

# R&S®ETC

## Compact TV Analyzer

### User Manual

### Volume 1 of 1



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The User Manual describes the following R&S®ETC models and options:

- R&S® ETC 04 (2116.5000.04)
- R&S® ETC 08 (2116.5000.08)

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The following abbreviations are used throughout this manual:

R&S®ETC is abbreviated as R&S ETC

# 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 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 purpose 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, in some cases, 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. For product-specific information, see the data sheet and the product documentation.

## Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation		ON/OFF Power
	Caution when handling heavy equipment		Standby indication
	Danger of electric shock		Direct current (DC)

## Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth		Direct/alternating current (DC/AC)
	Earth (Ground)		Class II Equipment to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)
	Frame or chassis Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

### Signal words and their meaning

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



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



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



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



Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.

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

These signal words 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 signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words 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, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of  $\pm 10\%$  shall apply to the nominal voltage and  $\pm 5\%$  to the nominal frequency, overvoltage category 2, pollution degree 2.
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 even 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 even death.

### Electrical safety

*If the information on electrical safety is not observed either at all or 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 mains-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 a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor 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 there is no power switch for disconnecting the product from the mains, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the mains. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 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, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

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6. The product may be operated only from TN/TT supply networks fuse-protected 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 provided for this purpose. 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, fuse protection, 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 IEC 60950-1 / EN 60950-1 or IEC 61010-1 / 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.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective 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 fuse-protected 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.

## Basic Safety Instructions

2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", 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. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. 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).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
  - Class A equipment:  
Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings  
Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
  - Class B equipment:  
Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

### 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.

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- 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, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

### Batteries and rechargeable batteries/cells

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

- Cells must not be taken apart or crushed.
- 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.
- 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.
- Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
- 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.
- 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.
- 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

- 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.
- 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.
- 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/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.  
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. 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.
4. 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.

For additional information about environmental protection, visit the Rohde & Schwarz website.

## Instrucciones de seguridad elementales

¡Es imprescindible leer y cumplir 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 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.

## Instrucciones de seguridad elementales

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.

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. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

### Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

## Instrucciones de seguridad elementales

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos  Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser  Más información en la sección "Funcionamiento", punto 7.		

### 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.



Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.



Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.

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.*

## Instrucciones de seguridad elementales

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, 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  $\pm 10\%$  sobre el voltaje nominal y de  $\pm 5\%$  sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, Índice de suciedad 2.
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, se pueden causar lesiones o, en determinadas circunstancias, 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.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor 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.

## Instrucciones de seguridad elementales

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  $U_{\text{eff}} > 30 \text{ V}$  se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
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".
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/protección del medio ambiente", 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. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. 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).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
  - Aparato de clase A:  
Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.  
Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
  - Aparato de clase B:  
Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

### 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. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. 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.
6. 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).
7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

### Transporte

1. 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.

## Instrucciones de seguridad elementales

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/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.  
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, dirijase a su servicio de atención al cliente de Rohde & Schwarz.
3. 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.
4. 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.

Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

# Grundlegende Sicherheitshinweise

Lesen und beachten Sie unbedingt die nachfolgenden Anweisungen und Sicherheitshinweise!

Alle Werke und Standorte der Rohde & Schwarz Firmengruppe sind ständig bemüht, den Sicherheitsstandard unserer Produkte auf dem aktuellsten Stand zu halten und unseren Kunden ein höchstmögliches Maß an Sicherheit zu bieten. Unsere Produkte und die dafür erforderlichen Zusatzgeräte werden entsprechend der jeweils gültigen Sicherheitsvorschriften gebaut und geprüft. Die Einhaltung dieser Bestimmungen wird durch unser Qualitätssicherungssystem laufend überwacht. Das vorliegende Produkt ist gemäß beiliegender EU-Konformitätsbescheinigung gebaut und geprüft und hat das Werk in sicherheitstechnisch einwandfreiem Zustand verlassen. Um diesen Zustand zu erhalten und einen gefahrlosen Betrieb sicherzustellen, muss der Benutzer alle Hinweise, Warnhinweise und Warnvermerke beachten. Bei allen Fragen bezüglich vorliegender Sicherheitshinweise steht Ihnen die Rohde & Schwarz Firmengruppe jederzeit gerne zur Verfügung.

Darüber hinaus liegt es in der Verantwortung des Benutzers, das Produkt in geeigneter Weise zu verwenden. Das Produkt ist ausschließlich für den Betrieb in Industrie und Labor bzw., wenn ausdrücklich zugelassen, auch für den Feldeinsatz bestimmt und darf in keiner Weise so verwendet werden, dass einer Person/Sache Schaden zugefügt werden kann. Die Benutzung des Produkts außerhalb des bestimmungsgemäßen Gebrauchs oder unter Missachtung der Anweisungen des Herstellers liegt in der Verantwortung des Benutzers. Der Hersteller übernimmt keine Verantwortung für die Zweckentfremdung des Produkts.

Die bestimmungsgemäße Verwendung des Produkts wird angenommen, wenn das Produkt nach den Vorgaben der zugehörigen Produktdokumentation innerhalb seiner Leistungsgrenzen verwendet wird (siehe Datenblatt, Dokumentation, nachfolgende Sicherheitshinweise). Die Benutzung des Produkts erfordert Fachkenntnisse und zum Teil englische Sprachkenntnisse. Es ist daher zu beachten, dass das Produkt ausschließlich von Fachkräften oder sorgfältig eingewiesenen Personen mit entsprechenden Fähigkeiten bedient werden darf. Sollte für die Verwendung von Rohde & Schwarz-Produkten persönliche Schutzausrüstung erforderlich sein, wird in der Produktdokumentation an entsprechender Stelle darauf hingewiesen. Bewahren Sie die grundlegenden Sicherheitshinweise und die Produktdokumentation gut auf und geben Sie diese an weitere Benutzer des Produkts weiter.

Die Einhaltung der Sicherheitshinweise dient dazu, Verletzungen oder Schäden durch Gefahren aller Art auszuschließen. Hierzu ist es erforderlich, dass die nachstehenden Sicherheitshinweise vor der Benutzung des Produkts sorgfältig gelesen und verstanden sowie bei der Benutzung des Produkts beachtet werden. Sämtliche weitere Sicherheitshinweise wie z.B. zum Personenschutz, die an entsprechender Stelle der Produktdokumentation stehen, sind ebenfalls unbedingt zu beachten. In den vorliegenden Sicherheitshinweisen sind sämtliche von der Rohde & Schwarz Firmengruppe vertriebenen Waren unter dem Begriff „Produkt“ zusammengefasst, hierzu zählen u. a. Geräte, Anlagen sowie sämtliches Zubehör.

## Grundlegende Sicherheitshinweise

### Symbole und Sicherheitskennzeichnungen

Symbol	Bedeutung	Symbol	Bedeutung
	Achtung, allgemeine Gefahrenstelle Produktdokumentation beachten		EIN-/AUS (Versorgung)
	Vorsicht beim Umgang mit Geräten mit hohem Gewicht		Stand-by-Anzeige
	Gefahr vor elektrischem Schlag		Gleichstrom (DC)
	Warnung vor heißer Oberfläche		Wechselstrom (AC)
	Schutzleiteranschluss		Gleichstrom/Wechselstrom (DC/AC)
	Erdungsanschluss		Gerät entspricht den Sicherheitsanforderungen an die Schutzklasse II (Gerät durchgehend durch doppelte / verstärkte Isolierung geschützt).
	Masseanschluss des Gestells oder Gehäuses		EU - Kennzeichnung für Batterien und Akkumulatoren.  Das Gerät enthält eine Batterie bzw. einen Akkumulator. Diese dürfen nicht über unsortierten Siedlungsabfall entsorgt werden, sondern sollten getrennt gesammelt werden.  Weitere Informationen siehe Seite 7.
	Achtung beim Umgang mit elektrostatisch gefährdeten Bauelementen		EU - Kennzeichnung für die getrennte Sammlung von Elektro- und Elektronikgeräten.  Elektroaltgeräte dürfen nicht über unsortierten Siedlungsabfall entsorgt werden, sondern müssen getrennt gesammelt werden.  Weitere Informationen siehe Seite 7.
	Warnung vor Laserstrahl Produkte mit Laser sind je nach ihrer <a href="#">Laser-Klasse</a> mit genormten Warnhinweisen versehen. Laser können aufgrund der Eigenschaften ihrer Strahlung und aufgrund ihrer extrem konzentrierten elektromagnetischen Leistung biologische Schäden verursachen.  Für zusätzliche Informationen siehe Kapitel „Betrieb“ Punkt 7.		

### Signalworte und ihre Bedeutung

Die folgenden Signalworte werden in der Produktdokumentation verwendet, um vor Risiken und Gefahren zu warnen.



kennzeichnet eine unmittelbare Gefährdung mit hohem Risiko, die Tod oder schwere Körperverletzung zur Folge haben wird, wenn sie nicht vermieden wird.



kennzeichnet eine mögliche Gefährdung mit mittlerem Risiko, die Tod oder (schwere) Körperverletzung zur Folge haben kann, wenn sie nicht vermieden wird.



kennzeichnet eine Gefährdung mit geringem Risiko, die leichte oder mittlere Körperverletzungen zur Folge haben könnte, wenn sie nicht vermieden wird.



weist auf die Möglichkeit einer Fehlbedienung hin, bei der das Produkt Schaden nehmen kann.

Diese Signalworte entsprechen der im europäischen Wirtschaftsraum üblichen Definition für zivile Anwendungen. Neben dieser Definition können in anderen Wirtschaftsräumen oder bei militärischen Anwendungen abweichende Definitionen existieren. Es ist daher darauf zu achten, dass die hier beschriebenen Signalworte stets nur in Verbindung mit der zugehörigen Produktdokumentation und nur in Verbindung mit dem zugehörigen Produkt verwendet werden. Die Verwendung von Signalworten in Zusammenhang mit nicht zugehörigen Produkten oder nicht zugehörigen Dokumentationen kann zu Fehlinterpretationen führen und damit zu Personen- oder Sachschäden führen.

### Betriebszustände und Betriebslagen

*Das Produkt darf nur in den vom Hersteller angegebenen Betriebszuständen und Betriebslagen ohne Behinderung der Belüftung betrieben werden. Werden die Herstellerangaben nicht eingehalten, kann dies elektrischen Schlag, Brand und/oder schwere Verletzungen von Personen, unter Umständen mit Todesfolge, verursachen. Bei allen Arbeiten sind die örtlichen bzw. landesspezifischen Sicherheits- und Unfallverhütungsvorschriften zu beachten.*

1. Sofern nicht anders vereinbart, gilt für R&S-Produkte folgendes:  
als vorgeschriebene Betriebslage grundsätzlich Gehäuseboden unten, IP-Schutzart 2X, Verschmutzungsgrad 2, Überspannungskategorie 2, nur in Innenräumen verwenden, Betrieb bis 2000 m ü. NN, Transport bis 4500 m ü. NN, für die Nennspannung gilt eine Toleranz von  $\pm 10\%$ , für die Nennfrequenz eine Toleranz von  $\pm 5\%$ .
2. Stellen Sie das Produkt nicht auf Oberflächen, Fahrzeuge, Ablagen oder Tische, die aus Gewichts- oder Stabilitätsgründen nicht dafür geeignet sind. Folgen Sie bei Aufbau und Befestigung des Produkts an Gegenständen oder Strukturen (z.B. Wände und Regale) immer den Installationshinweisen des Herstellers. Bei Installation abweichend von der Produktdokumentation können Personen verletzt, unter Umständen sogar getötet werden.
3. Stellen Sie das Produkt nicht auf hitzeerzeugende Gerätschaften (z.B. Radiatoren und Heizlüfter). Die Umgebungstemperatur darf nicht die in der Produktdokumentation oder im Datenblatt spezifizierte Maximaltemperatur überschreiten. Eine Überhitzung des Produkts kann elektrischen Schlag, Brand und/oder schwere Verletzungen von Personen, unter Umständen mit Todesfolge, verursachen.

### Elektrische Sicherheit

*Werden die Hinweise zur elektrischen Sicherheit nicht oder unzureichend beachtet, kann dies elektrischen Schlag, Brand und/oder schwere Verletzungen von Personen, unter Umständen mit Todesfolge, verursachen.*

1. Vor jedem Einschalten des Produkts ist sicherzustellen, dass die am Produkt eingestellte Nennspannung und die Netzennspannung des Versorgungsnetzes übereinstimmen. Ist es erforderlich, die Spannungseinstellung zu ändern, so muss ggf. auch die dazu gehörige Netzsicherung des Produkts geändert werden.
2. Bei Produkten der Schutzklasse I mit beweglicher Netzzuleitung und Gerätesteckvorrichtung ist der Betrieb nur an Steckdosen mit Schutzkontakt und angeschlossenem Schutzleiter zulässig.
3. Jegliche absichtliche Unterbrechung des Schutzleiters, sowohl in der Zuleitung als auch am Produkt selbst, ist unzulässig. Es kann dazu führen, dass von dem Produkt die Gefahr eines elektrischen Schlags ausgeht. Bei Verwendung von Verlängerungsleitungen oder Steckdosenleisten ist sicherzustellen, dass diese regelmäßig auf ihren sicherheitstechnischen Zustand überprüft werden.
4. Sofern das Produkt nicht mit einem Netzschalter zur Netztrennung ausgerüstet ist, beziehungsweise der vorhandene Netzschalter zu Netztrennung nicht geeignet ist, so ist der Stecker des Anschlusskabels als Trennvorrichtung anzusehen.  
Die Trennvorrichtung muss jederzeit leicht erreichbar und gut zugänglich sein. Ist z.B. der Netzstecker die Trennvorrichtung, darf die Länge des Anschlusskabels 3 m nicht überschreiten.  
Funktionsschalter oder elektronische Schalter sind zur Netztrennung nicht geeignet. Werden Produkte ohne Netzschalter in Gestelle oder Anlagen integriert, so ist die Trennvorrichtung auf Anlagenebene zu verlagern.
5. Benutzen Sie das Produkt niemals, wenn das Netzkabel beschädigt ist. Überprüfen Sie regelmäßig den einwandfreien Zustand der Netzkabel. Stellen Sie durch geeignete Schutzmaßnahmen und Verlegearten sicher, dass das Netzkabel nicht beschädigt werden kann und niemand z.B. durch Stolperfallen oder elektrischen Schlag zu Schaden kommen kann.
6. Der Betrieb ist nur an TN/TT Versorgungsnetzen gestattet, die mit höchstens 16 A abgesichert sind (höhere Absicherung nur nach Rücksprache mit der Rohde & Schwarz Firmengruppe).
7. Stecken Sie den Stecker nicht in verstaubte oder verschmutzte Steckdosen/-buchsen. Stecken Sie die Steckverbindung/-vorrichtung fest und vollständig in die dafür vorgesehenen Steckdosen/-buchsen. Missachtung dieser Maßnahmen kann zu Funken, Feuer und/oder Verletzungen führen.
8. Überlasten Sie keine Steckdosen, Verlängerungskabel oder Steckdosenleisten, dies kann Feuer oder elektrische Schläge verursachen.
9. Bei Messungen in Stromkreisen mit Spannungen  $U_{\text{eff}} > 30 \text{ V}$  ist mit geeigneten Maßnahmen Vorsorge zu treffen, dass jegliche Gefährdung ausgeschlossen wird (z.B. geeignete Messmittel, Absicherung, Strombegrenzung, Schutztrennung, Isolierung usw.).
10. Bei Verbindungen mit informationstechnischen Geräten, z.B. PC oder Industrierechner, ist darauf zu achten, dass diese der jeweils gültigen IEC 60950-1 / EN 60950-1 oder IEC 61010-1 / EN 61010-1 entsprechen.
11. Sofern nicht ausdrücklich erlaubt, darf der Deckel oder ein Teil des Gehäuses niemals entfernt werden, wenn das Produkt betrieben wird. Dies macht elektrische Leitungen und Komponenten zugänglich und kann zu Verletzungen, Feuer oder Schaden am Produkt führen.

## Grundlegende Sicherheitshinweise

12. Wird ein Produkt ortsfest angeschlossen, ist die Verbindung zwischen dem Schutzleiteranschluss vor Ort und dem Geräteschutzleiter vor jeglicher anderer Verbindung herzustellen. Aufstellung und Anschluss darf nur durch eine Elektrofachkraft erfolgen.
13. Bei ortsfesten Geräten ohne eingebaute Sicherung, Selbstschalter oder ähnliche Schutzeinrichtung muss der Versorgungskreis so abgesichert sein, dass alle Personen, die Zugang zum Produkt haben, sowie das Produkt selbst ausreichend vor Schäden geschützt sind.
14. Jedes Produkt muss durch geeigneten Überspannungsschutz vor Überspannung (z.B. durch Blitzschlag) geschützt werden. Andernfalls ist das bedienende Personal durch elektrischen Schlag gefährdet.
15. Gegenstände, die nicht dafür vorgesehen sind, dürfen nicht in die Öffnungen des Gehäuses eingebracht werden. Dies kann Kurzschlüsse im Produkt und/oder elektrische Schläge, Feuer oder Verletzungen verursachen.
16. Sofern nicht anders spezifiziert, sind Produkte nicht gegen das Eindringen von Flüssigkeiten geschützt, siehe auch Abschnitt "Betriebszustände und Betriebslagen", Punkt 1. Daher müssen die Geräte vor Eindringen von Flüssigkeiten geschützt werden. Wird dies nicht beachtet, besteht Gefahr durch elektrischen Schlag für den Benutzer oder Beschädigung des Produkts, was ebenfalls zur Gefährdung von Personen führen kann.
17. Benutzen Sie das Produkt nicht unter Bedingungen, bei denen Kondensation in oder am Produkt stattfinden könnte oder ggf. bereits stattgefunden hat, z.B. wenn das Produkt von kalter in warme Umgebung bewegt wurde. Das Eindringen von Wasser erhöht das Risiko eines elektrischen Schlages.
18. Trennen Sie das Produkt vor der Reinigung komplett von der Energieversorgung (z.B. speisendes Netz oder Batterie). Nehmen Sie bei Geräten die Reinigung mit einem weichen, nicht fasernden Staublappen vor. Verwenden Sie keinesfalls chemische Reinigungsmittel wie z.B. Alkohol, Aceton, Nitroverdünnung.

### Betrieb

1. Die Benutzung des Produkts erfordert spezielle Einweisung und hohe Konzentration während der Benutzung. Es muss sichergestellt sein, dass Personen, die das Produkt bedienen, bezüglich ihrer körperlichen, geistigen und seelischen Verfassung den Anforderungen gewachsen sind, da andernfalls Verletzungen oder Sachschäden nicht auszuschließen sind. Es liegt in der Verantwortung des Arbeitsgebers/Betreibers, geeignetes Personal für die Benutzung des Produkts auszuwählen.
2. Bevor Sie das Produkt bewegen oder transportieren, lesen und beachten Sie den Abschnitt "Transport".
3. Wie bei allen industriell gefertigten Gütern kann die Verwendung von Stoffen, die Allergien hervorrufen - so genannte Allergene (z.B. Nickel) - nicht generell ausgeschlossen werden. Sollten beim Umgang mit R&S-Produkten allergische Reaktionen, z.B. Hautausschlag, häufiges Niesen, Bindehautreizung oder Atembeschwerden auftreten, ist umgehend ein Arzt aufzusuchen, um die Ursachen zu klären und Gesundheitsschäden bzw. -belastungen zu vermeiden.
4. Vor der mechanischen und/oder thermischen Bearbeitung oder Zerlegung des Produkts beachten Sie unbedingt Abschnitt "Entsorgung", Punkt 1.

5. Bei bestimmten Produkten, z.B. HF-Funkanlagen, können funktionsbedingt erhöhte elektromagnetische Strahlungen auftreten. Unter Berücksichtigung der erhöhten Schutzwürdigkeit des ungeborenen Lebens müssen Schwangere durch geeignete Maßnahmen geschützt werden. Auch Träger von Herzschrittmachern können durch elektromagnetische Strahlungen gefährdet sein. Der Arbeitgeber/Betreiber ist verpflichtet, Arbeitsstätten, bei denen ein besonderes Risiko einer Strahlenexposition besteht, zu beurteilen und zu kennzeichnen und mögliche Gefahren abzuwenden.
6. Im Falle eines Brandes entweichen ggf. giftige Stoffe (Gase, Flüssigkeiten etc.) aus dem Produkt, die Gesundheitsschäden verursachen können. Daher sind im Brandfall geeignete Maßnahmen wie z.B. Atemschutzmasken und Schutzkleidung zu verwenden.
7. Falls ein Laser-Produkt in ein R&S-Produkt integriert ist (z.B. CD/DVD-Laufwerk), dürfen keine anderen Einstellungen oder Funktionen verwendet werden, als in der Produktdokumentation beschrieben, um Personenschäden zu vermeiden (z.B. durch Laserstrahl).
8. EMV Klassen (nach EN 55011 / CISPR 11; sinngemäß EN 55022 / CISPR 22, EN 55032 / CISPR 32)

Gerät der Klasse A:

Ein Gerät, das sich für den Gebrauch in allen anderen Bereichen außer dem Wohnbereich und solchen Bereichen eignet, die direkt an ein Niederspannungs-Versorgungsnetz angeschlossen sind, das Wohngebäude versorgt.

Hinweis: Diese Einrichtung kann wegen möglicher auftretender leitungsgebundener als auch gestrahlten Störgrößen im Wohnbereich Funkstörungen verursachen. In diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen.

Gerät der Klasse B:

Ein Gerät, das sich für den Betrieb im Wohnbereich sowie in solchen Bereichen eignet, die direkt an ein Niederspannungs-Versorgungsnetz angeschlossen sind, das Wohngebäude versorgt.

