. Connect the power sensor cable to the ACCESSORIES female on the top of the instrument and tighten it.

2. Press the MODE key.

3. Press the POWER METER softkey.

    The R&S ETH switches to power measurement mode and opens the screen for the power measurement. If a power sensor has not been connected, no measurement value is displayed. If a power sensor is connected, the R&S ETH sets up a connection via the interface and displays the measured power after a few seconds.
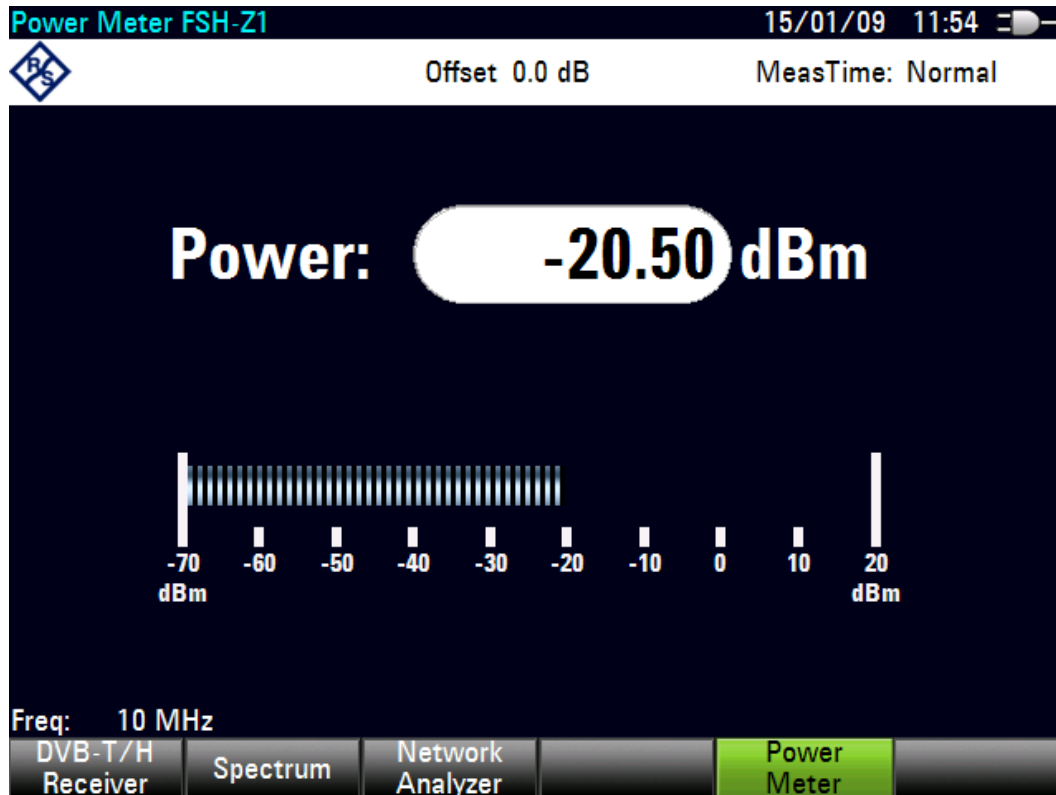
If there are any communication problems with the power sensor, the R&S ETH generates error messages (sensor error: error number, see main manual) indicating the possible causes.

To compensate for internal offset of the power sensor, a zeroing alignment needs to be performed before starting the measurement.

1. Press the MEAS key.

2. Press the ZERO softkey.

    The R&S ETH generates a message warning the user to refrain from applying signals to the power sensor while the zero alignment is performed.

3. Disconnect the power sensor from any signal sources.

4. Start the zero alignment by pressing the CONTINUE softkey.

    The R&S ETH immediately starts the power sensor zero alignment. While this process is being performed, the R&S ETH generates the message "Zeroing power sensor, please wait..."

    When the zero alignment is complete, the R&S ETH generates the message "Power Sensor Zero OK" and switches back to the power sensor softkey menu.

5. Connect the signal under test to the R&S FSH-Z1 or R&S FSH-Z18.

    The R&S ETH shows the measured power level in dBm.

For a highly accurate measurement, enter the frequency of the signal under test.

1. Press the FREQ softkey.

2. Using the numeric keys, enter the desired frequency, and confirm the entry with ENTER or by pressing the FREQ softkey again.

    The R&S ETH transfers the frequency information to the power sensor, which then adjusts the measured power readings accordingly.

8.4 Power and Return Loss Measurements with the R&S FSH-Z14 or the R&S FSH-Z44

The R&S FSH-Z14 and R&S FSH-Z44 directional power sensors are connected between the source and the load and measure the power flux in both directions, i.e. from the source to the load (forward power) and from the load to the source (reverse power). The ratio between reverse power and forward power is a measure of the load matching and is displayed as the return loss or standing wave ratio.

The R&S FSH-Z14 and the R&S FSH-Z44 have an asymmetrical design and must therefore be inserted into the test setup in such a way that the FORWARD arrow on the sensor points toward the load (in the direction of the power flux). They are controlled and powered via a special serial interface, which connects to the ACCESSORIES female on the top of the R&S ETH.
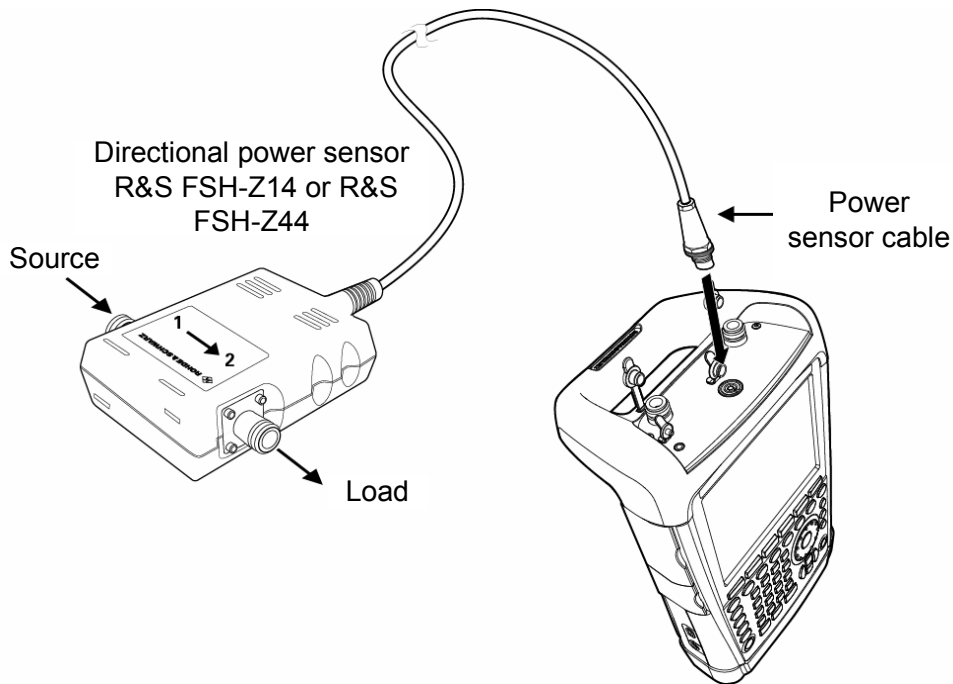
When taking measurements with high power levels, pay strict attention to the following instructions to avoid personal injury and damage to the power sensor:

⚠ **CAUTION**

Risk of skin burns

● Never exceed the permissible continuous power (see diagram on the rear of the sensor).

● Connect the sensor only when the RF power is off.

● Make sure the RF connectors are fastened tightly.

Failure to follow these rules can lead to injuries such as skin burns or it can cause damage to the instrument.

1. Connect the power sensor cable to the ACCESSORIES female on the R&S ETH and tighten it. Insert the directional power sensor between the source and the load.

2. Press the MODE key.

3. Press the POWER METER softkey.

   The R&S ETH switches to power measurement mode and opens the screen and the menu for the directional power measurement. If no power sensor is connected, no measured value is displayed. If a power sensor is connected, the R&S ETH establishes a connection to the power sensor via the interface. After a few seconds, it displays the connected power sensor type (R&S FSH-Z14 or R&S FSH-Z44) as well as the measured forward power and the reflection power.

Before performing the power measurement, zero the power sensor.

1. Press the MEAS key.

2. Press the ZERO softkey.

   The R&S ETH generates a warning not to apply any signals while the power sensor is being zeroed.

3. Disconnect the power sensor from any signal sources.

4. Start the zero alignment by pressing the CONTINUE softkey.

   The CANCEL softkey can be used to cancel zeroing before it begins, e.g. if the signal source cannot be disconnected.

   The R&S ETH immediately starts the power sensor zero alignment. While this process is being performed, the R&S ETH outputs the message "Zeroing power sensor, please wait..."

Power and Return Loss Measurements with the R&S FSH-Z14 or the R&S FSH-Z44

When the zero adjustment is complete, the R&S ETH generates the message "Power Sensor Zero OK" and switches back to the power sensor softkey menu.

5. Connect the R&S FSH-Z14 or R&S FSH-Z44 between the source and the load.

The R&S ETH displays the measured forward power and the reflected power.

The measured forward power can be displayed as absolute power in dBm or W or it can be displayed as relative power referenced to a reference power in dB. As alternative to the average power the peak envelope power is displayed.

The reflected power can be displayed as absolute power in dBm or W or the VSWR or the return loss is displayed.
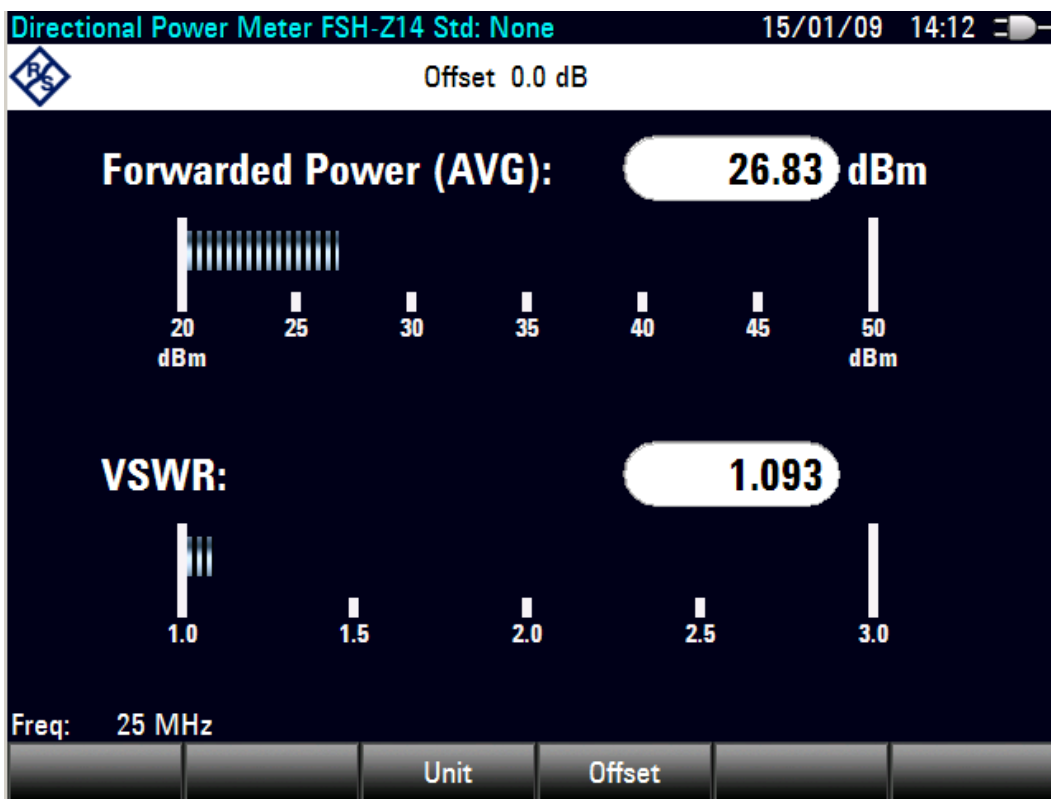
To achieve maximum measurement accuracy, enter the frequency of the signal under test.

1. Press the FREQ softkey.

The R&S ETH opens the frequency input menu.

2. Using the numeric keys, enter the desired frequency, and confirm the entry with ENTER or by pressing the FREQ softkey again.

The R&S ETH transfers the frequency information to the power sensor, which then adjusts the measured power readings accordingly.

8.5   Measurement of the Transfer Function of Two Port Networks

Only for the R&S ETH with tracking generator (Order No. 2114.1508.14 or 2114.1508.18).

For measurements of the gain or attenuation of two-port devices, the R&S ETH has a tracking generator which generates a signal that matches the current receive frequency of the R&S ETH.