### Reparatur und Service

1. Das Produkt darf nur von dafür autorisiertem Fachpersonal geöffnet werden. Vor Arbeiten am Produkt oder Öffnen des Produkts ist dieses von der Versorgungsspannung zu trennen, sonst besteht das Risiko eines elektrischen Schlages.
2. Abgleich, Auswechseln von Teilen, Wartung und Reparatur darf nur von R&S-autorisierten Elektrofachkräften ausgeführt werden. Werden sicherheitsrelevante Teile (z.B. Netzschalter, Netztrafos oder Sicherungen) ausgewechselt, so dürfen diese nur durch Originalteile ersetzt werden. Nach jedem Austausch von sicherheitsrelevanten Teilen ist eine Sicherheitsprüfung durchzuführen (Sichtprüfung, Schutzleitertest, Isolationswiderstand-, Ableitstrommessung, Funktionstest). Damit wird sichergestellt, dass die Sicherheit des Produkts erhalten bleibt.

### Batterien und Akkumulatoren/Zellen

*Werden die Hinweise zu Batterien und Akkumulatoren/Zellen nicht oder unzureichend beachtet, kann dies Explosion, Brand und/oder schwere Verletzungen von Personen, unter Umständen mit Todesfolge, verursachen. Die Handhabung von Batterien und Akkumulatoren mit alkalischen Elektrolyten (z.B. Lithiumzellen) muss der EN 62133 entsprechen.*

1. Zellen dürfen nicht zerlegt, geöffnet oder zerkleinert werden.
2. Zellen oder Batterien dürfen weder Hitze noch Feuer ausgesetzt werden. Die Lagerung im direkten Sonnenlicht ist zu vermeiden. Zellen und Batterien sauber und trocken halten. Verschmutzte Anschlüsse mit einem trockenen, sauberen Tuch reinigen.

## Grundlegende Sicherheitshinweise

3. Zellen oder Batterien dürfen nicht kurzgeschlossen werden. Zellen oder Batterien dürfen nicht gefahrbringend in einer Schachtel oder in einem Schubfach gelagert werden, wo sie sich gegenseitig kurzschließen oder durch andere leitende Werkstoffe kurzgeschlossen werden können. Eine Zelle oder Batterie darf erst aus ihrer Originalverpackung entnommen werden, wenn sie verwendet werden soll.
4. Zellen oder Batterien dürfen keinen unzulässig starken, mechanischen Stößen ausgesetzt werden.
5. Bei Undichtheit einer Zelle darf die Flüssigkeit nicht mit der Haut in Berührung kommen oder in die Augen gelangen. Falls es zu einer Berührung gekommen ist, den betroffenen Bereich mit reichlich Wasser waschen und ärztliche Hilfe in Anspruch nehmen.
6. Werden Zellen oder Batterien, die alkalische Elektrolyte enthalten (z.B. Lithiumzellen), unsachgemäß ausgewechselt oder geladen, besteht Explosionsgefahr. Zellen oder Batterien nur durch den entsprechenden R&S-Typ ersetzen (siehe Ersatzteilliste), um die Sicherheit des Produkts zu erhalten.
7. Zellen oder Batterien müssen wiederverwertet werden und dürfen nicht in den Restmüll gelangen. Akkumulatoren oder Batterien, die Blei, Quecksilber oder Cadmium enthalten, sind Sonderabfall. Beachten Sie hierzu die landesspezifischen Entsorgungs- und Recycling-Bestimmungen.

### Transport

1. Das Produkt kann ein hohes Gewicht aufweisen. Daher muss es vorsichtig und ggf. unter Verwendung eines geeigneten Hebmittels (z.B. Hubwagen) bewegt bzw. transportiert werden, um Rückenschäden oder Verletzungen zu vermeiden.
2. Griffe an den Produkten sind eine Handhabungshilfe, die ausschließlich für den Transport des Produkts durch Personen vorgesehen ist. Es ist daher nicht zulässig, Griffe zur Befestigung an bzw. auf Transportmitteln, z.B. Kränen, Gabelstaplern, Karren etc. zu verwenden. Es liegt in Ihrer Verantwortung, die Produkte sicher an bzw. auf geeigneten Transport- oder Hebmitteln zu befestigen. Beachten Sie die Sicherheitsvorschriften des jeweiligen Herstellers eingesetzter Transport- oder Hebmittel, um Personenschäden und Schäden am Produkt zu vermeiden.
3. Falls Sie das Produkt in einem Fahrzeug benutzen, liegt es in der alleinigen Verantwortung des Fahrers, das Fahrzeug in sicherer und angemessener Weise zu führen. Der Hersteller übernimmt keine Verantwortung für Unfälle oder Kollisionen. Verwenden Sie das Produkt niemals in einem sich bewegenden Fahrzeug, sofern dies den Fahrzeugführer ablenken könnte. Sichern Sie das Produkt im Fahrzeug ausreichend ab, um im Falle eines Unfalls Verletzungen oder Schäden anderer Art zu verhindern.

### Entsorgung

1. Batterien bzw. Akkumulatoren, die nicht mit dem Hausmüll entsorgt werden dürfen, darf nach Ende der Lebensdauer nur über eine geeignete Sammelstelle oder eine Rohde & Schwarz-Kundendienststelle entsorgt werden.
2. Am Ende der Lebensdauer des Produktes darf dieses Produkt nicht über den normalen Hausmüll entsorgt werden, sondern muss getrennt gesammelt werden. Rohde & Schwarz GmbH & Co.KG ein Entsorgungskonzept entwickelt und übernimmt die Pflichten der Rücknahme- und Entsorgung für Hersteller innerhalb der EU in vollem Umfang. Wenden Sie sich bitte an Ihre Rohde & Schwarz-Kundendienststelle, um das Produkt umweltgerecht zu entsorgen.

## Grundlegende Sicherheitshinweise

3. Werden Produkte oder ihre Bestandteile über den bestimmungsgemäßen Betrieb hinaus mechanisch und/oder thermisch bearbeitet, können ggf. gefährliche Stoffe (schwermetallhaltiger Staub wie z.B. Blei, Beryllium, Nickel) freigesetzt werden. Die Zerlegung des Produkts darf daher nur von speziell geschultem Fachpersonal erfolgen. Unsachgemäßes Zerlegen kann Gesundheitsschäden hervorrufen. Die nationalen Vorschriften zur Entsorgung sind zu beachten.
4. Falls beim Umgang mit dem Produkt Gefahren- oder Betriebsstoffe entstehen, die speziell zu entsorgen sind, z.B. regelmäßig zu wechselnde Kühlmittel oder Motorenöle, sind die Sicherheitshinweise des Herstellers dieser Gefahren- oder Betriebsstoffe und die regional gültigen Entsorgungsvorschriften einzuhalten. Beachten Sie ggf. auch die zugehörigen speziellen Sicherheitshinweise in der Produktdokumentation. Die unsachgemäße Entsorgung von Gefahren- oder Betriebsstoffen kann zu Gesundheitsschäden von Personen und Umweltschäden führen.

Weitere Informationen zu Umweltschutz finden Sie auf der Rohde & Schwarz Home Page.

# Consignes de sécurité fondamentales

Lisez et respectez impérativement les instructions et consignes de sécurité suivantes

Les usines et sites du groupe Rohde & Schwarz veillent à la conformité des produits du groupe avec les normes de sécurité en vigueur dans un souci constant de garantir aux clients le plus haut niveau de sécurité possible. Nos produits ainsi que les accessoires nécessaires sont fabriqués et testés conformément aux règles de sécurité en vigueur. Le respect de ces règles est vérifié régulièrement par notre système d'assurance qualité. Le présent produit a été fabriqué et contrôlé conformément au certificat de conformité CE ci-joint et a quitté l'usine dans un parfait état de sécurité. Pour le maintenir dans cet état et en garantir une utilisation sans danger, l'utilisateur doit respecter l'ensemble des consignes, remarques de sécurité et avertissements qui se trouvent dans ce manuel. Le groupe Rohde & Schwarz se tient à votre disposition pour toutes questions relatives aux présentes consignes de sécurité.

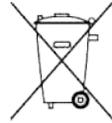
Il incombe à l'utilisateur d'employer ce produit de manière appropriée. Le produit est exclusivement destiné à l'utilisation en industrie et en laboratoire et/ou, si cela a été expressément autorisé, également aux travaux extérieurs ; il ne peut en aucun cas être utilisé à des fins pouvant causer des dommages corporels ou matériels. L'exploitation du produit en dehors de son utilisation prévue ou le non-respect des consignes du fabricant se font sous la responsabilité de l'utilisateur. Le fabricant décline toute responsabilité en cas d'utilisation non conforme du produit.

Le produit est présumé faire l'objet d'une utilisation conforme lorsqu'il est utilisé conformément aux consignes de la documentation produit correspondante et dans la limite de ses performances (voir fiche technique, documentation, consignes de sécurité ci-après). L'utilisation du produit exige des compétences en la matière et des connaissances de base de l'anglais. Par conséquent, le produit ne devra être utilisé que par un personnel qualifié ou des personnes formées de manière approfondie et possédant les compétences requises. Si, pour l'utilisation des produits Rohde & Schwarz, l'emploi d'un équipement personnel de protection s'avère nécessaire, il en est fait mention dans la documentation produit à l'emplacement correspondant. Conservez les consignes de sécurité fondamentales et la documentation produit dans un lieu sûr et transmettez ces documents aux autres utilisateurs du produit.

La stricte observation des consignes de sécurité a pour but d'exclure des blessures ou dommages causés par des dangers de toutes sortes. A cet effet, il est nécessaire de lire avec soin et de bien comprendre les consignes de sécurité ci-dessous avant l'utilisation du produit et de les respecter lors de l'utilisation du produit. Toutes les autres consignes de sécurité présentées à l'emplacement correspondant de la documentation produit, par exemple, celles concernant la protection des personnes, doivent également être impérativement respectées. Dans les présentes consignes de sécurité, toutes les marchandises commercialisées par le groupe Rohde & Schwarz, notamment les appareils, les systèmes ainsi que les accessoires, sont dénommés « produit ».

## Consignes de sécurité fondamentales

### Symboles et marquages de sécurité

Symbole	Signification	Symbole	Signification
	Avis, source générale de danger Se référer à la documentation produit	○	MARCHE / ARRET (tension d'alimentation)
	Attention lors de la manipulation d'appareils ayant un poids élevé	⏻	Indicateur de veille
	Risque de choc électrique	≡	Courant continu (CC)
	Avertissement, surface chaude	~	Courant alternatif (CA)
	Borne de conducteur de protection	⎓	Courant continu/alternatif (CC/CA)
	Borne de mise à la terre		L'appareil est conforme aux exigences de sécurité du degré de protection II (appareil entièrement protégé par isolation double/renforcée).
	Borne de mise à la masse du bâti ou du boîtier		Marquage UE pour batteries et accumulateurs. L'appareil contient une batterie ou un accumulateur. Ces pièces ne peuvent pas être éliminées avec les déchets urbains non triés, mais doivent faire l'objet d'une collecte séparée. Pour plus d'informations, voir la page 7.
	Avis : prudence lors de la manipulation de composants sensibles aux décharges électrostatiques		Marquage UE pour la collecte séparée d'équipements électriques et électroniques. Les déchets d'équipements électriques et électroniques ne peuvent pas être éliminés avec les déchets urbains non triés, mais doivent faire l'objet d'une collecte séparée. Pour plus d'informations, voir la page 7.
	Avertissement, rayon laser Les produits laser sont munis d'avertissements normalisés d'après leur catégorie laser. En raison des caractéristiques de leur rayonnement ainsi que de leur puissance électromagnétique extrêmement concentrée, les lasers peuvent causer des dommages biologiques. Pour plus d'informations, voir le chapitre « Fonctionnement », point 7.		

## Consignes de sécurité fondamentales

### Mots d'alerte et significations

Les mots d'alerte suivants sont utilisés dans la documentation produit pour avertir des risques et dangers.



Indique une situation dangereuse immédiate qui, si elle n'est pas évitée, comporte un risque élevé de blessures graves ou mortelles.



Indique une situation dangereuse possible qui, si elle n'est pas évitée, comporte un risque modéré de blessures (graves) ou mortelles.



Indique une situation dangereuse qui, si elle n'est pas évitée, comporte un risque faible de blessures mineures ou modérées.



Indique la possibilité d'une fausse manœuvre susceptible d'endommager le produit.

Ces mots d'alerte correspondent à la définition habituelle utilisée pour des applications civiles dans l'espace économique européen. Des définitions divergentes peuvent cependant exister dans d'autres espaces économiques ou dans le cadre d'applications militaires. Il faut donc veiller à ce que les mots d'alerte décrits ici ne soient utilisés qu'en relation avec la documentation produit correspondante et seulement avec le produit correspondant. L'utilisation des mots d'alerte en relation avec des produits ou des documentations non correspondants peut conduire à des erreurs d'interprétation et par conséquent à des dommages corporels ou matériels.

### États et positions de fonctionnement

*L'appareil ne doit être utilisé que dans les états et positions de fonctionnement indiqués par le fabricant. Tout obstacle à la ventilation doit être empêché. Le non-respect des indications du fabricant peut provoquer des chocs électriques, des incendies et/ou des blessures graves pouvant éventuellement entraîner la mort. Pour tous les travaux, les règles locales et/ou nationales de sécurité et de prévention des accidents doivent être respectées.*

1. Sauf stipulations contraires, les produits Rohde & Schwarz répondent aux exigences ci-après : faire fonctionner le produit avec le fond du boîtier toujours en bas, degré de protection IP 2X, degré de pollution 2, catégorie de surtension 2, utilisation uniquement à l'intérieur, fonctionnement à une altitude max. de 2000 m au-dessus du niveau de la mer, transport à une altitude max. de 4500 m au-dessus du niveau de la mer, tolérance de  $\pm 10$  % pour la tension nominale et de  $\pm 5$  % pour la fréquence nominale.
2. Ne jamais placer le produit sur des surfaces, véhicules, dépôts ou tables non appropriés pour raisons de stabilité ou de poids. Suivre toujours strictement les indications d'installation du fabricant pour le montage et la fixation du produit sur des objets ou des structures (par exemple parois et étagères). En cas d'installation non conforme à la documentation produit, il y a risque de blessures, voire de mort.
3. Ne jamais placer le produit sur des dispositifs générant de la chaleur (par exemple radiateurs et appareils de chauffage soufflants). La température ambiante ne doit pas dépasser la température maximale spécifiée dans la documentation produit ou dans la fiche technique. Une surchauffe du produit peut provoquer des chocs électriques, des incendies et/ou des blessures graves pouvant éventuellement entraîner la mort.

## Consignes de sécurité fondamentales

### Sécurité électrique

*Si les consignes relatives à la sécurité électrique ne sont pas ou sont insuffisamment respectées, il peut s'ensuivre des chocs électriques, des incendies et/ou des blessures graves pouvant éventuellement entraîner la mort.*

1. Avant chaque mise sous tension du produit, il faut s'assurer que la tension nominale réglée sur le produit correspond à la tension nominale du réseau électrique. S'il est nécessaire de modifier le réglage de la tension, il faut remplacer le fusible du produit, le cas échéant.
2. L'utilisation des produits du degré de protection I pourvus d'un câble d'alimentation mobile et d'un connecteur n'est autorisée qu'avec des prises munies d'un contact de protection et d'un conducteur de protection raccordé.
3. Toute déconnexion intentionnelle du conducteur de protection, dans le câble ou dans le produit lui-même, est interdite. Elle entraîne un risque de choc électrique au niveau du produit. En cas d'utilisation de câbles prolongateurs ou de multiprises, ceux-ci doivent être examinés régulièrement quant à leur état de sécurité technique.
4. Si le produit n'est pas doté d'un interrupteur d'alimentation pour le couper du réseau électrique ou si l'interrupteur d'alimentation disponible n'est pas approprié pour couper le produit du réseau électrique, le connecteur mâle du câble de raccordement est à considérer comme dispositif de séparation. Le dispositif de séparation doit être à tout moment facilement accessible. Si, par exemple, le connecteur d'alimentation sert de dispositif de séparation, la longueur du câble de raccordement ne doit pas dépasser 3 m.  
Les commutateurs fonctionnels ou électroniques ne sont pas appropriés pour couper l'appareil du réseau électrique. Si des produits sans interrupteur d'alimentation sont intégrés dans des bâtis ou systèmes, le dispositif de séparation doit être reporté au niveau du système.
5. Ne jamais utiliser le produit si le câble d'alimentation est endommagé. Vérifier régulièrement le parfait état du câble d'alimentation. Prendre les mesures préventives appropriées et opter pour des types de pose tels que le câble d'alimentation ne puisse pas être endommagé et que personne ne puisse subir de préjudice, par exemple en trébuchant sur le câble ou par des chocs électriques.
6. L'utilisation des produits est uniquement autorisée sur des réseaux d'alimentation de type TN/TT protégés par des fusibles d'une intensité max. de 16 A (pour toute intensité supérieure, consulter le groupe Rohde & Schwarz).
7. Ne pas brancher le connecteur dans des prises d'alimentation sales ou poussiéreuses. Enfoncer fermement le connecteur jusqu'au bout de la prise. Le non-respect de cette mesure peut provoquer des étincelles, incendies et/ou blessures.
8. Ne pas surcharger les prises, les câbles prolongateurs ou les multiprises, cela pouvant provoquer des incendies ou chocs électriques.
9. En cas de mesures sur les circuits électriques d'une tension efficace > 30 V, prendre les précautions nécessaires pour éviter tout risque (par exemple équipement de mesure approprié, fusibles, limitation de courant, coupe-circuit, isolation, etc.).
10. En cas d'interconnexion avec des équipements informatiques comme par exemple un PC ou un ordinateur industriel, veiller à ce que ces derniers soient conformes aux normes IEC 60950-1 / EN 60950-1 ou IEC 61010-1 / EN 61010-1 en vigueur.
11. Sauf autorisation expresse, il est interdit de retirer le couvercle ou toute autre pièce du boîtier lorsque le produit est en cours de service. Les câbles et composants électriques seraient ainsi accessibles, ce qui peut entraîner des blessures, des incendies ou des dégâts sur le produit.

## Consignes de sécurité fondamentales

12. Si un produit est connecté de façon stationnaire, établir avant toute autre connexion le raccordement du conducteur de protection local et du conducteur de protection du produit. L'installation et le raccordement ne peuvent être effectués que par un électricien ou électronicien qualifié.
13. Sur les appareils stationnaires sans fusible ni disjoncteur automatique ou dispositif de protection similaire intégrés, le circuit d'alimentation doit être sécurisé de sorte que toutes les personnes ayant accès au produit et le produit lui-même soient suffisamment protégés contre tout dommage.
14. Chaque produit doit être protégé de manière appropriée contre les éventuelles surtensions (par exemple dues à un coup de foudre). Sinon, les utilisateurs sont exposés à des risques de choc électrique.
15. Ne jamais introduire d'objets non prévus à cet effet dans les ouvertures du boîtier, étant donné que cela peut entraîner des courts-circuits dans le produit et/ou des chocs électriques, incendies ou blessures.
16. Sauf spécification contraire, les produits ne sont pas protégés contre l'infiltration de liquides, voir aussi la section « États et positions de fonctionnement », point 1. Il faut donc protéger les produits contre l'infiltration de liquides. La non-observation de cette consigne entraîne le risque de choc électrique pour l'utilisateur ou d'endommagement du produit, ce qui peut également mettre les personnes en danger.
17. Ne pas utiliser le produit dans des conditions pouvant occasionner ou ayant déjà occasionné, le cas échéant, des condensations dans ou sur le produit, par exemple lorsque celui-ci est déplacé d'un environnement froid dans un environnement chaud. L'infiltration d'eau augmente le risque de choc électrique.
18. Avant le nettoyage, débrancher le produit de l'alimentation (par exemple réseau électrique ou batterie). Pour le nettoyage des appareils, utiliser un chiffon doux non pelucheux. N'utiliser en aucun cas de produit de nettoyage chimique, tel que de l'alcool, de l'acétone ou un diluant nitrocellulosique.

### Fonctionnement

1. L'utilisation du produit exige une formation spécifique ainsi qu'une grande concentration. Il est impératif que les personnes qui utilisent le produit présentent les aptitudes physiques, mentales et psychiques requises, vu qu'autrement des dommages corporels ou matériels ne peuvent pas être exclus. Le choix du personnel qualifié pour l'utilisation du produit est sous la responsabilité de l'employeur/l'exploitant.
2. Avant de déplacer ou de transporter le produit, lire et respecter la section « Transport ».
3. Comme pour tous les biens produits de façon industrielle, l'utilisation de matériaux pouvant causer des allergies (allergènes, comme par exemple le nickel) ne peut être totalement exclue. Si, lors de l'utilisation de produits Rohde & Schwarz, des réactions allergiques surviennent, telles qu'éruption cutanée, éternuements fréquents, rougeur de la conjonctive ou difficultés respiratoires, il faut immédiatement consulter un médecin pour en clarifier la cause et éviter toute atteinte à la santé.
4. Avant le traitement mécanique et/ou thermique ou le démontage du produit, il faut impérativement observer la section « Élimination des déchets », point 1.