1. Press the MODE key.

2. Press the NETWORK ANALYZER softkey.

    The R&S ETH changes to network analyzer mode and switches on the tracking generator. Since no calibration is performed, (UNCAL) is displayed at the top left of the screen.

The desired span, an appropriate generator level and RF input attenuator setting must be configured before performing calibration. The calibration is valid only for this particular span, generator level and RF input attenuator setting.

Setting the span

1. Press the FREQ key.

2. Enter the center frequency using the numeric keys.

3. Press the SPAN key.

4. Enter the span with the numeric keys.

    Alternatively, the start and stop frequencies can be entered using the START FREQ and STOP FREQ softkeys in the frequency menu.

Setting the generator level

1. Press the AMPT key.

2. Press the TG OUTPUT ATTENUATION softkey.

3. Enter the desired entry.

    – Enter the desired entry, and confirm with the ENTER key.
    – Use the rotary knob or the cursor keys to change the output attenuator.

    The generator level can be set from 0 dBm to -40 dBm in 1 dB steps. The TG ATTENUATOR setting of 0 dB corresponds to a generator level of 0 dBm.

Setting the RF input attenuator

1. Press the AMPT key.

2. Press the RF ATT / PRES / IMP softkey.

3. Select RF Attenuation: MANUAL: .. dB , and confirm with ENTER.

4. Enter the desired entry, and confirm with the ENTER key or

5. Using the rotary knob or the cursor keys in order to change the setting.

If there is a direct connection from the generator output to the receiver input (this corresponds to a 0 dB gain of the DUT), the sum of the generator output attenuation and the receiver attenuation must be at least 20 dB to prevent an overload of the receiver. If RF preselection is active, the sum of output and input attenuation must be at least 35 dB.

8.5.1   Scalar Transmission Measurement

The test setup must be calibrated prior to the measurement

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select SCALAR, and confirm with ENTER key or MEAS MODE Softkey.

4. Press the CALIBRATE softkey.

5. Select NORMALIZE, and confirm with ENTER key or CALIBRATE Softkey.

   The R&S ETH requests that the RF input be connected to the tracking generator output for directional calibration.
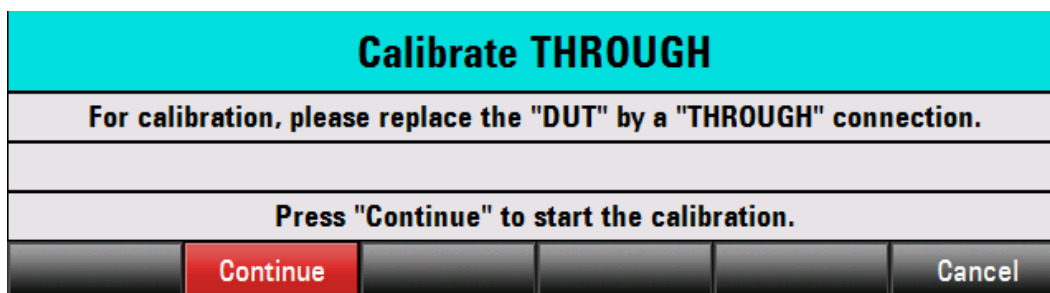
6. Connect the generator output and the RF input with a measuring cable without connecting a device under test.

7. Press CONTINUE to start the calibration.

8. After calibration is complete, the R&S ETH displays (Norm) at the top left of the screen.

9. Connect the device under test between the RF input and the generator output.

The R&S ETH displays the magnitude of the transfer function. These values can be read out with the markers for example.

The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range. In this case, the R&S ETH interpolates the correction data between the reference points of the calibration. In this case, the R&S ETH displays (APPROX) at the top left of the screen to indicate a potentially higher measurement error ratio. If the modified frequency domain lies outside the calibrated frequency range, the calibration becomes invalid and (UNCAL) is displayed at the top left of the screen.

8.5.2   Vector Transmission Measurement

Only for the R&S ETH with tracking generator (Order No. 2114.1508.14 or 2114.1508.18) and installed option R&S FSH-K42 (order no. 1304.5629.02).

The test setup must be calibrated prior to the measurement

Before the R&S ETH shall be calibrated, the desired frequency range, a suitable setting of generator level and input attenuator must be set. If they are set later, the calibration values are lost and the measurement must be recalibrated, see section 8.5.

Calibrating transmission in vector mode

1. Press the MEAS key.

2. Press the MEAS MODE softkey.

3. Select VECTOR, and confirm with the ENTER key or the MEAS MODE softkey.

4. Press the CALIBRATE softkey.

5. Select TRANSMISSION, and confirm with the ENTER key or the CALIBRATE softkey.

    To calibrate the transfer measurement, the R&S ETH requests that the RF input be connected to the tracking generator output.

6. Connect the RF input of the R&S ETH directly to the tracking generator output without the DUT.

7. Press the CONTINUE softkey to start calibration.

    The R&S ETH then requests to terminate the output of the tracking generator into 50 Ω (LOAD).

8. Connect the generator output with the 50 Ω termination.

9. Press the CONTINUE softkey.

10. When calibration is over, TRANSMISSION VECTOR (CAL) is displayed in the upper area of the screen to indicate that the R&S ETH is vector-calibrated for transmission measurement.

11. Connect the device under test between the RF input and the generator output.

In vector transmission measurement the R&S ETH offers the measurement parameters Magnitude, Phase and Group Delay.

Selecting the measurement parameter

1. Press the FORMAT softkey.

2. Select the desired format, and confirm with the ENTER key.

    The R&S ETH displays the selected transmission parameter. You can read out values with the markers, for example.

The calibration for the transmission measurement is not lost if the start, stop frequency, the center frequency and the span are subsequently changed within the calibrated frequency domain. In this case, the R&S ETH interpolates the correction data between the reference points of the calibration. In this case, the R&S ETH displays (APPROX) at top left and indicates the possibly increased measurement error. If the modified frequency domain lies outside the calibrated frequency range, the calibration becomes invalid and (UNCAL) is displayed at top left.

8.5.3   Recalling Calibration

To restore the last valid calibration, proceed as follows:

1. Press the CALIBRATE softkey in the main menu of the network analyzer.

2. Select RESTORE CALIBRATION SETTINGS with the rotary knob or the cursor keys (∧ or ∨), and confirm with the ENTER key.

   The R&S FSH restores all instrument settings which were used at the time of the last calibration. The calibration is reactivated and (CAL) is displayed at top left.