## Consignes de sécurité fondamentales

5. Selon les fonctions, certains produits, tels que des systèmes de radiocommunication RF, peuvent produire des niveaux élevés de rayonnement électromagnétique. Étant donné la vulnérabilité de l'enfant à naître, les femmes enceintes doivent être protégées par des mesures appropriées. Les porteurs de stimulateurs cardiaques peuvent également être menacés par les rayonnements électromagnétiques. L'employeur/l'exploitant est tenu d'évaluer et de repérer les lieux de travail soumis à un risque particulier d'exposition aux rayonnements et de prévenir les dangers éventuels.
6. En cas d'incendie, il se peut que le produit dégage des matières toxiques (gaz, liquides, etc.) susceptibles de nuire à la santé. Il faut donc, en cas d'incendie, prendre des mesures adéquates comme par exemple le port de masques respiratoires et de vêtements de protection.
7. Si un produit laser est intégré dans un produit Rohde & Schwarz (par exemple lecteur CD/DVD), il ne faut pas utiliser de réglages ou fonctions autres que ceux décrits dans la documentation produit pour éviter tout dommage corporel (par exemple causé par rayon laser).
8. Classes CEM (selon EN 55011 / CISPR 11 ; selon EN 55022 / CISPR 22, EN 55032 / CISPR 32 par analogie)
  - Appareil de la classe A :  
Appareil approprié à un usage dans tous les environnements autres que l'environnement résidentiel et les environnements raccordés directement à un réseau d'alimentation basse tension qui alimente des bâtiments résidentiels.  
Remarque : ces appareils peuvent provoquer des perturbations radioélectriques dans l'environnement résidentiel en raison de perturbations conduites ou rayonnées. Dans ce cas, on peut exiger que l'exploitant mette en œuvre de mesures appropriées pour éliminer ces perturbations.
  - Appareil de la classe B :  
Appareil approprié à un usage dans l'environnement résidentiel ainsi que dans les environnements raccordés directement à un réseau d'alimentation basse tension qui alimente des bâtiments résidentiels.

### Réparation et service après-vente

1. Le produit ne doit être ouvert que par un personnel qualifié et autorisé. Avant de travailler sur le produit ou de l'ouvrir, il faut le couper de la tension d'alimentation ; sinon il y a risque de choc électrique.
2. Les travaux d'ajustement, le remplacement des pièces, la maintenance et la réparation ne doivent être effectués que par des électroniciens qualifiés et autorisés par Rohde & Schwarz. En cas de remplacement de pièces concernant la sécurité (notamment interrupteur d'alimentation, transformateur d'alimentation réseau ou fusibles), celles-ci ne doivent être remplacées que par des pièces d'origine. Après chaque remplacement de pièces concernant la sécurité, une vérification de sécurité doit être effectuée (contrôle visuel, vérification du conducteur de protection, mesure de la résistance d'isolement et du courant de fuite, essai de fonctionnement). Cela permet d'assurer le maintien de la sécurité du produit.

### Batteries et accumulateurs/cellules

*Si les instructions concernant les batteries et accumulateurs/cellules ne sont pas ou sont insuffisamment respectées, cela peut provoquer des explosions, des incendies et/ou des blessures graves pouvant entraîner la mort. La manipulation de batteries et accumulateurs contenant des électrolytes alcalins (par exemple cellules de lithium) doit être conforme à la norme EN 62133.*

## Consignes de sécurité fondamentales

1. Les cellules ne doivent être ni démontées, ni ouvertes, ni réduites en morceaux.
2. Ne jamais exposer les cellules ou batteries à la chaleur ou au feu. Ne pas les stocker dans un endroit où elles sont exposées au rayonnement direct du soleil. Tenir les cellules et batteries au sec. Nettoyer les raccords sales avec un chiffon sec et propre.
3. Ne jamais court-circuiter les cellules ou batteries. Les cellules ou batteries ne doivent pas être gardées dans une boîte ou un tiroir où elles peuvent se court-circuiter mutuellement ou être court-circuitées par d'autres matériaux conducteurs. Une cellule ou batterie ne doit être retirée de son emballage d'origine que lorsqu'on l'utilise.
4. Les cellules ou batteries ne doivent pas être exposées à des chocs mécaniques de force non admissible.
5. En cas de manque d'étanchéité d'une cellule, le liquide ne doit pas entrer en contact avec la peau ou les yeux. S'il y a contact, rincer abondamment à l'eau l'endroit concerné et consulter un médecin.
6. Il y a danger d'explosion en cas de remplacement ou chargement incorrect des cellules ou batteries qui contiennent des électrolytes alcalins (par exemple cellules de lithium). Remplacer les cellules ou batteries uniquement par le type Rohde & Schwarz correspondant (voir la liste des pièces de rechange) pour maintenir la sécurité du produit.
7. Il faut recycler les cellules ou batteries et il est interdit de les éliminer comme déchets normaux. Les accumulateurs ou batteries qui contiennent du plomb, du mercure ou du cadmium sont des déchets spéciaux. Observer les règles nationales d'élimination et de recyclage.

### Transport

1. Le produit peut avoir un poids élevé. Il faut donc le déplacer ou le transporter avec précaution et en utilisant le cas échéant un moyen de levage approprié (par exemple, chariot élévateur) pour éviter des dommages au dos ou des blessures.
2. Les poignées des produits sont une aide de manipulation exclusivement réservée au transport du produit par des personnes. Il est donc proscrit d'utiliser ces poignées pour attacher le produit à ou sur des moyens de transport, tels que grues, chariots et chariots élévateurs, etc. Vous êtes responsable de la fixation sûre des produits à ou sur des moyens de transport et de levage appropriés. Observer les consignes de sécurité du fabricant des moyens de transport ou de levage utilisés pour éviter des dommages corporels et des dégâts sur le produit.
3. L'utilisation du produit dans un véhicule se fait sous l'unique responsabilité du conducteur qui doit piloter le véhicule de manière sûre et appropriée. Le fabricant décline toute responsabilité en cas d'accidents ou de collisions. Ne jamais utiliser le produit dans un véhicule en mouvement si cela pouvait détourner l'attention du conducteur. Sécuriser suffisamment le produit dans le véhicule pour empêcher des blessures ou dommages de tout type en cas d'accident.

### Élimination des déchets

1. Au terme de leur durée de vie, les batteries ou accumulateurs qui ne peuvent pas être éliminés avec les déchets ménagers peuvent uniquement être éliminés par des points de collecte appropriés ou par un centre de service après-vente Rohde & Schwarz.

## Consignes de sécurité fondamentales

2. Au terme de sa durée de vie, un produit ne peut pas être éliminé avec les déchets ménagers normaux, mais doit être collecté séparément.  
Rohde & Schwarz GmbH & Co. KG a développé un concept d'élimination des déchets et assume toutes les obligations en matière de reprise et d'élimination, valables pour les fabricants au sein de l'UE. Veuillez vous adresser à votre centre de service après-vente Rohde & Schwarz pour éliminer le produit de manière écologique.
3. Si les produits ou leurs composants sont travaillés mécaniquement et/ou thermiquement au-delà de l'utilisation prévue, ils peuvent, le cas échéant, libérer des substances dangereuses (poussières contenant des métaux lourds comme par exemple du plomb, du béryllium ou du nickel). Le démontage du produit ne doit donc être effectué que par un personnel qualifié et spécialement formé. Le démontage inadéquat peut nuire à la santé. Les règles nationales concernant l'élimination des déchets doivent être observées.
4. Si, lors de l'utilisation du produit, des substances dangereuses ou combustibles exigeant une élimination spéciale sont dégagées, comme par exemple liquides de refroidissement ou huiles moteurs qui sont à changer régulièrement, les consignes de sécurité du fabricant de ces substances dangereuses ou combustibles ainsi que les règles sur l'élimination en vigueur au niveau régional doivent être respectées. Les consignes de sécurité spéciales correspondantes dans la documentation produit doivent également être respectées, le cas échéant. L'élimination non conforme des substances dangereuses ou combustibles peut provoquer des atteintes à la santé et des dommages écologiques.

Pour plus d'informations concernant la protection de l'environnement, voir la page d'accueil de Rohde & Schwarz.

## Supplementary Safety Instructions

### **NOTICE**

Observe the following safety instructions to protect your R&S ETC from damage.

The RF INPUT test input of the R&S ETC 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.

The R&S ETC 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).

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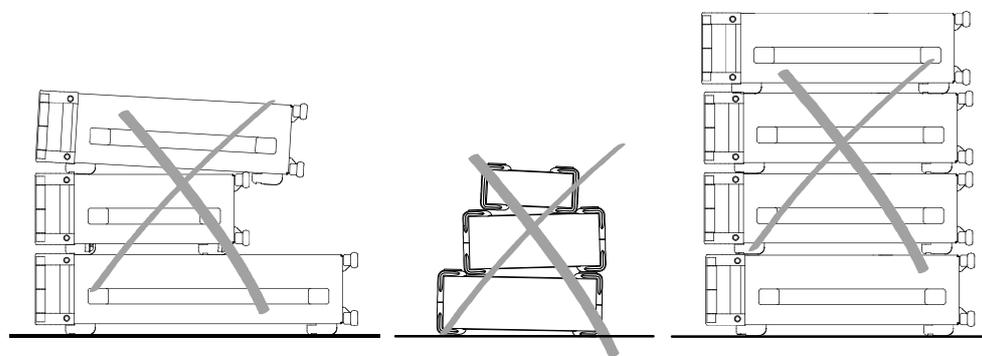
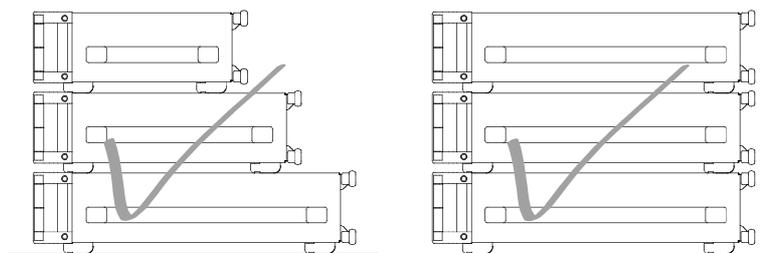
## Safety Instructions for Stacking Instruments

**⚠ WARNING**

### Danger of injury

Instruments may slip if they are stacked on top of each other.

Place the instrument on a stable, even surface. Stack the instruments according to their size, with the largest instrument on the bottom. Do not stack more than three instruments directly on top of each other. Instruments may only be stacked if their feet and housing allow horizontal stacking. If these conditions are not met, the instruments must be installed in a rack in order to avoid the risk of personal injury and material damage.



Incorrect order

Incompatible feet

Too many instruments stacked

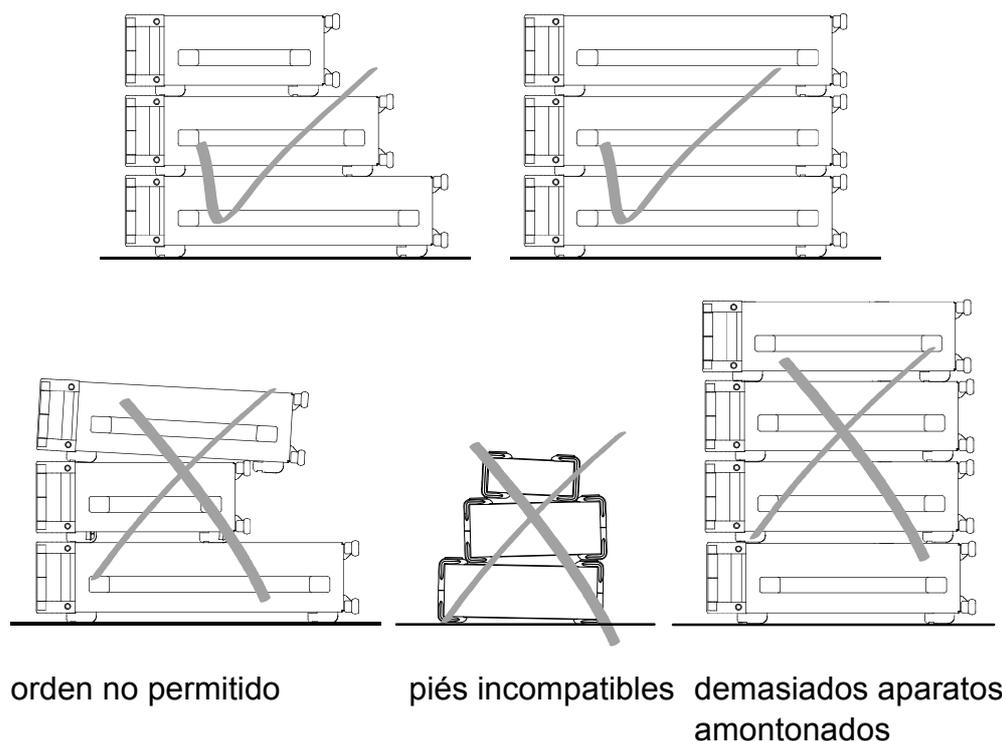
## Informaciones de seguridad para el amontonamiento de aparatos

### **⚠ ADVERTENCIA**

#### **Peligro de heridas**

Los aparatos pueden desplazarse al ser amontonados.

Posicionar los aparatos sobre una superficie estable y lisa. Amontonar los aparatos por orden de su tamaño. No amontonar nunca más de tres aparatos uno sobre el otro. Los aparatos solamente deberán ser amontonados, si los piés y la caja del aparato correspondiente hacen posible amontonarlos de forma horizontal. Si no se cumplen estas condiciones, deberán ser montados los aparatos en una caja apta para este propósito. De esta manera evitarán el riesgo de daños en personas y daños en el aparato.



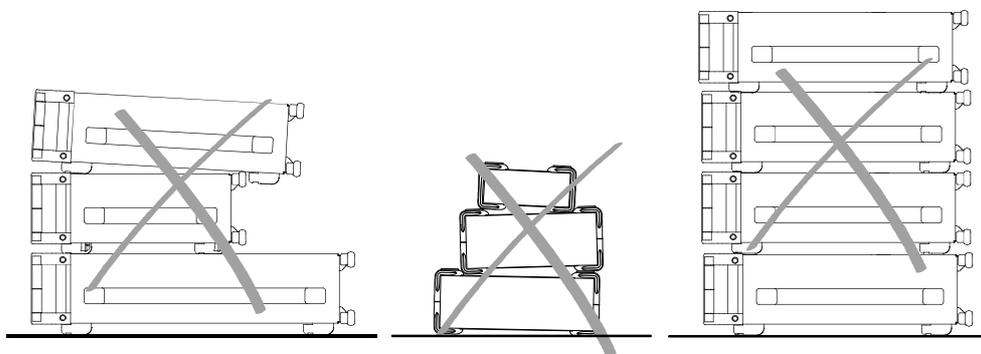
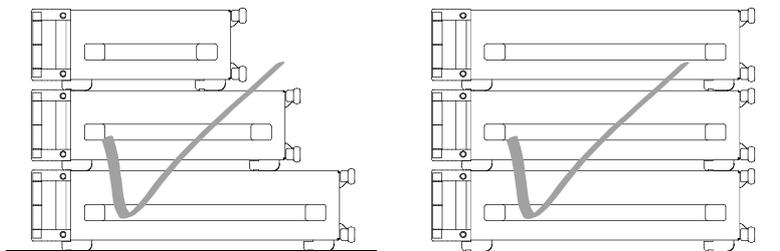
## Sicherheitshinweise für das Stapeln von Geräten

**⚠️ WARNUNG**

**Verletzungsgefahr**

Geräte können beim Aufeinanderstapeln verrutschen.

Gerät auf stabile, gerade Unterlage stellen. Die Geräte der Größe nach stapeln. Nicht mehr als drei Geräte direkt übereinander stellen. Geräte dürfen nur gestapelt werden, wenn Gerätefüße und Gehäuseteile waagerechtes Stapeln ermöglichen. Wenn diese Bedingungen nicht erfüllt sind, müssen die Geräte in ein Gestell eingebaut werden. So vermeiden Sie das Risiko von Personenschäden und Schäden am Gerät.



falsche Reihenfolge

inkompatible FüÙe

zu viele Geräte gestapelt

# 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](mailto:customersupport@rohde-schwarz.com)

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Phone 1-888-TEST-RSA (1-888-837-8772)  
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[customersupport.china@rohde-schwarz.com](mailto:customersupport.china@rohde-schwarz.com)



# Quality management and environmental management

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

## Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz Produktes entschieden. Sie erhalten damit ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unserer Qualitäts- und Umweltmanagementsysteme entwickelt, gefertigt und geprüft. Rohde&Schwarz ist unter anderem nach den Managementsystemen ISO9001 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. This product has been manufactured using the most advanced methods. It was developed, manufactured and tested in compliance with our quality management and environmental management systems. Rohde&Schwarz has been certified, for example, according to the ISO9001 and ISO 14001 management systems.

## 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 de ce produit ont été effectués selon nos systèmes de management de qualité et de management environnemental. La société Rohde&Schwarz a été homologuée, entre autres, conformément aux systèmes de management ISO9001 et ISO 14001.

## Engagement écologique

- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de management environnemental certifié selon ISO 14001



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# Preface

This chapter gives an overview of the user documentation and the conventions used in the documentation.

## Documentation Overview

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

- Getting started

This manual is delivered with the R&S ETC in printed form and in PDF format on the CD-ROM. It provides the information needed to set up the R&S ETC and start working with it. Also a sample application is described. For instructions on installation, refer to the release notes. The printed getting started manual also includes general information, e.g. the basic safety instructions.

- User manual

This manual is delivered with the R&S ETC in PDF format on CD-ROM. It provides the necessary information to work with the R&S ETC. For additional information on default settings and parameters, refer to the data sheet.

- Remote control

This manual is delivered with the R&S ETC in PDF format on CD-ROM. It describes the operation of the R&S ETC by means of remote control. It is included in the user manual.

## Conventions Used in the Documentation

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

When describing how to operate the R&S ETC, several alternative methods may be available to perform the same task. If possible, the procedure using the front panel is described. The terms "select" and "press" may refer to any of the described methods, i.e. using the keys on the R&S ETC or on a keyboard, or a mouse pointer in the display.

# 1 Operating Concepts

This chapter explains the manual operation of the R&S ETC by using the hardkeys and the associated menus.

For remote control, the remote control via LAN or USB is possible. The information for remote control is provided in an extra manual on the CD-ROM.

## 1.1 Selecting Menu Items and Entries

The lower part of the display is a touch-sensitive. There, the menu bar is displayed.

- Touch the display (tap) to open a menu.
- Select a menu item or list entry using the rotary knob or the cursor keys.

## 1.2 Entering Measurement Parameters

The R&S ETC supports a variety of practices to enter values and texts.

If a measurement parameter is defined as value or text, a text field opens after tapping the corresponding menu. Make your changes using the alphanumeric keypad, the rotary knob or the cursor keys.

For details on the alphanumeric keypad, rotary knob and keys see the getting started manual, chapter "Interfaces and Connectors".

### 1.2.1 Entering Values and Texts Using the Alphanumeric Keypad

The following steps are required:

1. Enter the value or text.
2. Confirm the entry.

#### Entering the Value or Text

Enter values by using the number keys (0 to 9), the decimal point key (.) and the minus key (-). You can also enter letters, e.g. file names for data sets. If the R&S ETC is expecting a letter entry, it automatically assigns the letters above the keys to the keys in the alphanumeric keypad. The keys have multiple assignments. To obtain the letter you want, you have to press the key the appropriate number of times. The key assignment is listed in [Table 1-1](#)

Table 1-1: Key assignment

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

To correct your entry, use the BACK key. Pressing the BACK key deletes the last keystroke (letter or digit) that you have entered. Using the CANCEL key, you can cancel the complete entry.

### Confirming the Entry

After you have entered the correct values or texts, you need to confirm your entry.

If the entry is dimensionless, press the ENTER key. Alternatively, you can tap the menu again that has opened the entry field.

If the value requires a unit, you need to press the appropriate unit key to confirm your entry (see chapter [1.2.1.1](#)).

### 1.2.1.1 Entering Units

To enter a unit for a value entry, confirm the entry with a unit key. Use the unit keys down the right-hand side of the alphanumeric keypad. These keys have multiple assignments which depend on the unit entry expected by the R&S ETC.



GHz, -dBm, W, V, s



MHz, dBm, dBmV, mW, mV, ms



kHz, dB $\mu$ V,  $\mu$ W,  $\mu$ V,  $\mu$ s



Hz, nW, nV, ns

To enter the relative unit dB, you can use any of the unit keys.

### 1.2.2 Entering Values Using the Rotary Knob or the Cursor Keys

The following steps are required:

1. Change the value using the rotary knob or the cursor keys.

The entry is changed in steps. The R&S ETC *immediately* sets the selected entry parameter. The entry field remains open to allow further entries.

2. Close the entry field when the required entry has been reached.

Press the CANCEL key or the ENTER key. Alternatively, you can tap the menu again that has opened the entry field or, if provided, the SELECT menu.

### 1.3 Measurement Screens

This chapter describes the measurement screen layouts for the different modes.