When a data record for measurement in calibrated state is saved, the R&S ETH also discards the calibration data with the remaining settings. This means that it is possible to measure without first having to recalibrate after the settings have been restored.

8.5.4   Using the Factory Calibration

To use the factory calibration, proceed as follows:

1. Press the CALIBRATE softkey in the main menu for the network analyzer.

2. Select USER CALIBRATION OFF with the rotary knob or the cursor keys (∧ or ∨) and conclude with the ENTER key or the CALIBRATE softkey.

   The R&S ETH now uses the calibration data recorded in the factory for transmission measurement. (UNCAL) is displayed at the top left of the screen.

8.6   Measuring the Reflection

For R&S ETH models with a tracking generator (order no. 2114.1508.14 or 2114.1508.18) and using of an external VSWR bridge, R&S FSH-Z2 (order no. 1145.5767.02) or R&S FSH-Z3 (order no. 1300.7756.02).

It can be used also another VSWR bridge, R&S ZRB2, for example. The R&S FSH-Z3 and R&S FSH-Z2 VSWR bridges have the advantage that the VSWR bridge does not have to be unscrewed for receiver or spectral measurements. The typical transmission loss is automatically taken into account by the R&S ETH in the level measurement. However, the accuracy of the level measurement is reduced.

The VSWR bridge R&S FSH-Z2 is specified up to 3 GHz.

The VSWR bridge R&S FSH-Z3 is specified up to 6 GHz. It also has the advantage that the VSWR bridge does not have to be unscrewed even for transmission measurements. In addition, the R&S FSH-Z3 VSWR bridge allows the external DC supply of the DUT's ports, e.g. of tower mounted amplifiers (TMAs).

The R&S FSH3-TV can display the return loss as well as the voltage standing wave ratio (VSWR) of a DUT.

Connecting the R&S FSH-Z2 or R&S FSH-Z3 VSWR bridge

1. Connect the control cable of the R&S FSH-Z2/Z3 VSWR bridge to the ACCESSORIES jack on the R&S ETH.

2. Screw the R&S FSH-Z2/Z3 VSWR bridge directly onto the RF input jack and the generator output according to the labeling on the bridge.
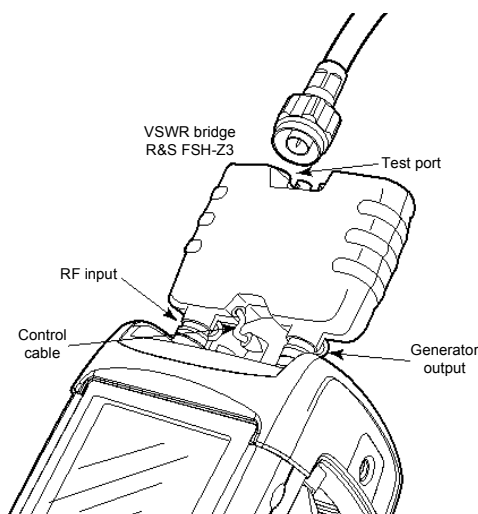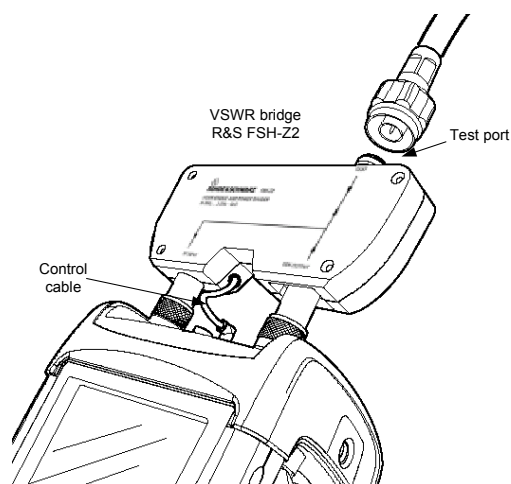
R&S ETH with VSWR bridge R&S FSH-Z3   R&S ETH with VSWR bridge R&S FSH-Z2

The R&S ETH automatically detects the connected accessory and displays the detected VSWR bridge on the screen.

3. Press the MODE key.

4. Press the NETWORK ANALYZER softkey.

   The R&S ETH changes to the network analyzer mode and switches on the tracking generator. Since no calibration is performed, (UNCAL) is displayed at top left.

8.6.1   Scalar Reflection Measurement

The following example shows a scalar measurement of return loss. If the R&S FSH-K42 option is installed, measurement must first be switched to scalar.

Before performing calibration, set the required span because calibration is valid only for the calibrated span.

1. Press the FREQ key

2. Using the numeric keys, enter the center frequency.

3. Press the SPAN key.

4. Using the numeric keys, enter the span.

   Alternatively, the start and stop frequency can be input using the START FREQ and STOP FREQ softkeys in the frequency menu.

5. Press the MEAS key.

6. Press the MEAS MODE softkey.

7. Using the rotary knob or cursor keys, select SCALAR.

8. Confirm with ENTER or the MEAS MODE softkey.

9. Press the CALIBRATE softkey in the main menu for the network analyzer.

10. Select REFLECTION with the rotary knob or the cursor keys, and confirm with ENTER.

11. Follow the instructions of the R&S ETH.

After the calibration is finished, the R&S ETH displays the "Calibration done!" message for 3 seconds.

At the top of the display, the R&S ETH displays REFLECTION SCALAR (CAL). This indicates that the R&S ETH is calibrated for scalar reflection measurements.

Performing scalar reflection measurement

► Connect the device under test to the measurement port of the bridge or the end of the measurement cable.