#### 1.3.1 TV Analyzer

TV standard	Measurement mode	Measurement profile				
DVB-T/H	Meas List	DVB-T/H 8MHz Tran	06/04/12		16:49	
<i>Field for Status Information</i>	RF	666 MHz				
	Channel / Band	45 / UHF 4/5				
	Channel Table	TV Europe				
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB				
	OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz				
Measurement Parameter		Result				
Power		-50.25 dBm				
Crest Factor		12.25 dB				
Demodulator		locked				
Sideband Position		normal				
Transmission Parameter Signaling		8K	1/32	QAM64 NH		
Carrier Frequency Offset		39.0 Hz				
Symbol Rate Offset		0.1 ppm				
Modulation Error Ratio		rms	36.9	dB	peak	23.0 dB
Error Vector Magnitude		rms	0.94	%	peak	4.62 %
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		27.144387 Mbit/s				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info	

Fig. 1-1: DVB-T/H Analysis – Measurement List

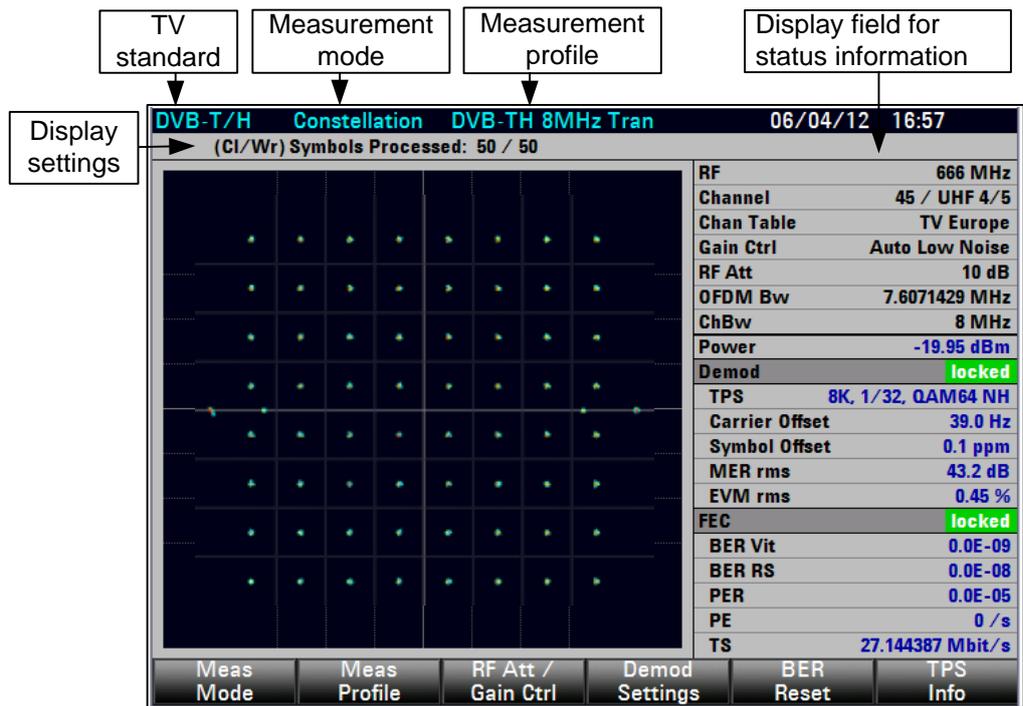


Fig. 1-2: DVB-T/H Analysis – Constellation Diagram

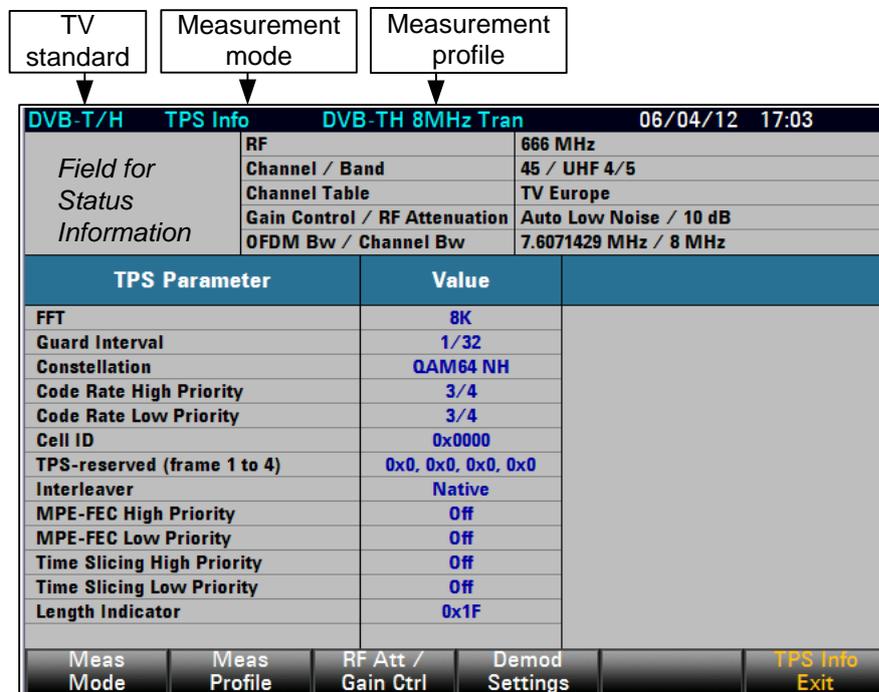


Fig. 1-3: DVB-T/H– TPS Parameter

TV standard	Measurement mode	Measurement profile	23/03/12 11:36	
ISDB-T	Meas List	Transmitter		
RF Preselection	RF	503.142857 MHz		
	Channel / Band	19 / UHF		
	Channel Table	TV Brazil ISDB-T		
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
<b>Measurement Parameter</b>				
Power	-50.34 dBm	Crest Factor	12.88 dB	
OFDM Demodulator	locked	FEC Decoder	locked	
ISDB-T Mode	Mode 3 (8K)			
Guard Interval	1/32	MER (total,rms)	43.0 dB	
Sideband Position	normal	MER (total,peak)	31.4 dB	
RF Offset	-811.4 Hz	MER TMCC	45.0 dB	
Symbol Rate Offset	0.1 ppm	MER AC	45.1 dB	
	Layer A	Layer B	Layer C	
MER (Layer,rms)	42.6	42.7	42.6	dB
BER before Viterbi	0.0E-08	0.0E-07	0.0E-07	
BER before Reed Solomon	0.0E-08	0.0E-07	0.0E-07	
BER after Reed Solomon	0.0E-07	0.0E-06	0.0E-06	
Packet Errors	0	0	0	/s
MPEG TS Bitrate	16.851542	1.531958	1.531958	Mbit/s

Fig. 1-4: ISDB-T Analysis – Measurement List

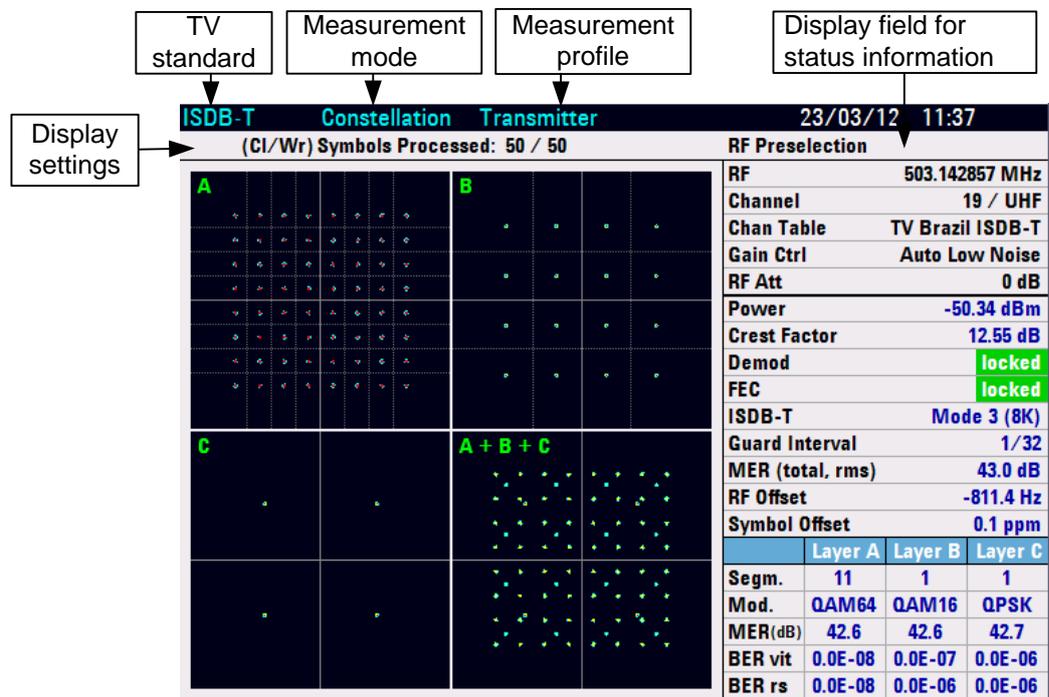


Fig. 1-5: ISDB-T Analysis – Constellation Diagram

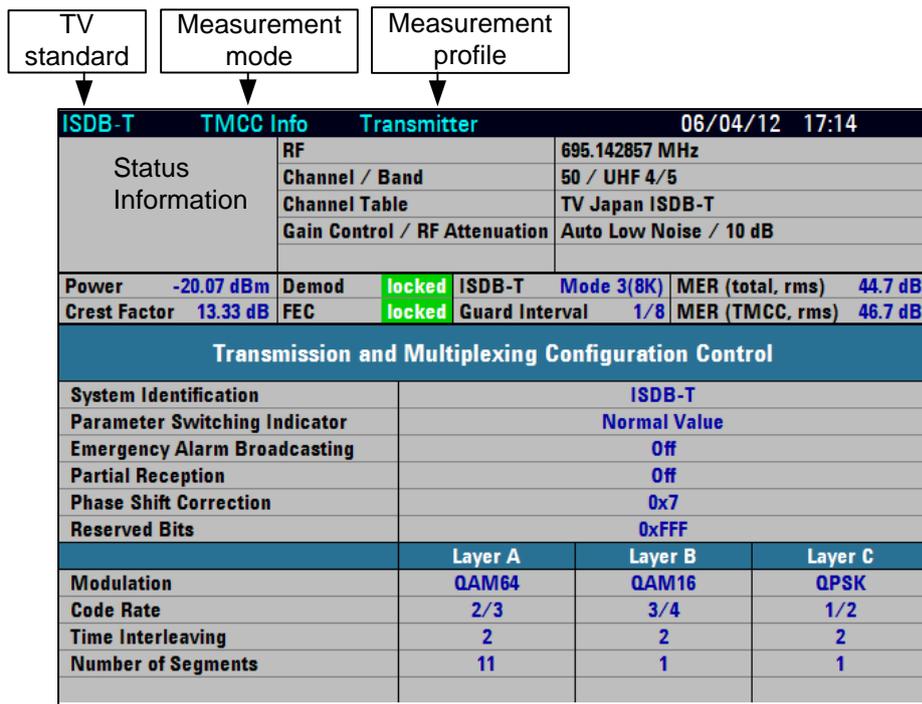


Fig. 1-6: ISDB-T Analysis – TMCC Parameter

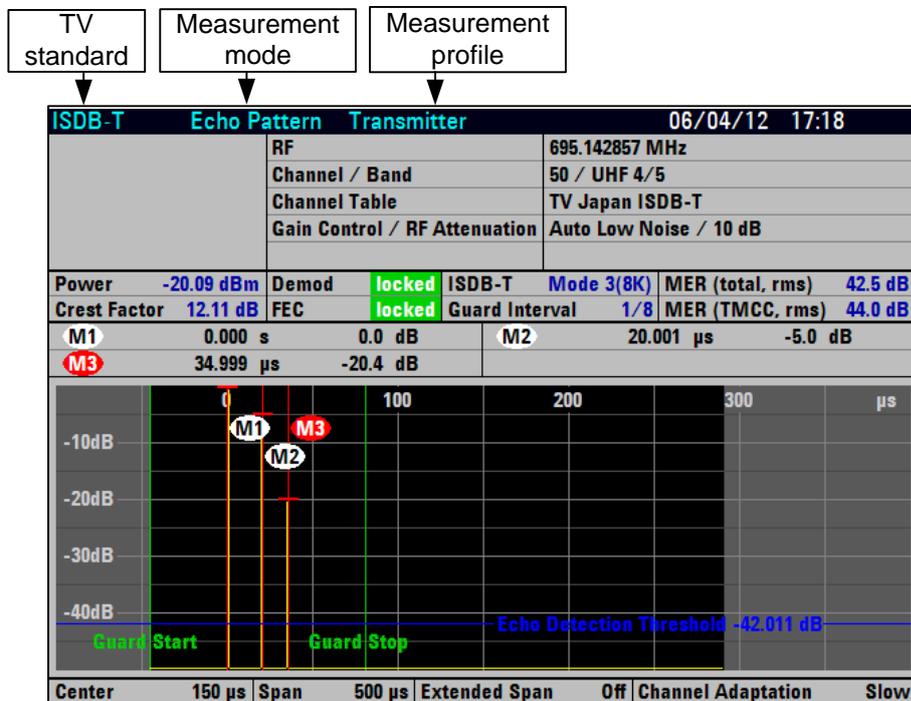


Fig. 1-7: Echo Pattern Measurement

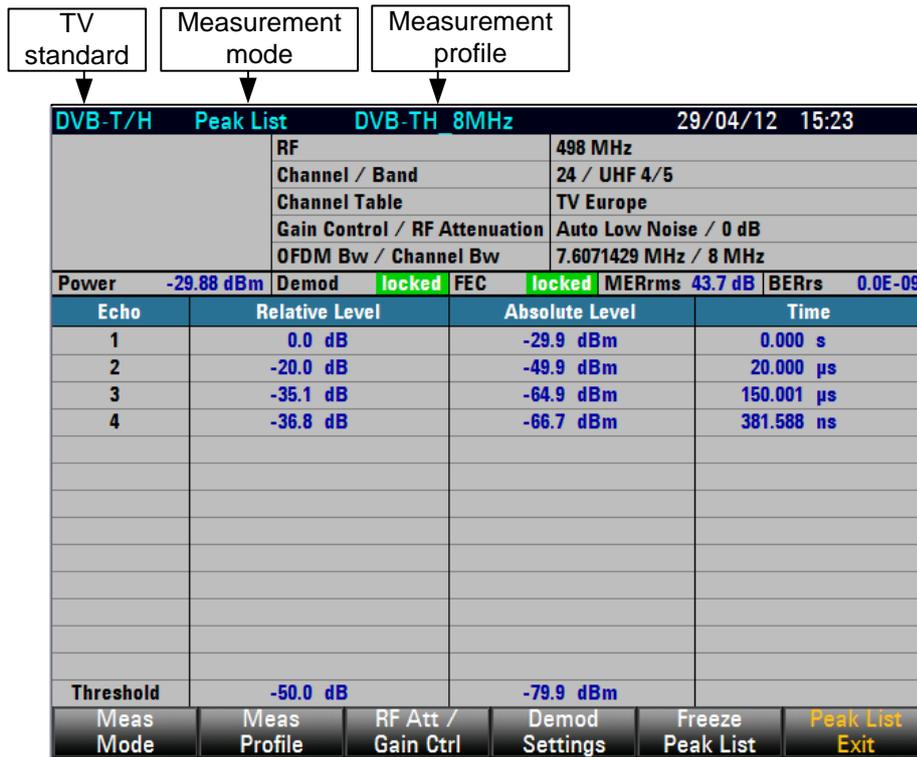


Fig. 1-8: Echo Pattern Peak List

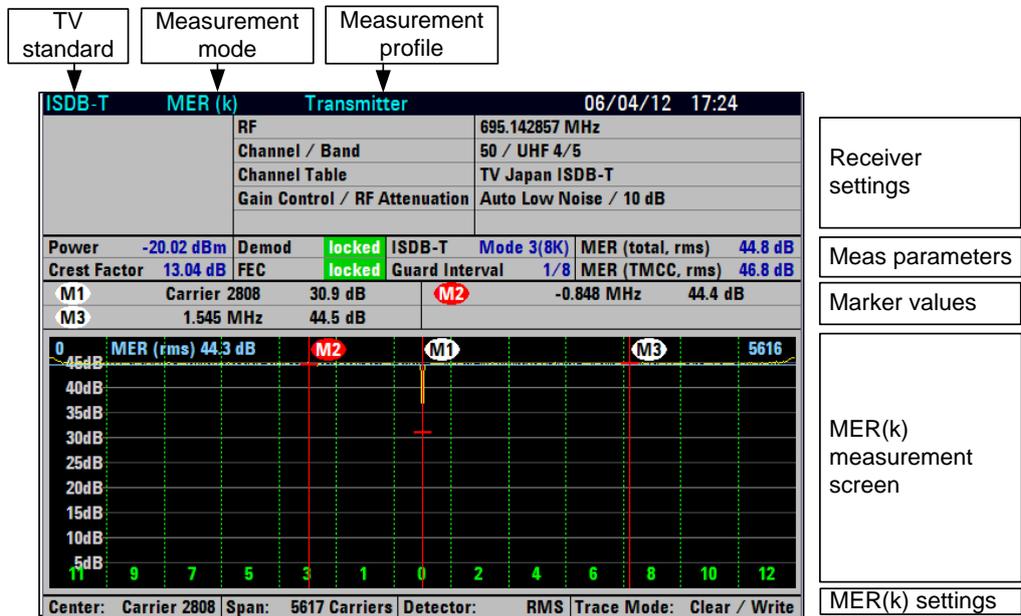


Fig. 1-9: MER(k) Measurement

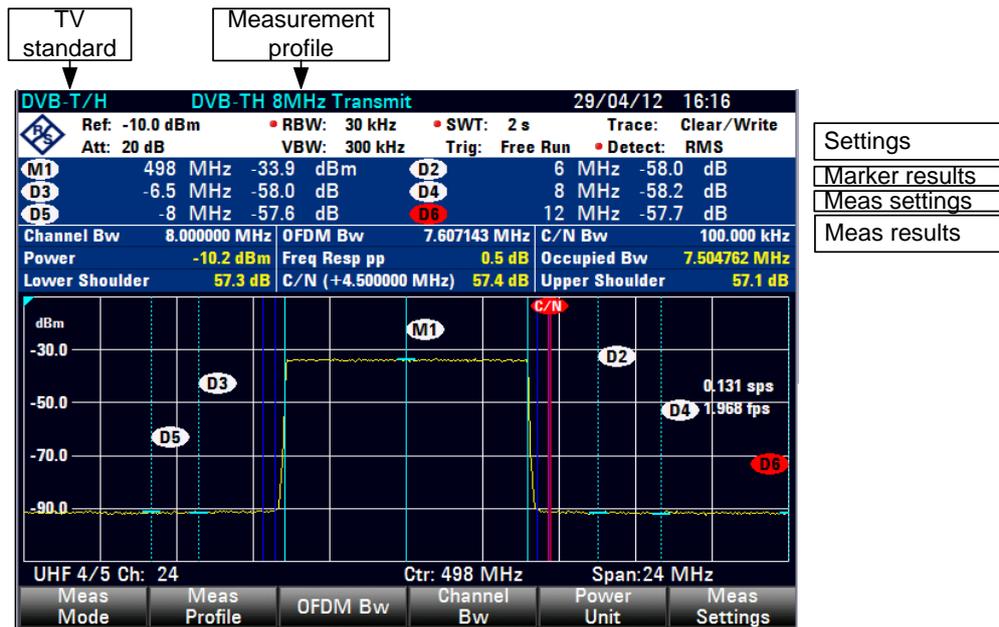


Fig. 1-10: TV Spectrum Measurement



- (1) TV standards
- (2) TV measurement mode
- (3) Measurement profile
- (4) Spectrum analyzer settings
- (5) Marker area
- (6) Transmission channel parameters
- (7) Emission mask results
- (8) Emission mask list
- (9) Emission mask scroll bar
- (10) Emission mask limit line
- (11) Trace
- (12) Absolute marker
- (13) Delta marker

Fig. 1-11: TV Spectrum Emission Mask Measurement

### 1.3.2 Spectrum Analyzer

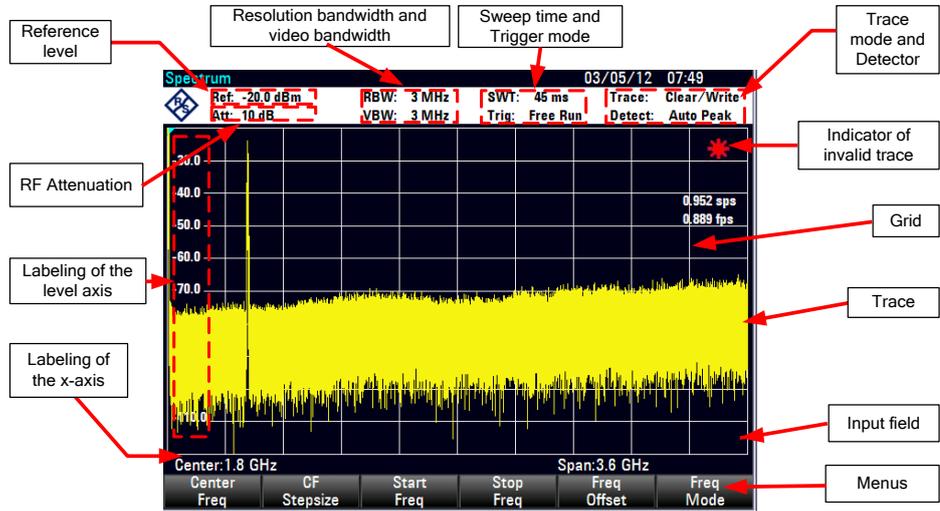


Fig. 1-12: Spectrum Analyzer without markers

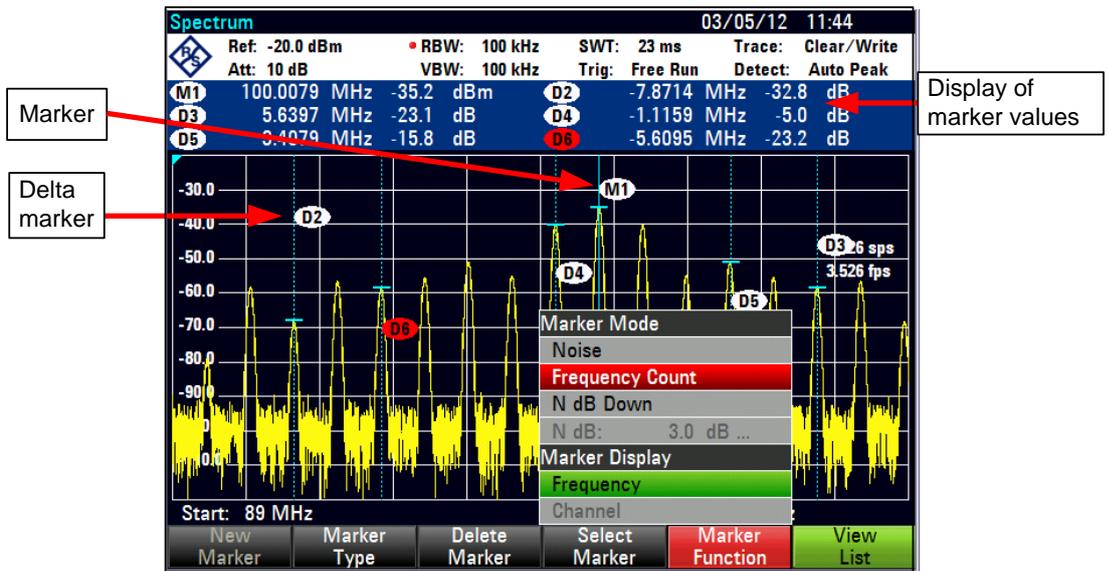


Fig. 1-13: Spectrum Analyzer with markers

The color of the menu and its background indicate the status of the menu in question:

Menu color	Meaning
Gray background, white labeling	Menu function is turned off

Menu color	Meaning
Gray background, gray labeling	In the current setting, this menu is not available
Green background	Menu function is turned on
Red background	Menu function has been activated for value entry or selecting a menu function

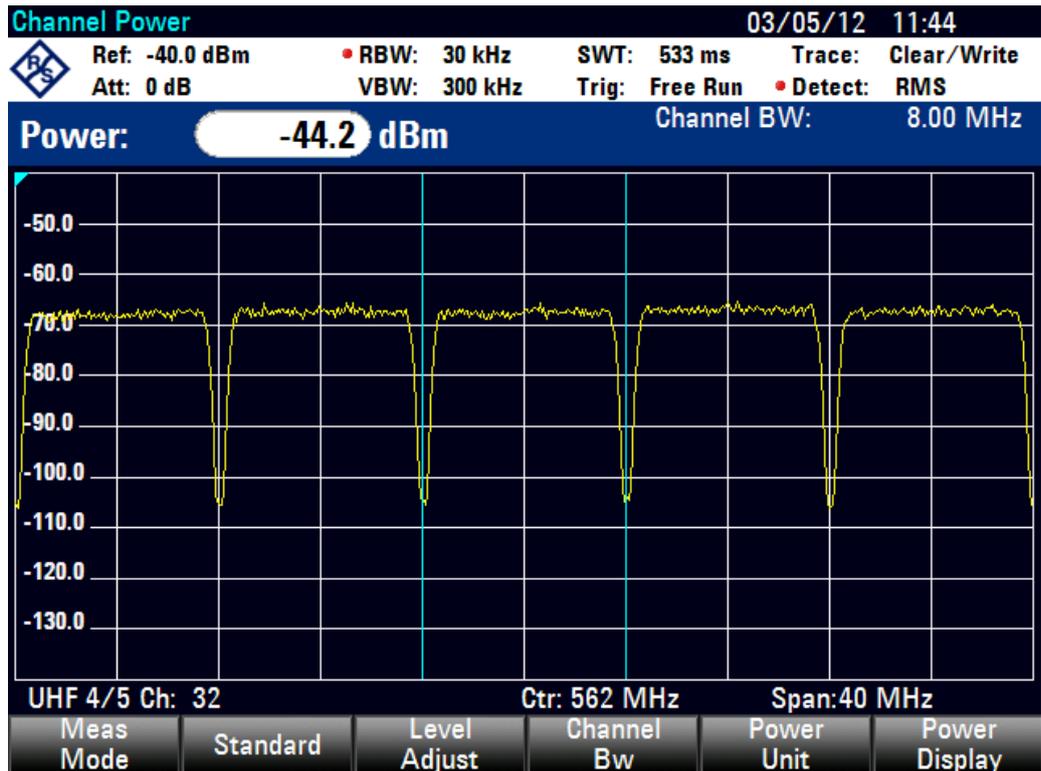


Fig. 1-14: Channel Power

- ① Standard
- ② Marker information
- ③ Channel information
- ④ TX channel (green line)
- ⑤ Adj channel (green line)
- ⑥ Alt channel (green line)
- ⑦ Marker (blue line)
- ⑧ ACP menu

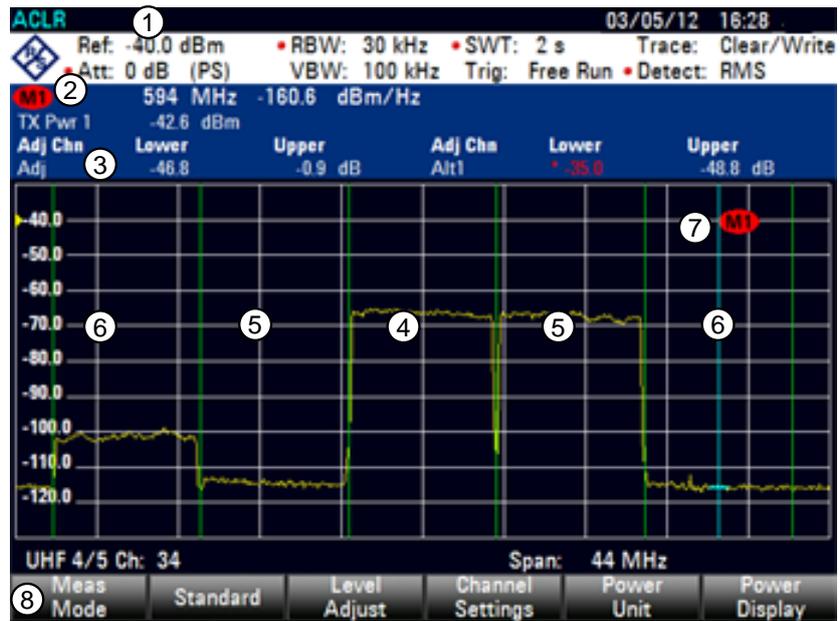


Fig. 1-15: Adjacent Channel Power

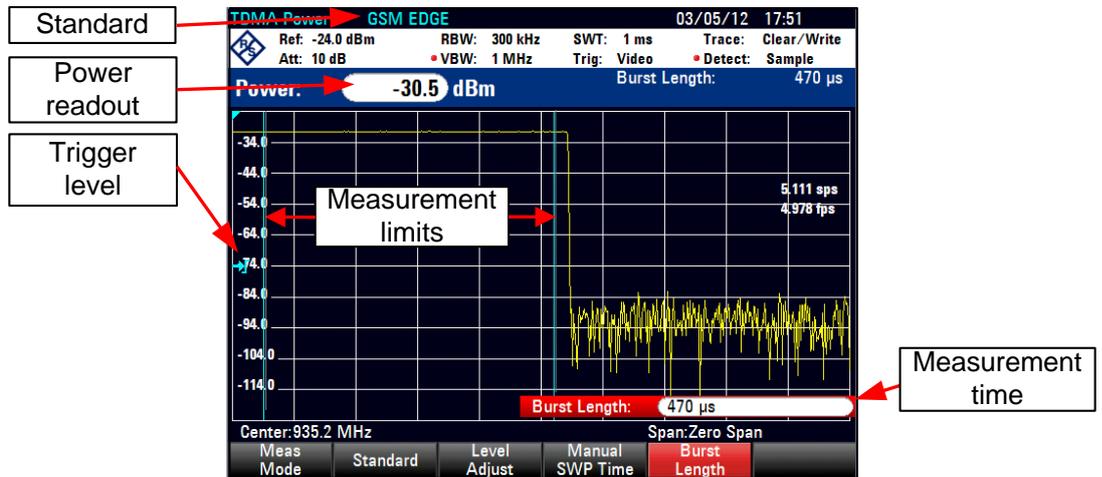
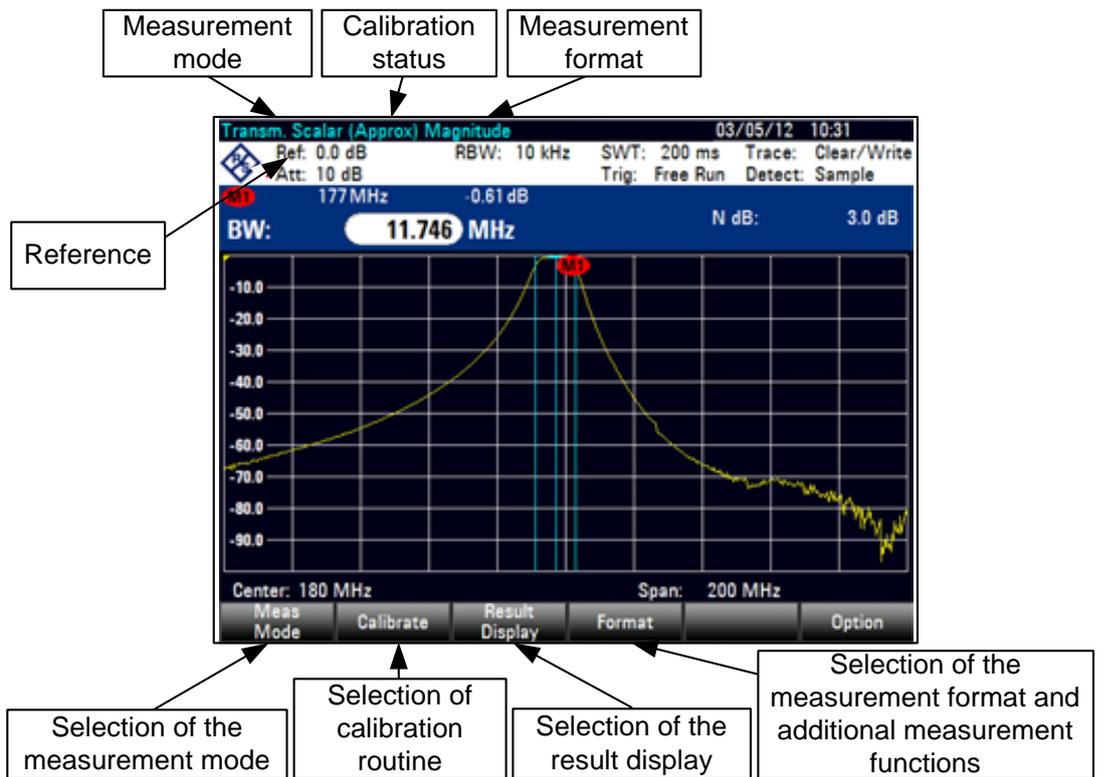


Fig. 1-16: TDMA Power

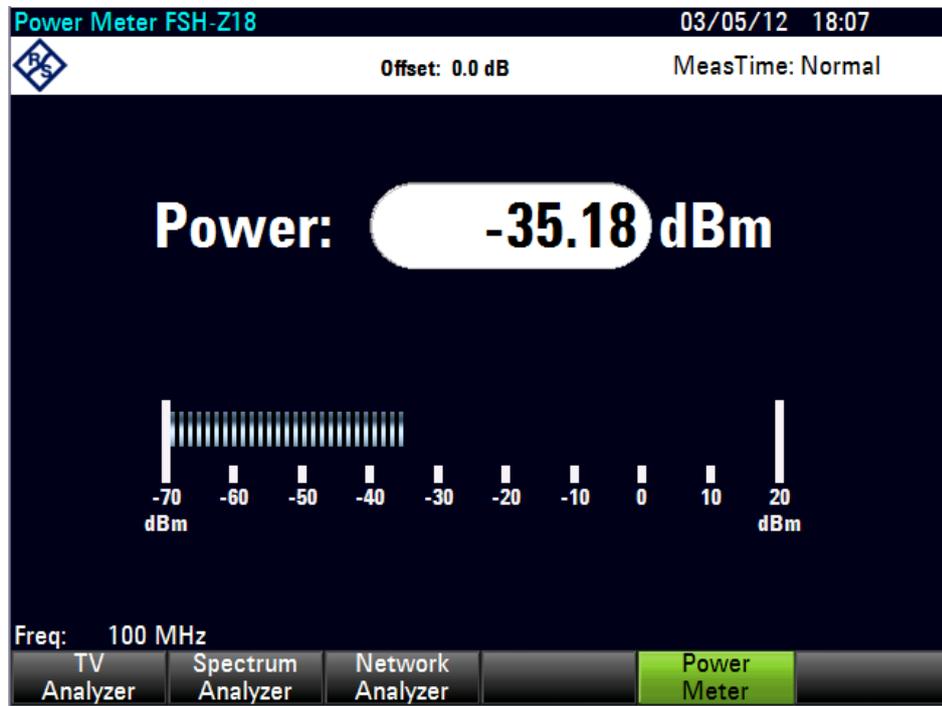


Fig. 1-17: Occupied Bandwidth

### 1.3.3 Network Analyzer



### 1.3.4 Power Meter



## 1.4 Menu Overview

This chapter describes the menus of all measurement modes.

### 1.4.1 Menus Available for All Measurement Modes

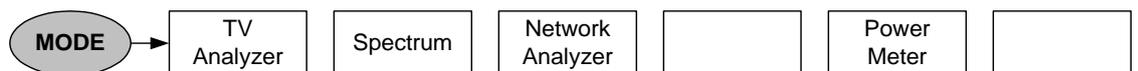


Fig. 1-18: Measurement mode selection (MODE menu)

The TV RECEIVER and NETWORK ANALYZER instrument modes are only available if the corresponding software options are activated.

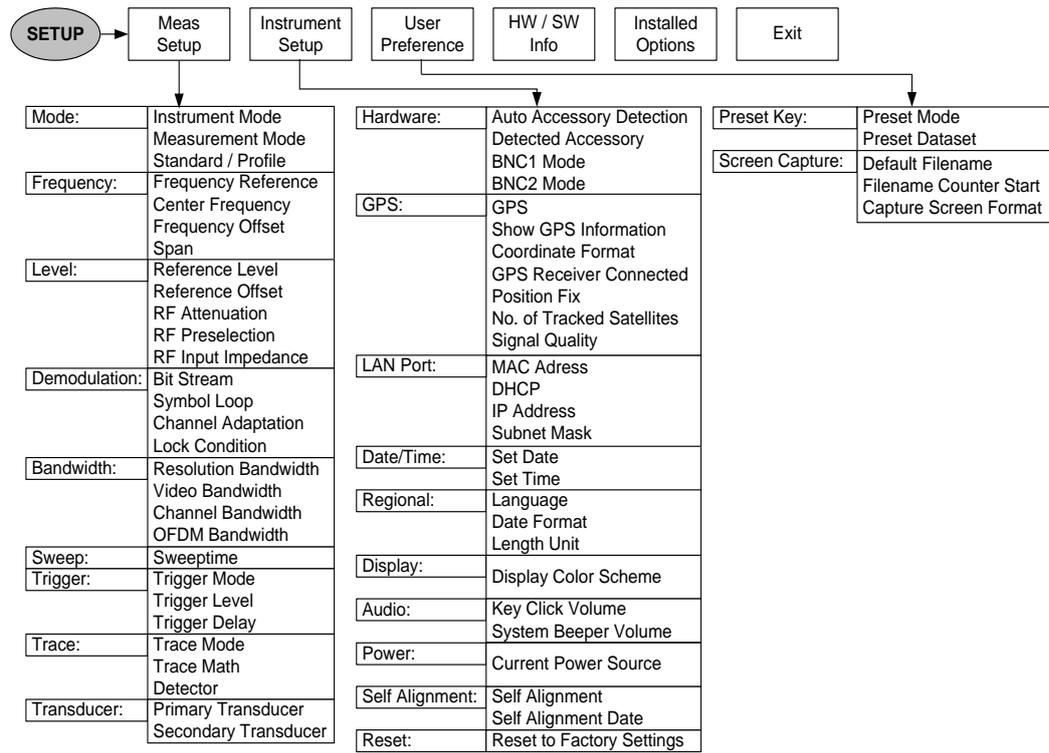


Fig. 1-19: General settings (SETUP menu)

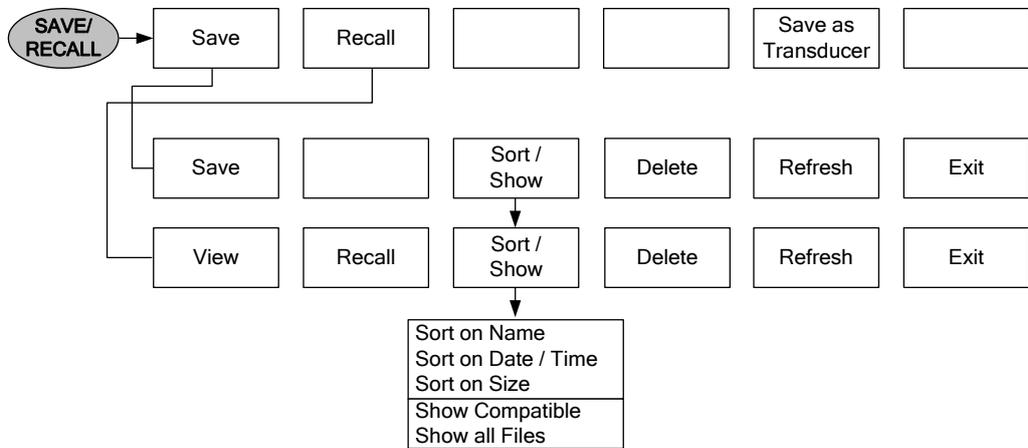


Fig. 1-20: File management (SAVE/RECALL menu)

The SAVE AS TRANSDUCER menu element is only available in the NETWORK ANALYZER instrument mode.

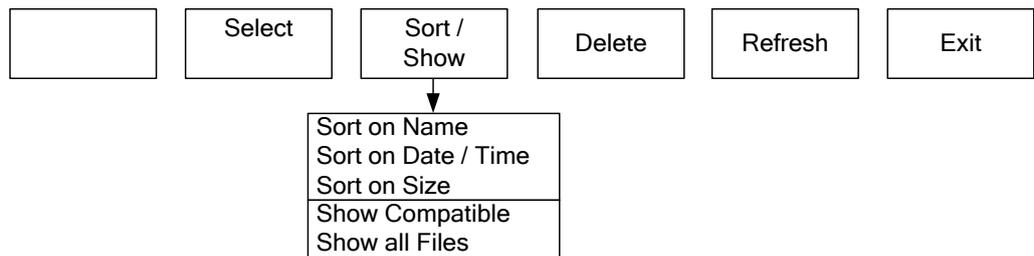


Fig. 1-21: Tables

## 1.4.2 Menus of the DVB-T/H Analyzer

### 1.4.2.1 DVB-T/H Measurement List

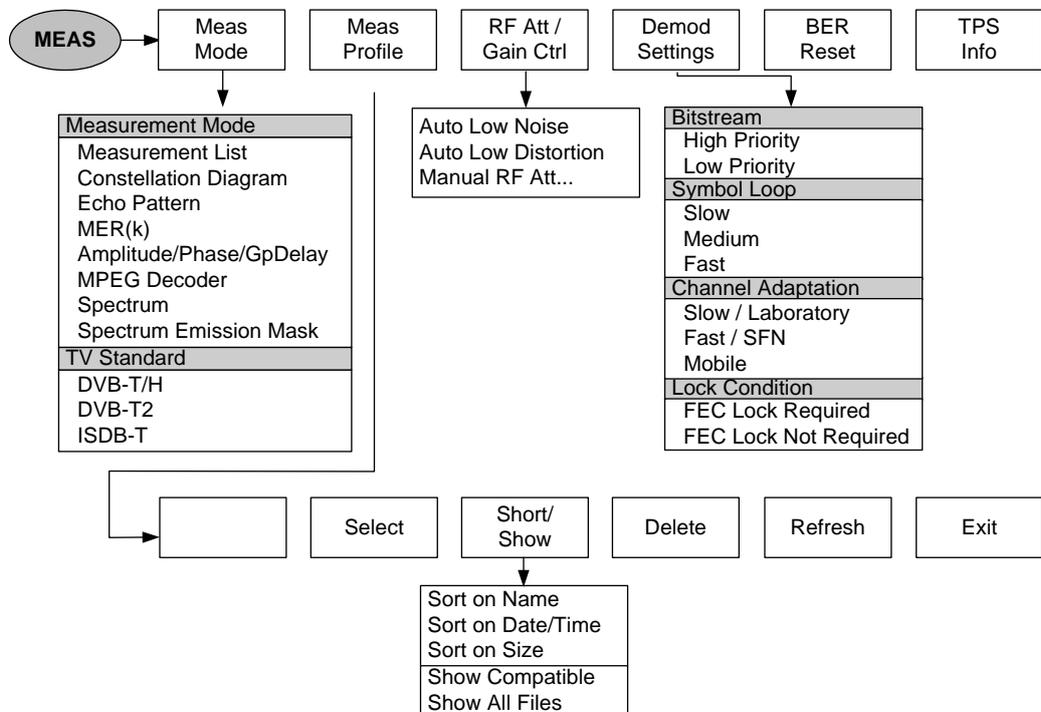


Fig. 1-22: MEAS menu for DVB-T/H Measurement List

### 1.4.2.2 TPS Parameter

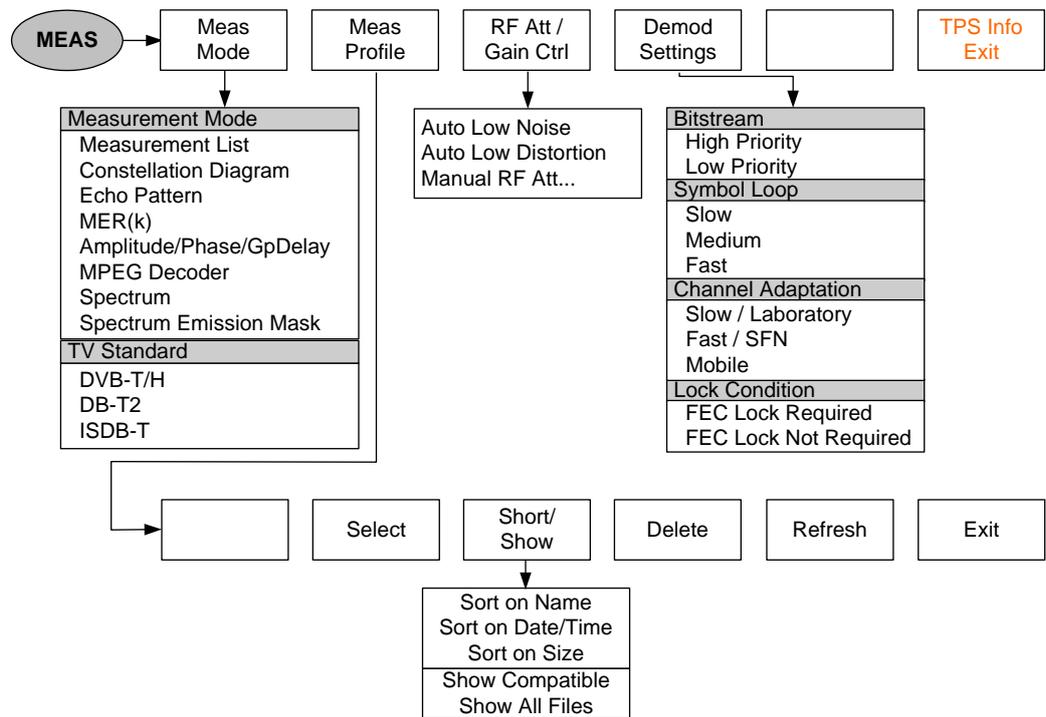


Fig. 1-23: MEAS menu for DVB-T/H TPS Parameter

### 1.4.2.3 DVB-T/H Constellation Diagram

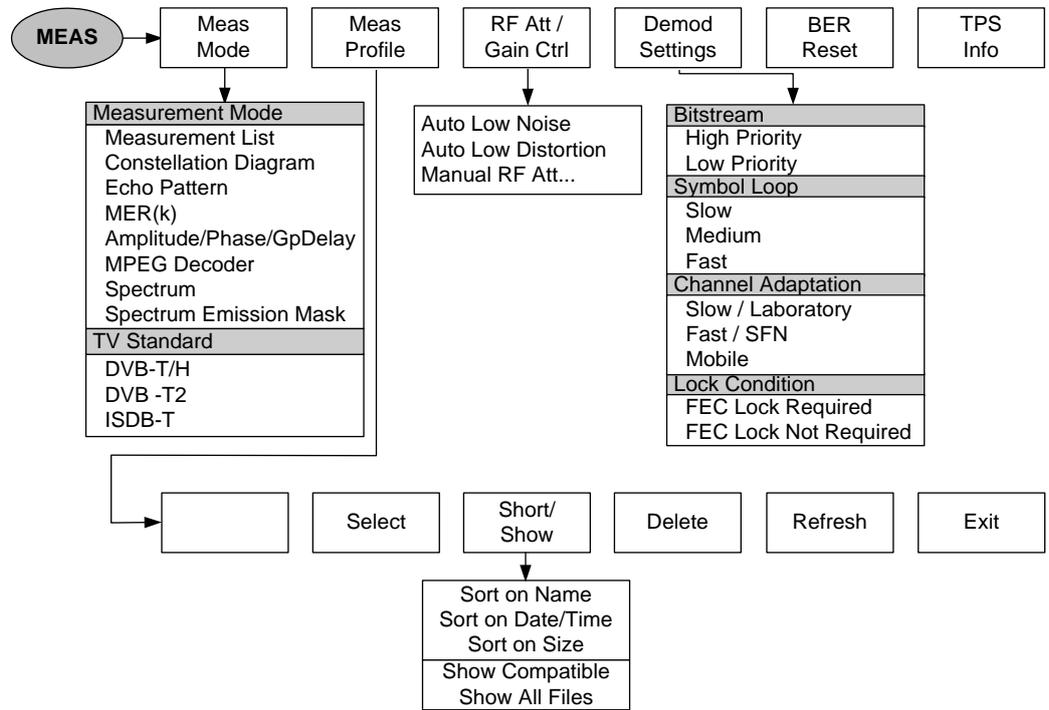


Fig. 1-24: MEAS menu for DVB-T/H Constellation Diagram



Fig. 1-25: TRACE menu for DVB-T/H Constellation Diagram

### 1.4.2.4 DVB-T/H Echo Pattern

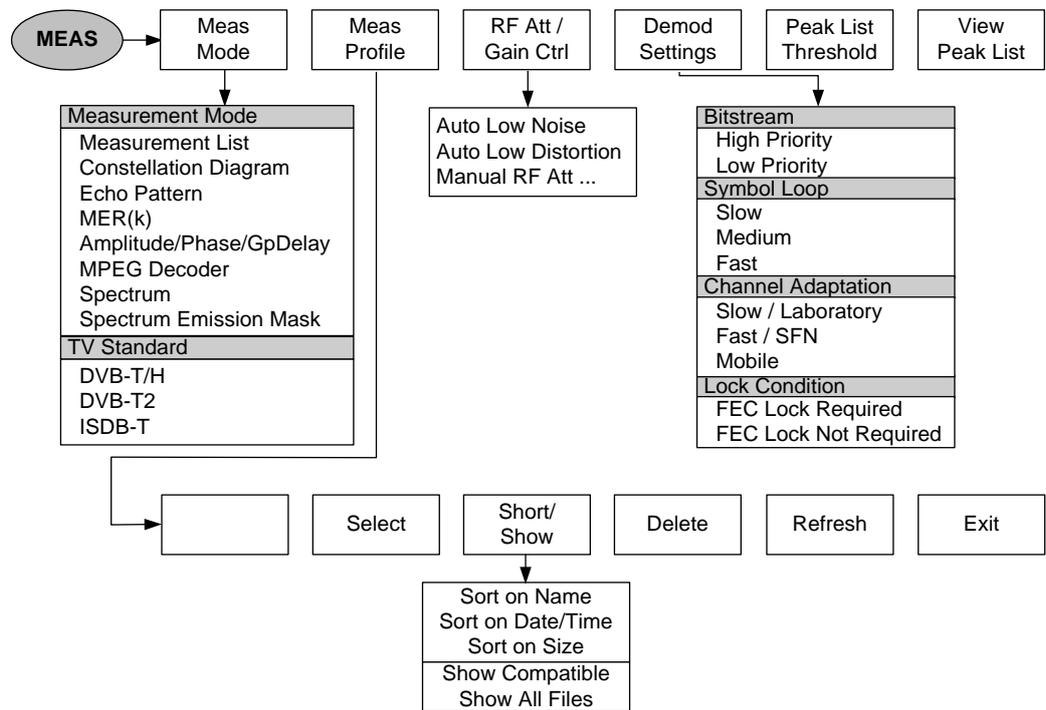


Fig. 1-26: MEAS menu for DVB-T/H Echo Pattern

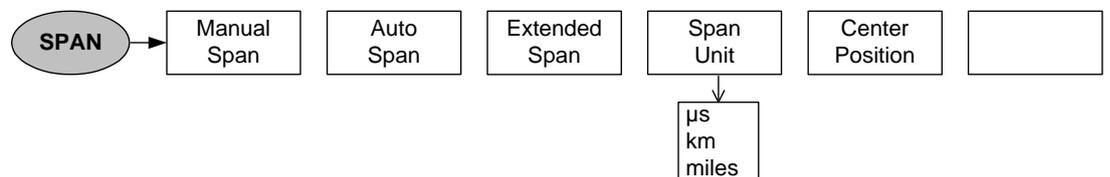


Fig. 1-27: SPAN menu for DVB-T/H Echo Pattern

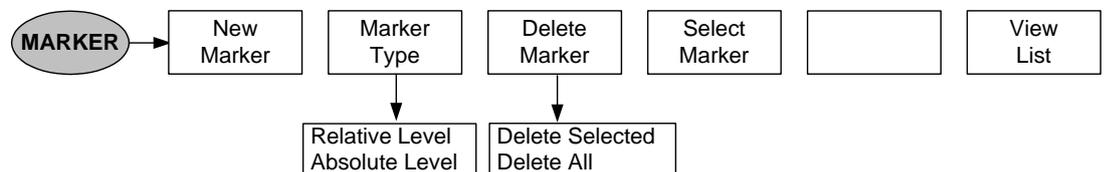


Fig. 1-28: MARKER menu for DVB-T/H Echo Pattern

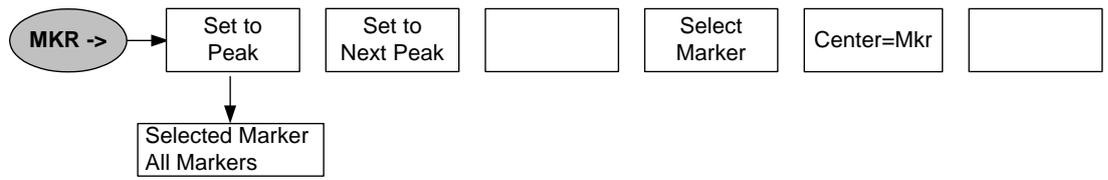


Fig. 1-29: Marker position (MKR menu) for DVB-T/H Echo Pattern

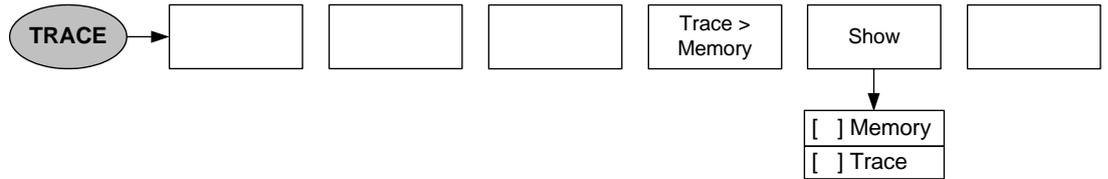


Fig. 1-30: TRACE menu for DVB-T/H Echo Pattern

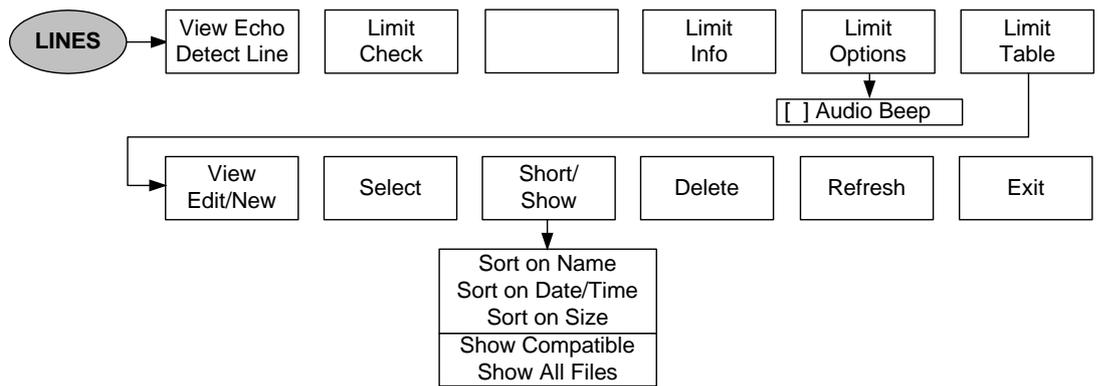


Fig. 1-31: Echo detection line (LINES menu) for DVB-T/H Echo Pattern

### 1.4.2.5 DVB-T/H Echo Pattern Peak List

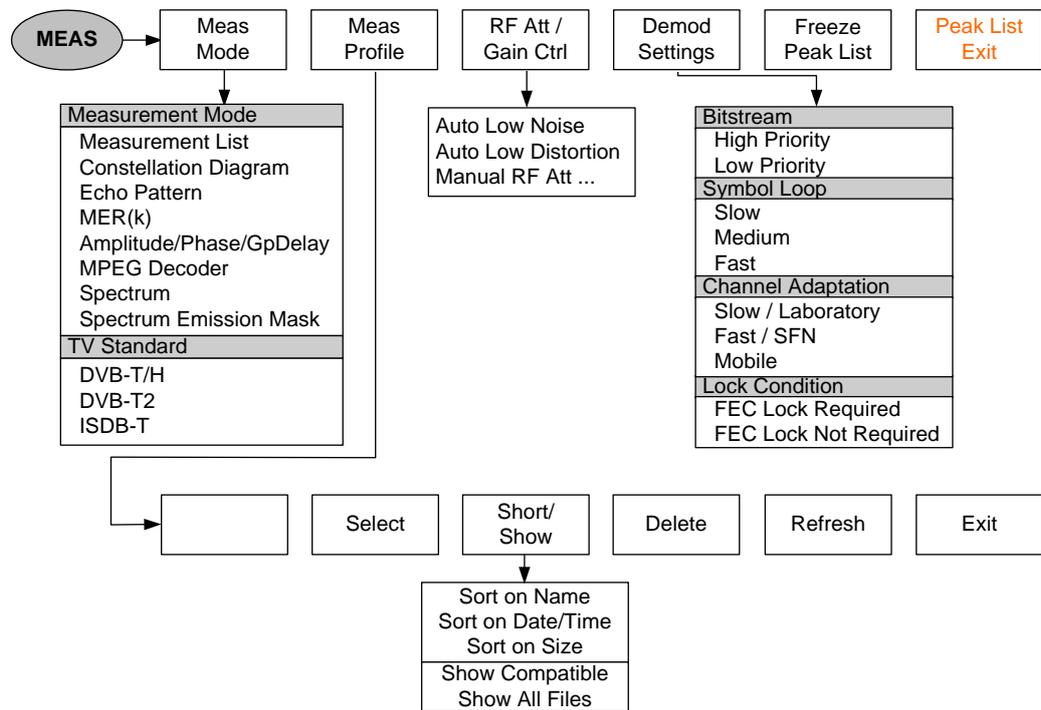


Fig. 1-32: MEAS menu for DVB-T/H Echo Pattern Peak List

### 1.4.2.6 DVB-T/H MER(k)

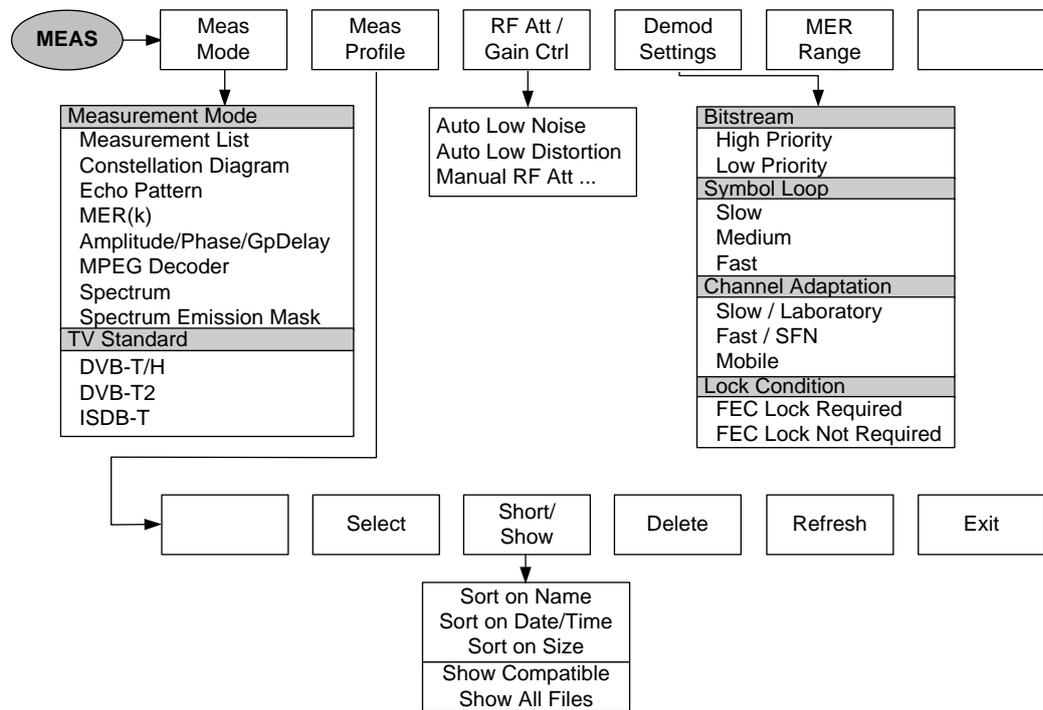


Fig. 1-33: MEAS menu for DVB-T/H MER(k)

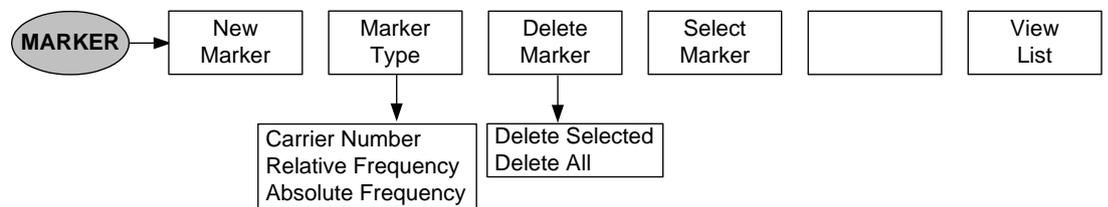


Fig. 1-34: MARKER menu for DVB-T/H MER(k)

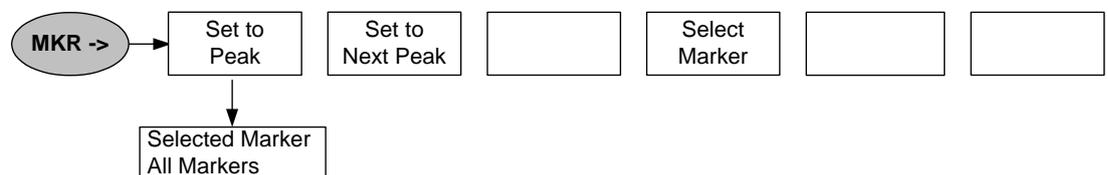


Fig. 1-35: Marker position (MKR menu) for DVB-T/H MER(k)

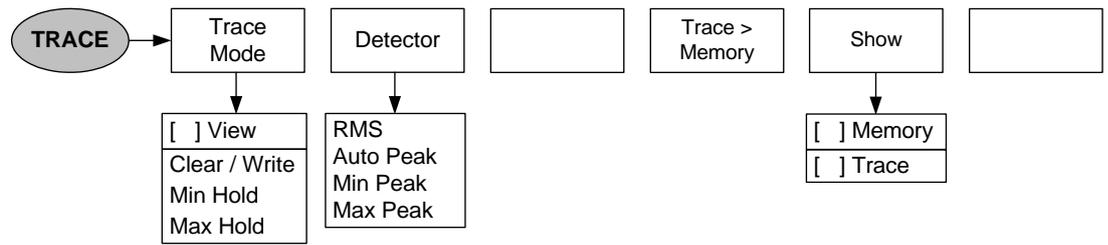
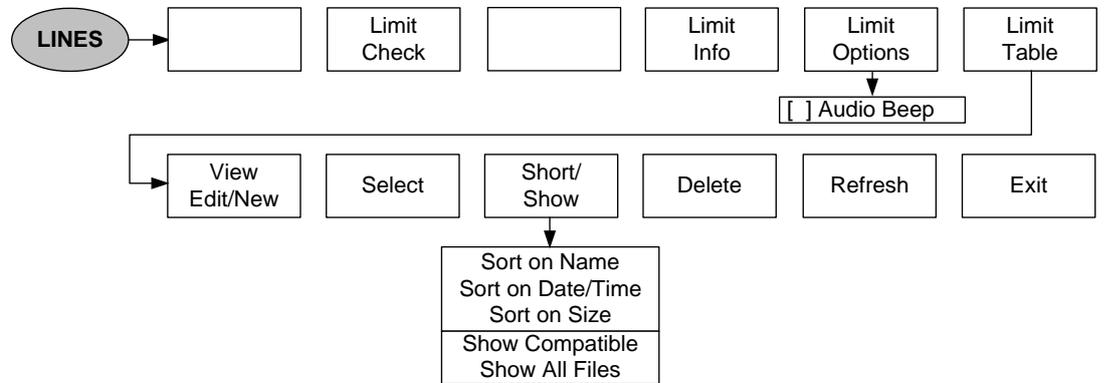
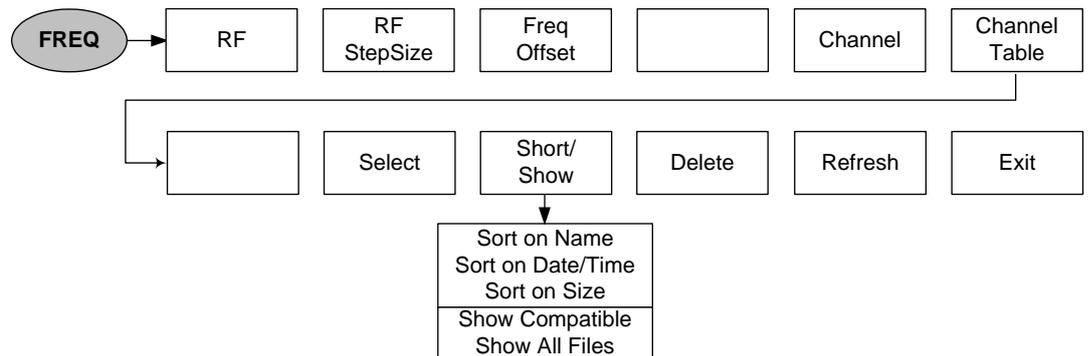