The R&S ETH displays the return loss of the device under test in dB.
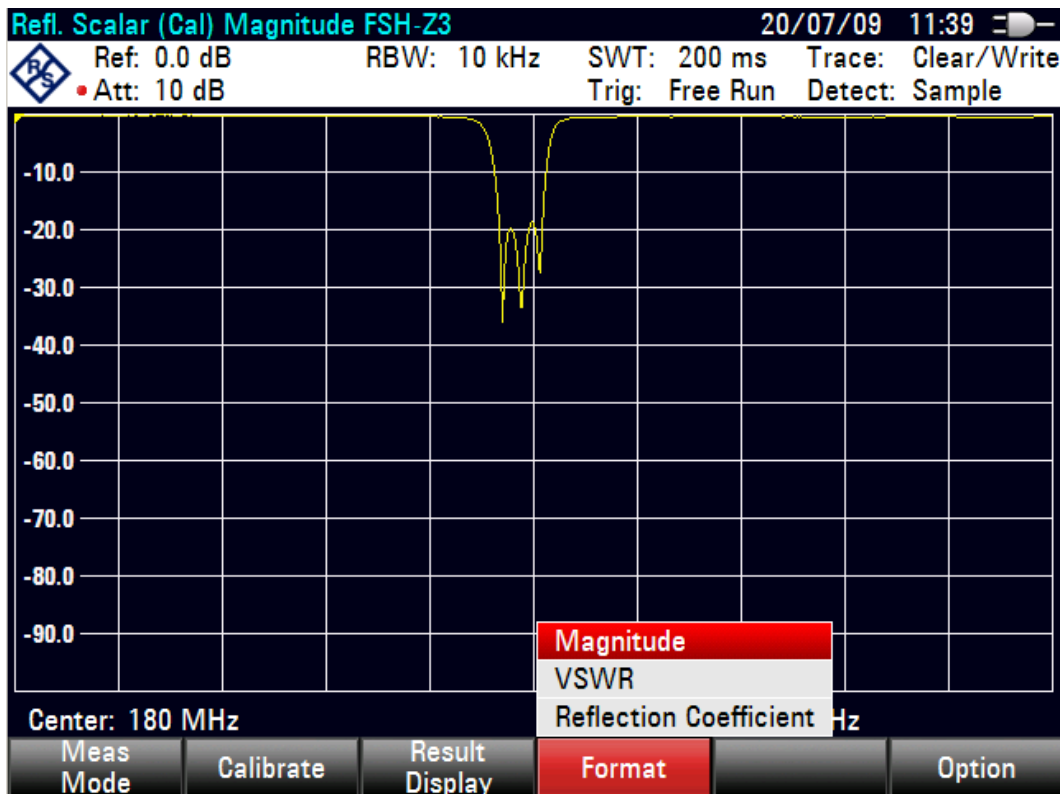
The R&S ETH additionally offers to display the reflection in Voltage Standing Wave Ratio (VSWR) or as a reflection coefficient.

Selecting the measurement parameter

1. Press the FORMAT softkey.

2. Using the rotary knob or cursor keys, select the desired format, and confirm with ENTER or the FORMAT softkey.

The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range. In this case, the R&S ETH interpolates the correction data between the reference points of the calibration. In this case, the R&S ETH displays (APPROX) at top left and indicates the possibly increased measurement error. If the modified frequency range lies outside the calibrated frequency range, the calibration becomes invalid and (UNCAL) is displayed at top left.

If the RF output attenuator setting or the RF input attenuator setting is changed after calibration the R&S ETH displays (APPROX) at top left in order to indicate the possibly increased measurement error.

> The transmission as well as the reflection can be measured using a connected R&S FSH-Z3 VSWR bridge. If the R&S FSH-Z3 is detected, the R&S ETH also offers the FULL calibration, which is performed for transmission and reflection. The R&S ETH saves the complete calibration data set. This makes it possible to measure reflection immediately after measuring transmission without having to calibrate in between.

8.6.2   Vector Reflection Measurement

For vector reflection measurements besides the VSWR bridge the option R&S FSH-K42 and a calibration standard is required, for example R&S FSH-Z28 or R&S FSH-Z29. In vector reflection measurement the R&S ETH offers the reflection parameters return loss, phase, group delay, reflection coefficient and VSWR. In addition the reflection measurement is presented in the Smith Chart diagram and a cable loss measurement is offered.

1. Press the MODE key.

2. Press the NETWORK ANALYZER softkey.

3. Press the MEAS MODE softkey.

4. Using the rotary knob or cursor keys, select VECTOR.

5. Confirm with ENTER or the MEAS MODE softkey.

   The R&S ETH changes to network analyzer mode and switches on the tracking generator. Since no calibration is performed, (UNCAL) is displayed at the top left.

Calibrating vector reflection measurement

Before performing calibration, set the required span because calibration is valid only for the calibrated span.

1. Press the FREQ key.

2. Using the numeric keys, enter the center frequency.

3. Press the SPAN key.

4. Using the numeric keys, enter the span.

    Alternatively, the start and stop frequency can be input using the START FREQ and STOP FREQ softkeys in the frequency menu.

5. Press the MEAS key.

6. Press the CALIBRATE softkey.

7. Using the rotary knob or cursor keys, select REFLECTION (OPEN, SHORT, LOAD).

    The R&S ETH displays a message requesting termination of the measurement port into an open circuit (Open).

8. Terminate the measurement port of the VSWR bridge or the end of the measurement cable into an open circuit.

9. Start open-circuit calibration by pressing CONTINUE.

    When the open-circuit calibration is done, the R&S ETH outputs a message requesting the termination of the measurement port into a short circuit (SHORT).

10. Terminate the measurement port of the bridge or the end of the measurement cable into a short circuit.

11. Start the short-circuit calibration by pressing CONTINUE.

    In the third step of calibration, terminate the measurement port into a 50 Ω termination.

12. Terminate the measurement port of the bridge or the end of the measurement cable into a 50 Ω termination (LOAD)

13. Start termination calibration by pressing CONTINUE.

    When calibration is done, the R&S ETH outputs the message "Calibration done" for three seconds. REFL. VECTOR (CAL) is displayed in the upper area of the diagram. The R&S ETH is vector-calibrated for reflection measurements.

Performing vector reflection measurement

► Connect the device under test to the measurement port of the bridge or the end of the measurement cable.

The R&S ETH displays the return loss of the device under test in dB.
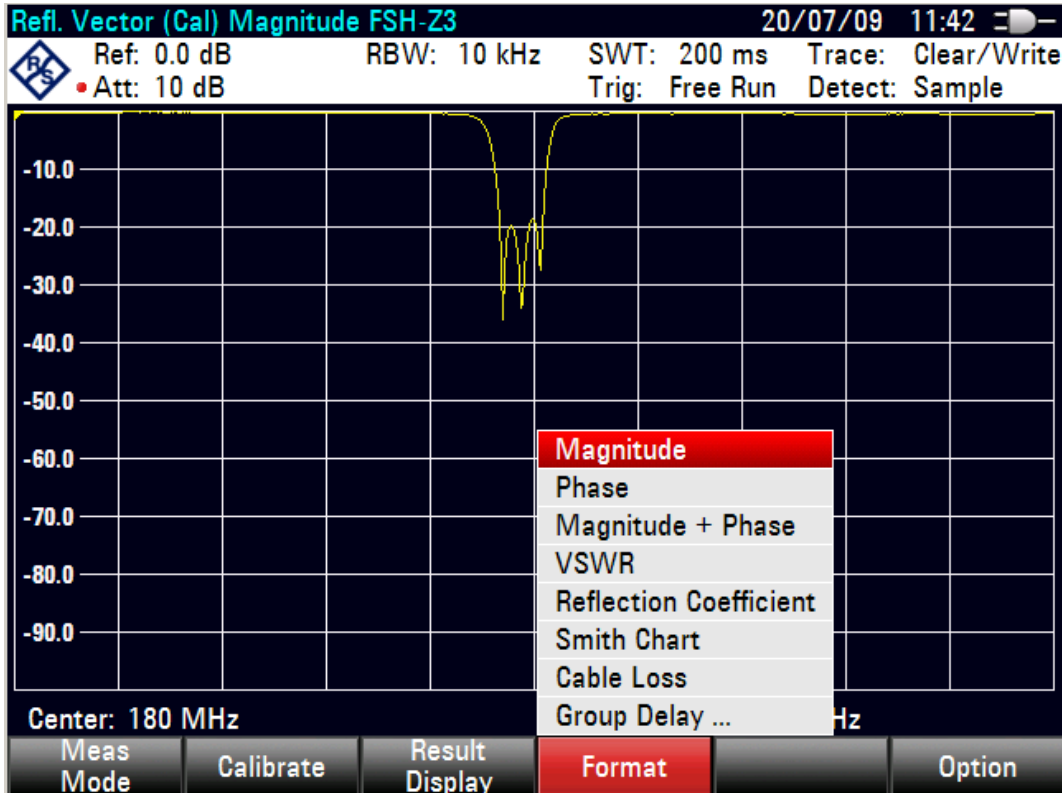
In vector reflection measurement the R&S ETH offers the reflection parameters return loss, phase, group delay, reflection coefficient and VSWR. In addition the reflection measurement is presented in the Smith Chart diagram and a cable loss measurement is offered. Proceed as follows:

1. Press the FORMAT softkey.

2. Using the rotary knob or cursor keys, select the desired format, and confirm with ENTER or the FORMAT softkey.

The calibration remains valid if the start frequency, stop frequency, center frequency and span are subsequently changed within the calibrated frequency range. In this case, the R&S ETH interpolates the correction data between the reference points of the calibration. In this case, the R&S ETH displays (APPROX) at top left and indicates the possibly increased measurement error. If the modified frequency range lies outside the calibrated frequency range, the calibration becomes invalid and (UNCAL) is displayed at top left.

If the RF output attenuator setting or the RF input attenuator setting is changed after calibration the R&S ETH displays (APPROX) at top left in order to indicate the possibly increased measurement error.

> The transmission as well as the reflection can be measured using a connected R&S FSH-Z3 VSWR bridge. If the R&S FSH-Z3 is detected, the R&S ETH also offers the FULL calibration, which is performed for transmission and reflection. The R&S ETH saves the complete calibration data set. This makes it possible to measure reflection immediately after measuring transmission without having to calibrate in between.

8.6.3   Recalling Calibration

To restore the last valid calibration, proceed as follows:

1. Press the CALIBRATE softkey in the main menu for the network analyzer.

2. Select RESTORE CALIBRATION SETTINGS with
   the rotary knob or the cursor keys, and confirm with the ENTER key or the
   CALIBRATE softkey.

   The R&S ETH restores all instrument settings which were used at the time of the last calibration. The calibration is reactivated and (CAL) is displayed at top left.

When saving a data set for a measurement in a calibrated state, the R&S ETH stores the calibration data along with the other settings. Thus, after the setting is recalled, a measurement can be performed without prior calibration.

8.7   Measuring Cable Faults

For R&S ETH models with a tracking generator (order no. 2114.1508.14 or 2114.1508.18), using of an external VSWR bridge, R&S FSH-Z2 (order no. 1145.5767.02) or R&S FSH-Z3 (order no. 1300.7756.02) and installed option R&S FSH-K41 (Distance to Fault measurement).

The R&S FSH-Z20 spare RF cable and the spare R&S FSH-Z28 (0 GHz to 8 GHz) or R&S FSH-Z29 (0 GHz to 3.6 GHz) calibration standard are also required.

It can be used also another VSWR bridge, R&S ZRB2, for example. The R&S FSH-Z3 and R&S FSH-Z2 VSWR bridges have the advantage that the VSWR bridge does not have to be unscrewed for receiver or spectral measurements. The typical transmission loss is taken into account by the R&S ETH in the level measurement. However, the accuracy of the level measurement is reduced.

Test setup

1. Connect the control cable of the VSWR bridge R&S FSH-Z2/Z3 to the connector ACCESSORIES of the R&S ETH.

2. Screw the R&S FSH-Z2/Z3 VSWR bridge directly onto the RF input jack and the generator output according to the labeling on the bridge.

3. Connect the RF test cable supplied with option R&S FSH-Z20 to the test port of the VSWR bridge.

> The 1 m long RF test cable must be used. Results are invalid without this cable.
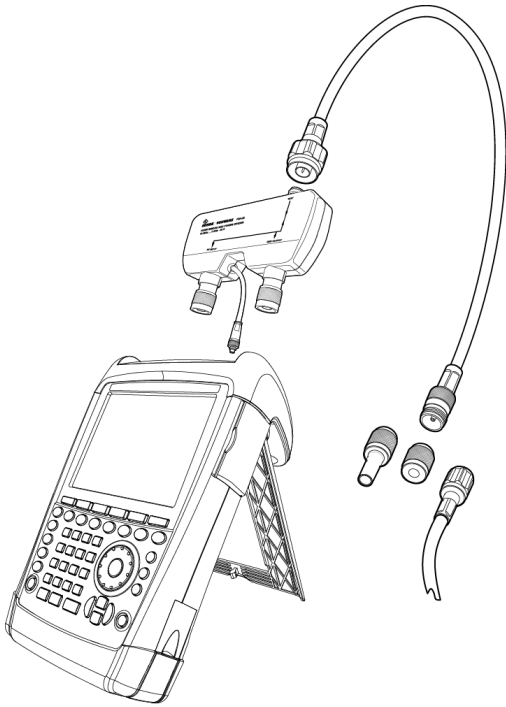
R&S ETH with VSWR bridge and
RF test cable R&S FSH-Z20

Performing the measurement

1. Press the MODE key.

2. Press the DISTANCE TO FAULT softkey.

3. Press the MEAS MODE softkey.

4. Select DTF, and confirm with ENTER key or the MEAS MODE softkey.

   The R&S ETH switches on the distance-to-fault measurement function.