Fig. 1-36: TRACE menu for DVB-T/H MER(k)

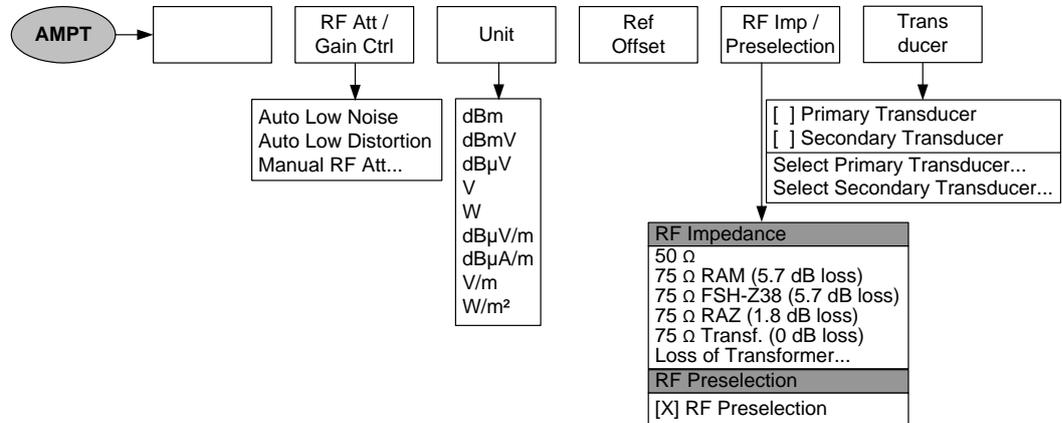
### 1.4.2.7 Limit Control of DVB-T/H Measurement Parameters



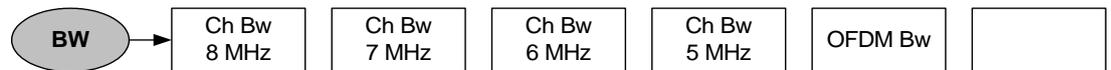
### 1.4.2.8 Frequency Entry for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



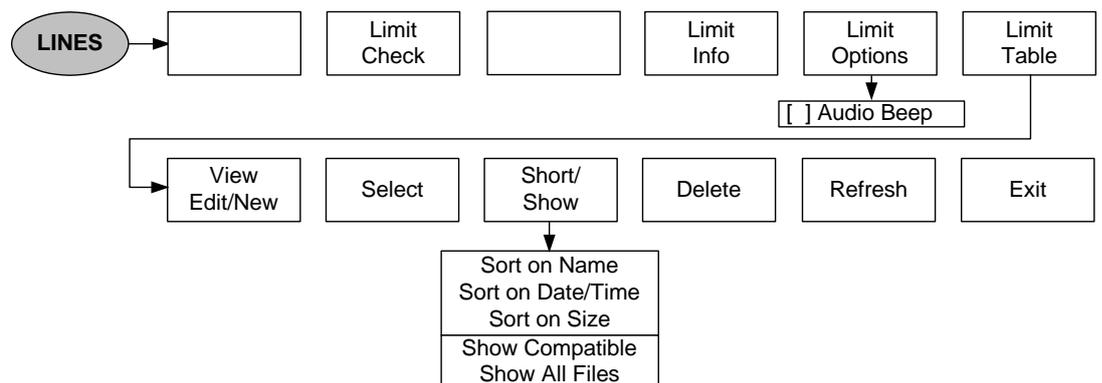
### 1.4.2.9 Level Settings for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.2.10 Bandwidth Settings for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.2.11 Limit Control of Measurement Parameters for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.3 Menus of the ISDB-T Analyzer