The R&S ETH delivers optimum results if the center frequency is set to the frequency at which the device under test is operated.

1. Press the FREQ key.

2. Input the center frequency (CENTER).

To perform distance-to-fault cable measurement, the R&S ETH needs to be informed about the type of cable and its approximate length. Frequency-dependent cable models can be generated with the supplied R&S ETH VIEW software for Windows and loaded onto the R&S ETH. The procedure is described in the R&S ETH VIEW manual.

Selecting a cable model from the list

1. Press the MEAS key.

2. Press the CABLE MODEL softkey.

   The R&S ETH displays the list of loaded cable models.

3. Select the desired cable model with the rotary knob or the cursor keys.

4. Using the SELECT softkey, activate the cable model you have selected.

   The R&S ETH displays the cable used for the measurement in the upper left-hand corner of the screen.

The R&S ETH uses the cable length to determine the optimal span for the measurement and for scaling the x axis in DTF mode. For best results, the cable should be specified 20 % to 50 % longer than the actual cable length.

1. Press the CABLE LENGTH softkey.

   The R&S ETH opens the cable length value entry box and displays the current length setting.

2. Using the numeric keys, enter the cable length in meters and terminate the entry with the ENTER key or one of the unit keys or adjust the cable length using the rotary knob for 1 m steps or the cursor keys (∧ or ∨) for 10 m steps.

   The minimum cable length is 0 m. The maximum cable length that can be set is 1500 m.

Calibrating the test setup

> The reference plane must be the output of the 1 m measurement cable; i.e. the measurement cable may not be dispensed with. If the output of the VSWR bridge is used as the reference plane, the DTF results are useless.

1. Press the CALIBRATE softkey.

2. Select the CALIBRATE menu item with the rotary knob or the cursor keys (∧ or ∨), and confirm the selection with the ENTER key or the CALIBRATE softkey.

   The R&S ETH opens a text window that prompts you to terminate the measurement cable with a SHORT.

3. Follow the instructions of the R&S ETH.

   When calibration is over, the R&S ETH displays DTF (CAL) in the top left-hand corner of the screen.

> The R&S ETH performs calibration over its entire span. It is thus not necessary to perform a new calibration following a change of frequency range or cable length. The calibration data is stored in the R&S ETH memory. Thus, the calibration is valid after the operating mode is changed or after the instrument is switched off.

4. Screw the cable under test to the measurement cable.

   The R&S ETH displays the return loss produced in the cable under test versus the distance.

Checking the spectrum in the span for detecting external interferers

1. Press the MEAS MODE softkey.

2. Select SPECTRUM using the rotary knob or the cursor keys (∧ or ∨).

3. Confirm your selection by pressing the MEAS MODE softkey again or by pressing the ENTER key.

   The R&S ETH turns off the tracking generator and displays the spectrum over the span of the DTF measurement. To indicate that the R&S ETH is in the spectrum mode, DTF SPECTRUM is displayed in the upper left-hand corner of the screen. Otherwise, the R&S ETH uses exactly the same settings as it did for DTF measurements.

Measuring impedance matching in DTF mode

Apart from the DTF measurement, the R&S ETH offers the option of also determining the cable impedance matching as a function of the frequency. For this purpose, the R&S ETH must be calibrated with three calibration standards (short-circuit, open circuit and 50 Ω match). Proceed as follows:

1. Press the MEAS MODE softkey.

2. Select DTF with the rotary knob or the cursor key (∧ or ∨), and confirm the selection with the ENTER key or the MEAS MODE softkey.

3. Press the CALIBRATE softkey.

4. Select the DTF + REFLECTION menu item with the rotary knob or the cursor key (∧ or ∨), and confirm the selection with the ENTER key or the CALIBRATE softkey.

   The R&S ETH opens a text box in which it requests the matching of the measuring cable with a short circuit (Short), an open circuit (Open) and 50 Ω match (Load) consecutively.

5. Firmly screw on the required calibration standards to the output of the measuring cable one after the other and start the calibration for each with the CONTINUE softkey.

   After calibration is finished, the R&S ETH displays DTF (CAL) at the top of the screen.

6. Press the MEAS MODE softkey.

7. Select REFLECTION with the rotary knob or the cursor keys (∧ or ∨).

8. Confirm the selection by pressing the MEAS MODE softkey again or by pressing the ENTER key.

   With the REFLECTION setting, the R&S ETH changes from the DTF measurement to measuring the impedance matching and displays this via the frequency.

As an indication that the R&S ETH is working in reflection display mode, it displays DTF REFLECTION at the top of the screen. Otherwise, the R&S ETH uses exactly the same settings as it did for DTF measurements.

8.8   Saving and Recalling Settings and Test Results

The R&S ETH can store measurement results and settings in the internal memory or on a removable SD memory card or USB stick. Results and settings are always stored together, allowing them to be interpreted in context when recalled. The R&S ETH can store at least 100 data records with unique names in the internal memory.

A removable SD card can be used for memory expansion or for data transfer to a PC without a direct LAN or USB connection. The SD memory card (e.g. R&S HA-Z231, Order No. 1309.6217.00) is inserted into the SD card slot on the right side of the R&S ETH until it clicks into place. To remove the SD card, first release it by pressing it in and then pull it out (do not attempt to remove it before releasing it).

The R&S ETH can store measurement results and settings also on a removable USB stick. Please connect the USB stick via the supplied USB adapter with the USB interface for that.

8.8.1   Saving Measurement Results

1. Press the SAVE / RECALL key.

2. Press the SAVE softkey.

   The R&S ETH opens the file manager.

3. Using the rotary knob or the cursor keys ($\wedge$ or $\vee$) and the ENTER key in order to change to the internal memory or to navigate to the desired directory of the desired mass storage media.

4. Press the SAVE softkey.

Stat	Name	Size	Date	Time
🖙	\Public\.			
🖙	\Storage Card			
🖙	\USB			
	Dataset000.set	39 kB	18/12/2008	13:46
	Dataset001.set	40 kB	19/01/2009	12:52
	Dataset002.set	40 kB	19/01/2009	12:53
	Dataset003.set	40 kB	19/01/2009	12:53
	Dataset004.set	40 kB	19/01/2009	12:53
	Dataset005.set	40 kB	19/01/2009	12:53
	Dataset006.set	40 kB	19/01/2009	12:53

Save Dataset 19/01/09 12:53

Save as: Dataset007.set   Free: 15 MB

| Save | | Sort / Show | Delete | Refresh | Exit |

The R&S ETH opens a dialogue box and prompts the user to enter a name for the data record. The name of the most recently stored data record, plus a numeric extension incremented by one, is displayed in the dialogue box (white background). The data record can be saved under the suggested name by pressing ENTER or by simply pressing the SAVE softkey a second time.

An existing data record can be selected from the list using the rotary knob or the cursor keys (∧ or ∨).This data record is transferred to the input field by pressing ENTER. It can then be overwritten with the current data record or saved under a different name. A new name can be entered with the numeric keypad. The letter assignment for the keypad is the same as that for a mobile phone. Enter the letter by pressing the corresponding key until the desired letter appears.

The number of free memory locations (FREE) is also displayed at the bottom right of the text field.

5. Enter a name for the data record using the numeric keypad.

6. Confirm with ENTER.

The data record is saved under the name specified in the internal R&S ETH CMOS RAM or on the SD memory card or on the USB stick.

The name of an existing data record can be edited with the cursor keys. This eliminates the need to enter the full name of a new data record.

1. Using the rotary knob or the cursor keys (∧ or ∨) and the ENTER key in order to navigate to the file of the desired directory.

2. Press the SAVE Softkey or the ENTER key.

   The R&S ETH suggests a name for the data record to be saved based on the name of the existing data set.

Save as:	Dataset007.set				Free: 15 MB
Save		Sort / Show	Delete	Refresh	Exit

3. Press a cursor key (< or >).

   A vertical cursor is positioned at the end of the name of the data record.

   Use the < key to move the cursor to the left.

   Use the > key to move the cursor to the right.

4. Insert a new letter or number at the cursor position using the alphanumeric keypad.

5. Press the BACK key to delete the letter or digit to the left of the cursor.

6. Press the SAVE Softkey or the ENTER key for saving the data set.

8.8.2   Recalling Measurement Results

Use the R&S ETH RECALL function to review previously saved measurement results and settings.

1. Press the SAVE/RECALL key.

2. Press the RECALL softkey.

   The R&S ETH opens the file manager.

3. Using the rotary knob or the cursor keys (∧ or ∨) and the ENTER key in order to navigate to the desired directory.

4. Using the rotary knob or the cursor keys (∧ or ∨) in order to select a dataset (*.SET).

Stat	Name	Size	Date	Time
◄□	\Public\Datasets\..			
🗃	\Public			
	DVB-T Const.set	**311 kB**	**10/09/2010**	**14:54**
	DVB-T MER.set	**307 kB**	**10/09/2010**	**14:53**
	ISDB-T MER.set	**307 kB**	**10/09/2010**	**14:49**

Recall Dataset — 10/09/10 14:58 — Free: 14 MB

View | Recall | Sort / Show | Delete | Refresh | Exit

5. Press the VIEW Softkey.

The R&S ETH graphically displays the content of the selected data record on the screen without adopting its settings in the device. This provides the option of visually inspecting the data record before its settings are adopted.

The name of the data record appears at the top left of the screen edge. By using the softkeys ◄PREV or NEXT►, you can scroll through the stored data records in this directory.

6. Pressing the RECALL softkey recalls the settings of the selected dataset.

8.9   GPS Receiver

GPS antenna function requires GPS receiver R&S HA-Z240, order no. 1309.6700.02.

The GPS function offers the following possibilities:

1. Locate and display your exact position.

2. The accurate 1 pps pulse of the GPS receiver is applied for correction of all frequency measurement values (Carrier Offset, Symbol Rate Offset, TS Bitrate, Frequency Count Marker). This follows in an improved frequency measurement accuracy.

The reference frequency is automatically adjusted as soon as the GPS receiver function is enabled and there is a fix connection with enough satellites.

The frequency accuracy increases with the fixed connection time to the GPS satellites.

8.9.1   Enabling the GPS Receiver

The GPS receiver function is set in the INSTRUMENT SETUP menu.

1. Press the SETUP key.

2. Press the Softkey INSTRUMENT SETUP softkey.

   The R&S ETH opens a list of general settings.

Instrument Setup		
GPS	Enabled	
Show GPS Information	Disabled	
Coordinate Format	Enabled	
GPS Receiver Connected	Yes	
Position Fix	Valid	
Number of Tracked Satellites	4	
Signal Quality	Medium	

3. Select GPS FUNCTION from the list using the rotary knob or the cursor keys (∧ or ∨), and confirm with ENTER.

4. Select ENABLED, and confirm with ENTER.

8.9.2   Selecting the GPS Coordinate Format

1. Press the SETUP key.

2. Press the Softkey INSTRUMENT SETUP softkey.

3. Select COORDINATE FORMAT from the list using the rotary knob or the cursor keys
    (∧ or ∨), and confirm with ENTER.

4. Select ENABLED, and confirm with ENTER.

8.9.3   Displaying the GPS Information

1. Press the SETUP key.

2. Press the Softkey INSTRUMENT SETUP softkey.

3. Select SHOW GPS INFORMATION from the list using the rotary knob or the cursor
    keys (∧ or ∨), and confirm with ENTER.

4. Select ENABLED, and confirm with ENTER.

When the GPS receiver (HA-Z240, order no. 1309.6700.02) is connected to the AUX
connector on the left side of the R&S ETH and there is a fix connection with enough
satellites, the position is displayed.

Position: Latitude 048° 15' 21.696" N   Longitude 012° 27' 40.266" E

The state of satellite lock is indicated in the title bar of the display. In case of a fix
connection with enough satellites **GPS** is displayed.

> When the satellite lock is lost, the bar turns red and the GPS coordination is in
> brackets. The last position, however is still shown in brackets.
>
> [Position: Latitude 048° 15' 21.924" N   Longitude 012° 27' 40.230" E]
>
> In the title bar of the display **[GPS]** is displayed.

> When the GPS Receiver Function is enabled and there is no GPS receiver
> connected (or the GPS receiver is defective), this symbol is shown: **[GPS]** and
> the GPS information bar is red.

If the R&S ETH is booted with GPS enabled and GPS receiver connected, you are questioned whether to restore the GPS information (latitude, longitude and frequency correction factor) of the device from just before it was shut down, or to erase this data and start with unknown position and correction factor.