#### 1.4.3.1 ISDB-T Measurement List

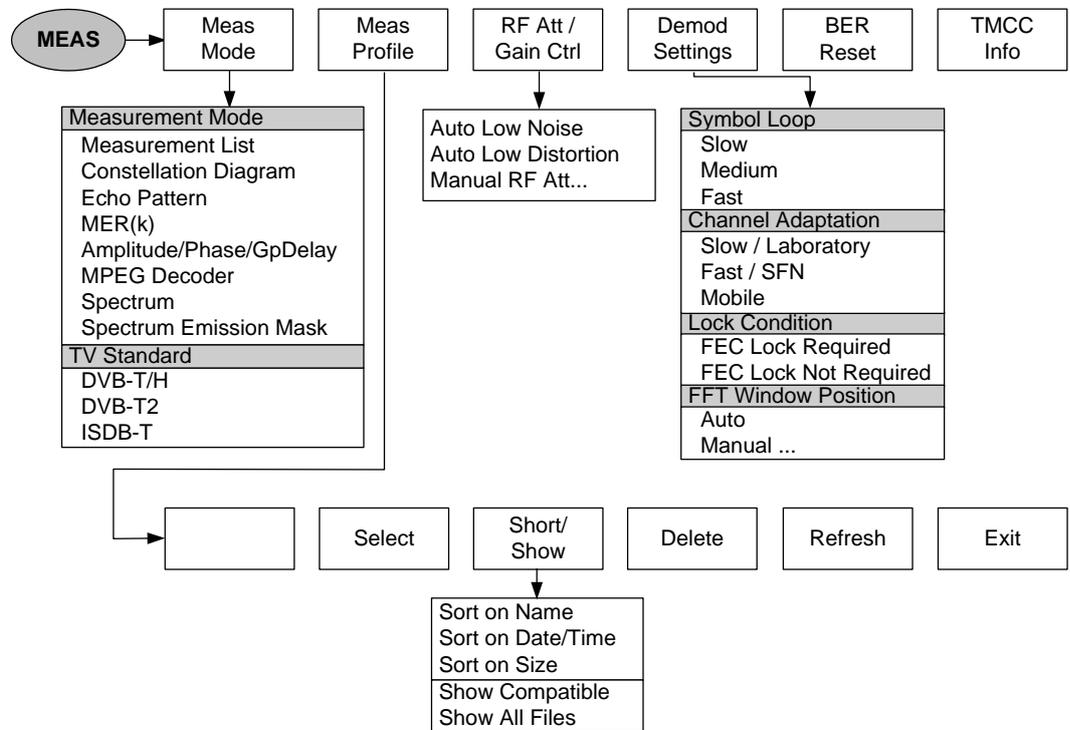


Fig. 1-37: MEAS menu for ISDB-T Measurement List

### 1.4.3.2 TMCC Parameter

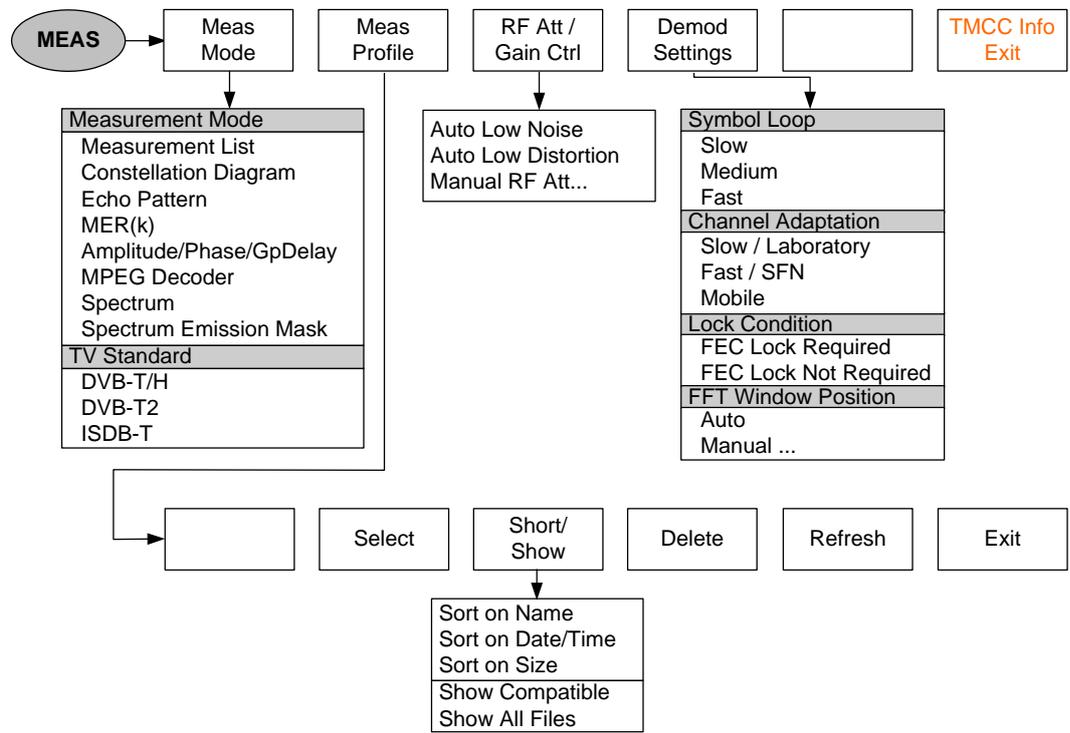


Fig. 1-38: MEAS menu for ISDB-T TMCC

### 1.4.3.3 ISDB-T Constellation Diagram

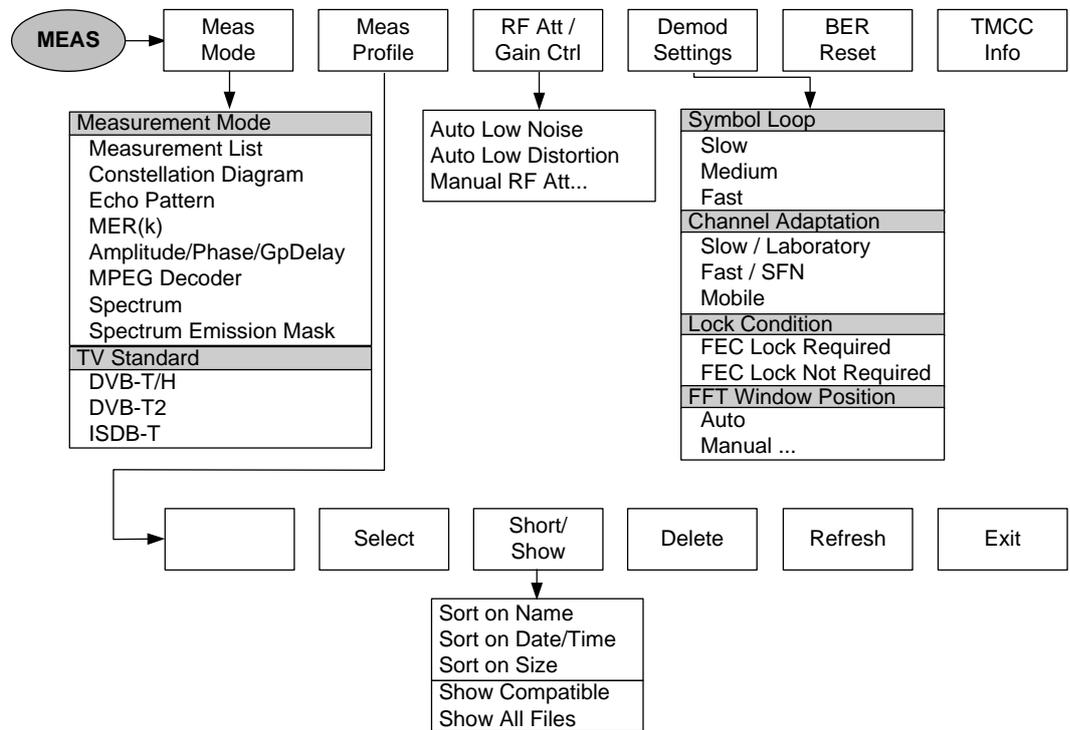


Fig. 1-39: MEAS menu for ISDB-T Constellation Diagram



Fig. 1-40: TRACE menu for ISDB-T Constellation Diagram

### 1.4.3.4 ISDB-T Echo Pattern

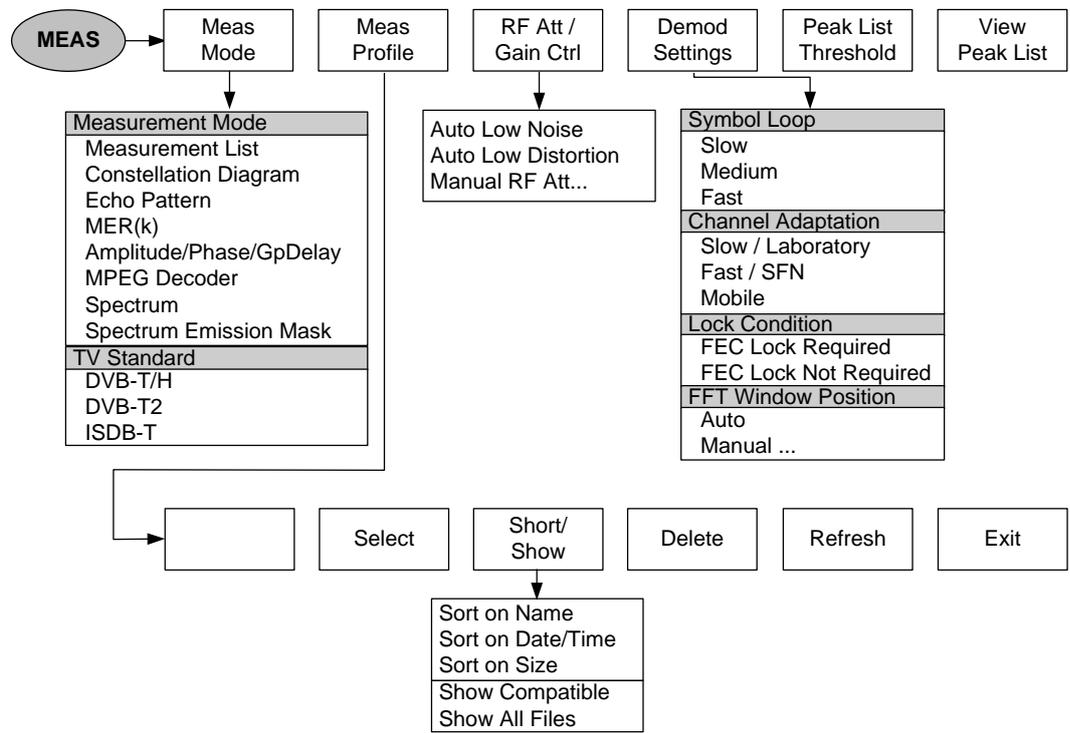


Fig. 1-41: MEAS menu for ISDB-T Echo Pattern

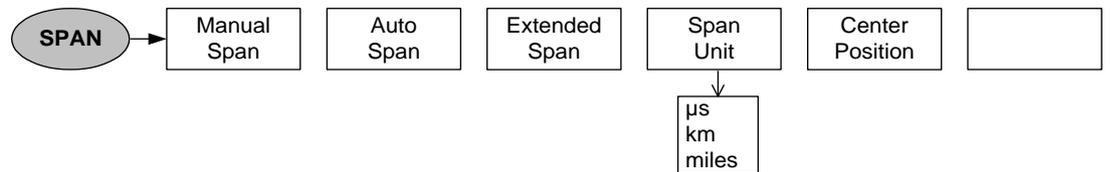


Fig. 1-42: SPAN menu for ISDB-T Echo Pattern

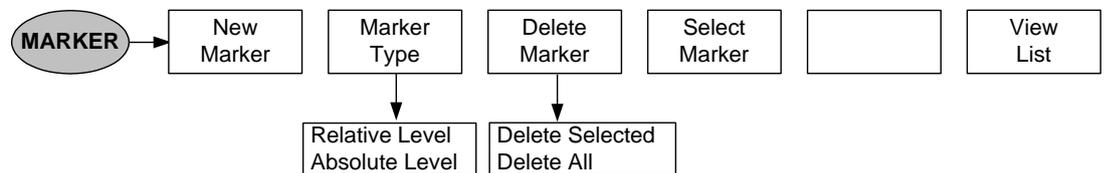


Fig. 1-43: MARKER menu for ISDB-T Echo Pattern

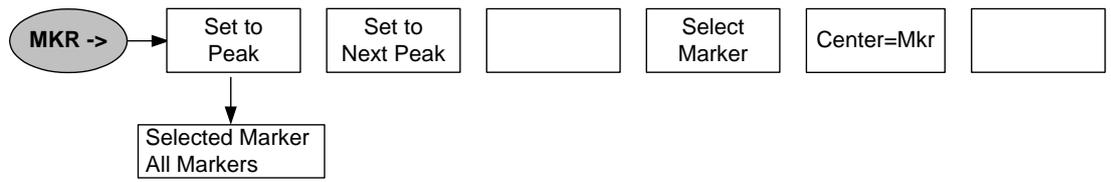


Fig. 1-44: Marker position (MKR menu) for ISDB-T Echo Pattern

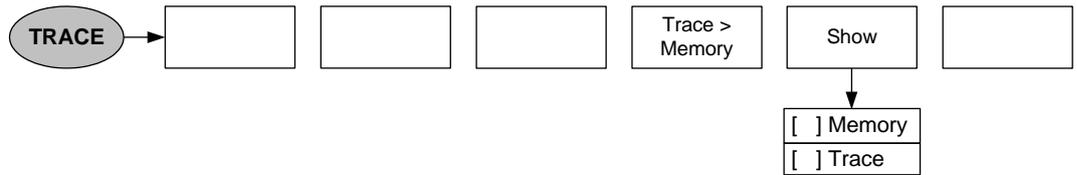


Fig. 1-45: TRACE menu for ISDB-T Echo Pattern

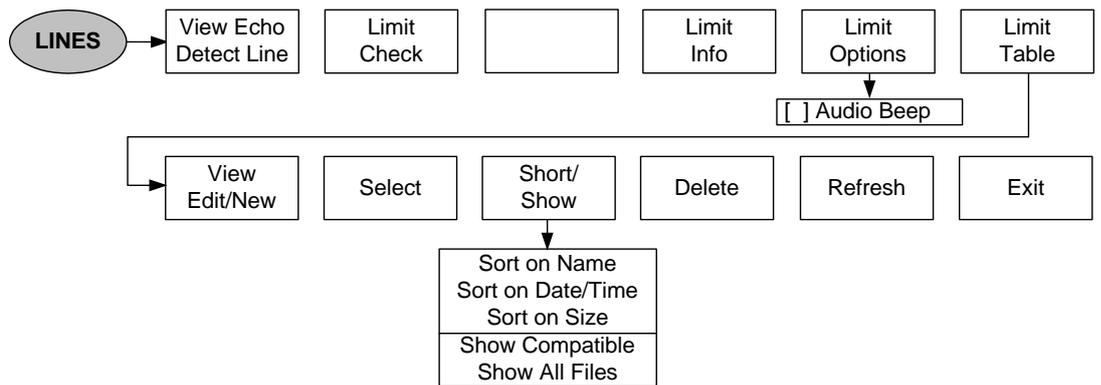


Fig. 1-46: Echo detection line (LINES menu) for ISDB-T Echo Pattern

### 1.4.3.5 ISDB-T Echo Pattern Peak List

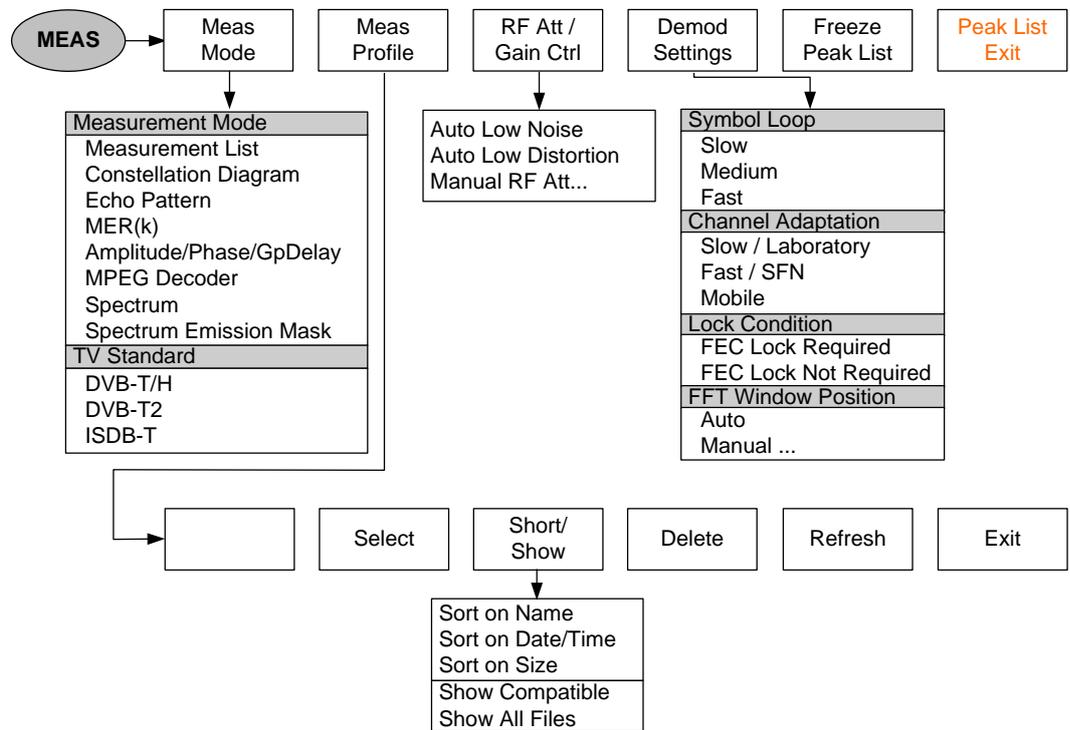


Fig. 1-47: MEAS menu for ISDB-T Echo Pattern Peak List

### 1.4.3.6 ISDB-T MER(k)

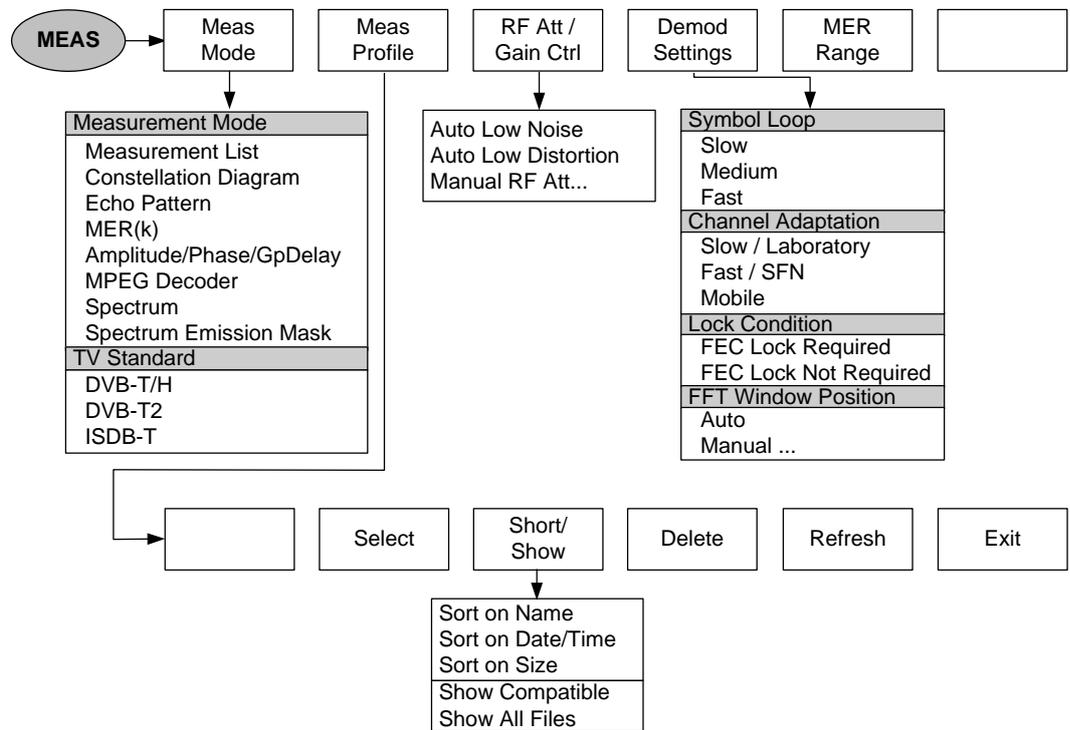


Fig. 1-48: MEAS menu for ISDB-T MER(k)

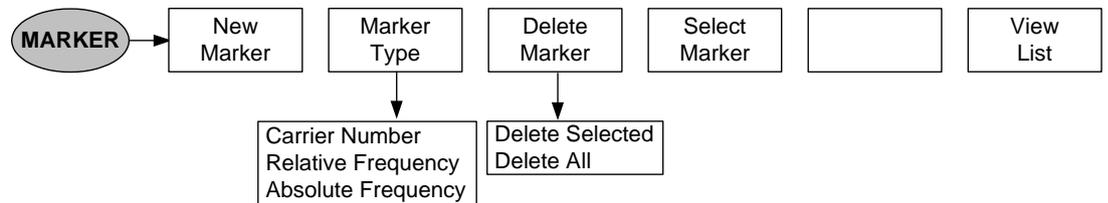


Fig. 1-49: MARKER menu for ISDB-T MER(k)

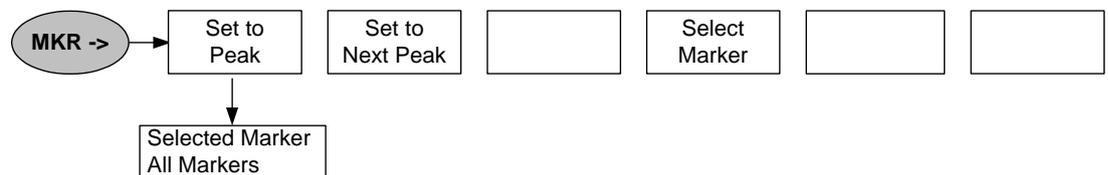


Fig. 1-50: Marker position (MKR menu) for ISDB-T MER(k)

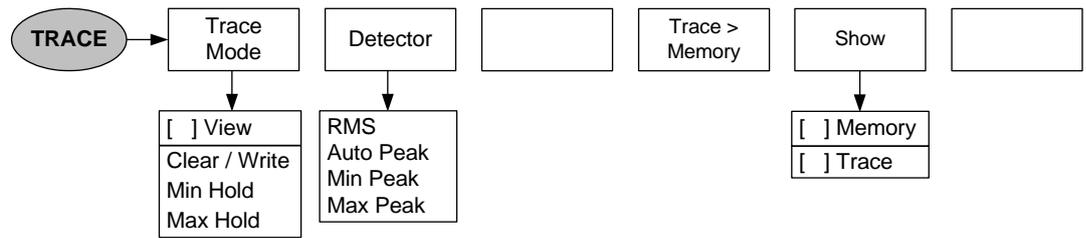
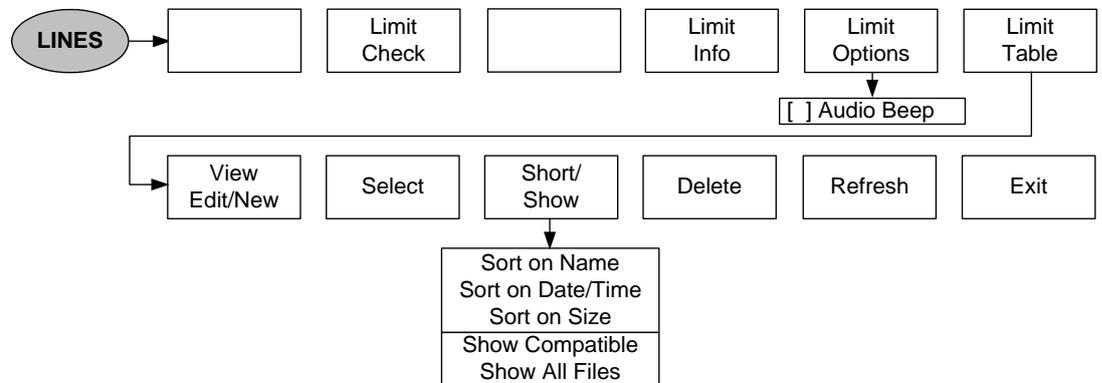
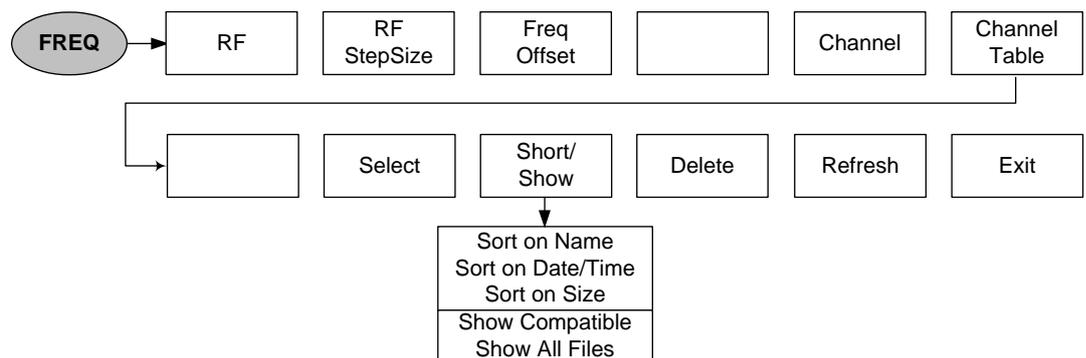


Fig. 1-51: TRACE menu for ISDB-T MER(k)

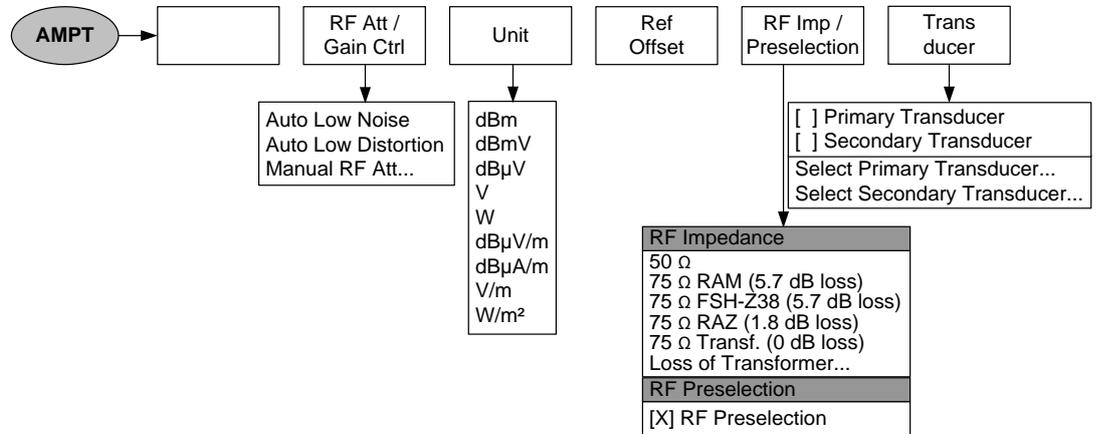
### 1.4.3.7 Limit Control of ISDB-T Measurement Parameters



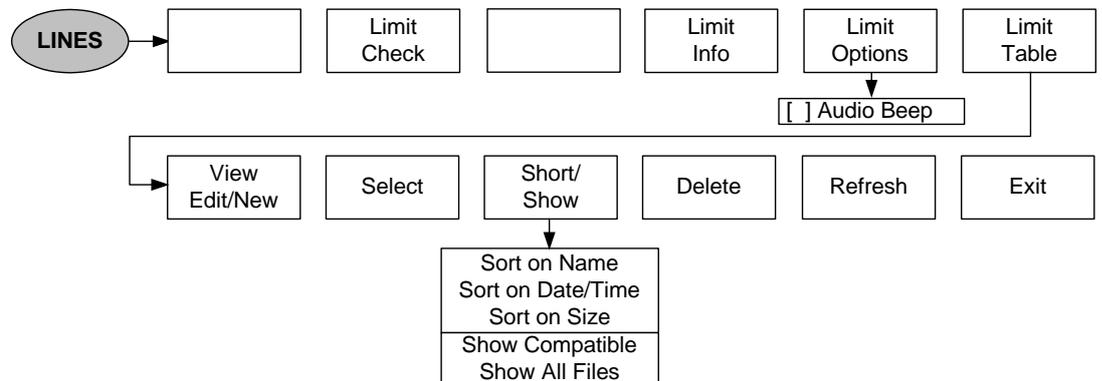
### 1.4.3.8 Frequency Entry for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.3.9 Level Settings for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.3.10 Limit Control of Measurement Parameters for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.4 Menus of the DVB-T2 Analyzer

#### 1.4.4.1 DVB-T2 Measurement List

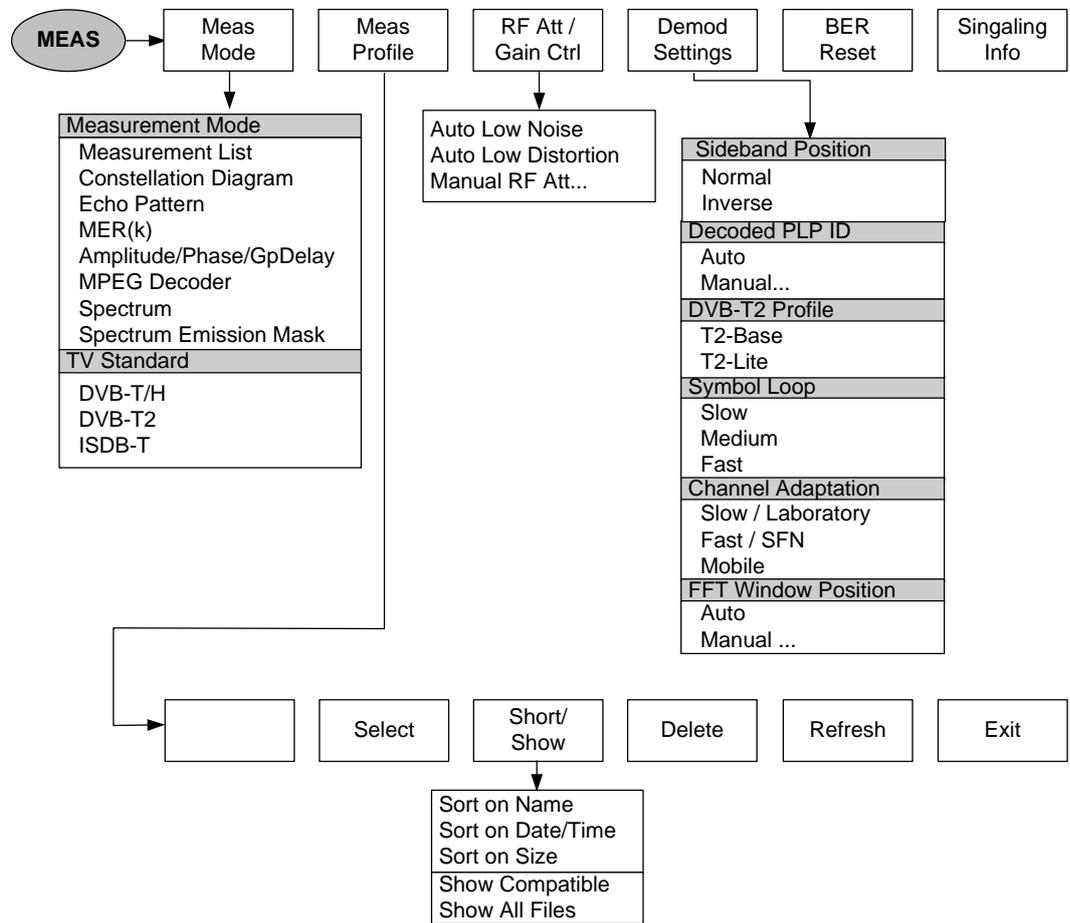


Fig. 1-52: MEAS menu for DVB-T2 Measurement List

### 1.4.4.2 PLP Signaling Info Parameter

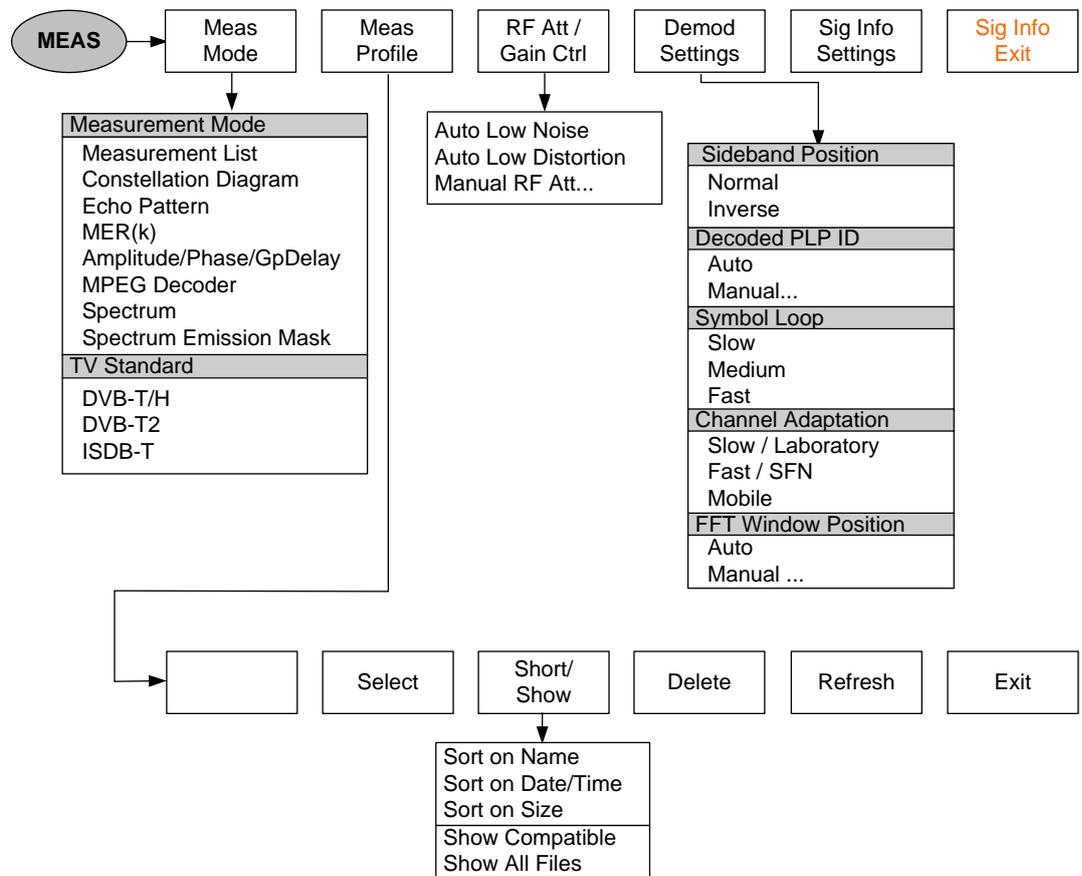


Fig. 1-53: MEAS menu for DVB-T2 PLP Signaling Info Parameter

### 1.4.4.3 DVB-T2 Constellation Diagram

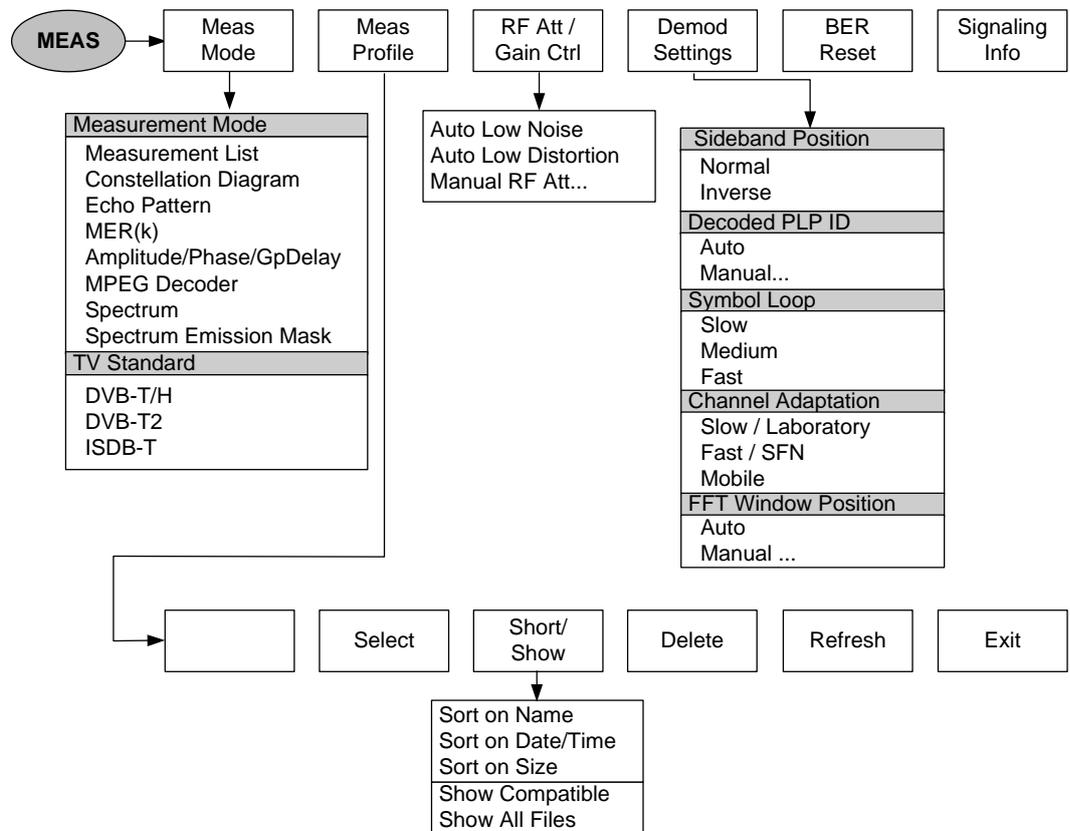


Fig. 1-54: MEAS menu for DVB-T2 Constellation Diagram



Fig. 1-55: TRACE menu for DVB-T2 Constellation Diagram

### 1.4.4.4 DVB-T2 Echo Pattern

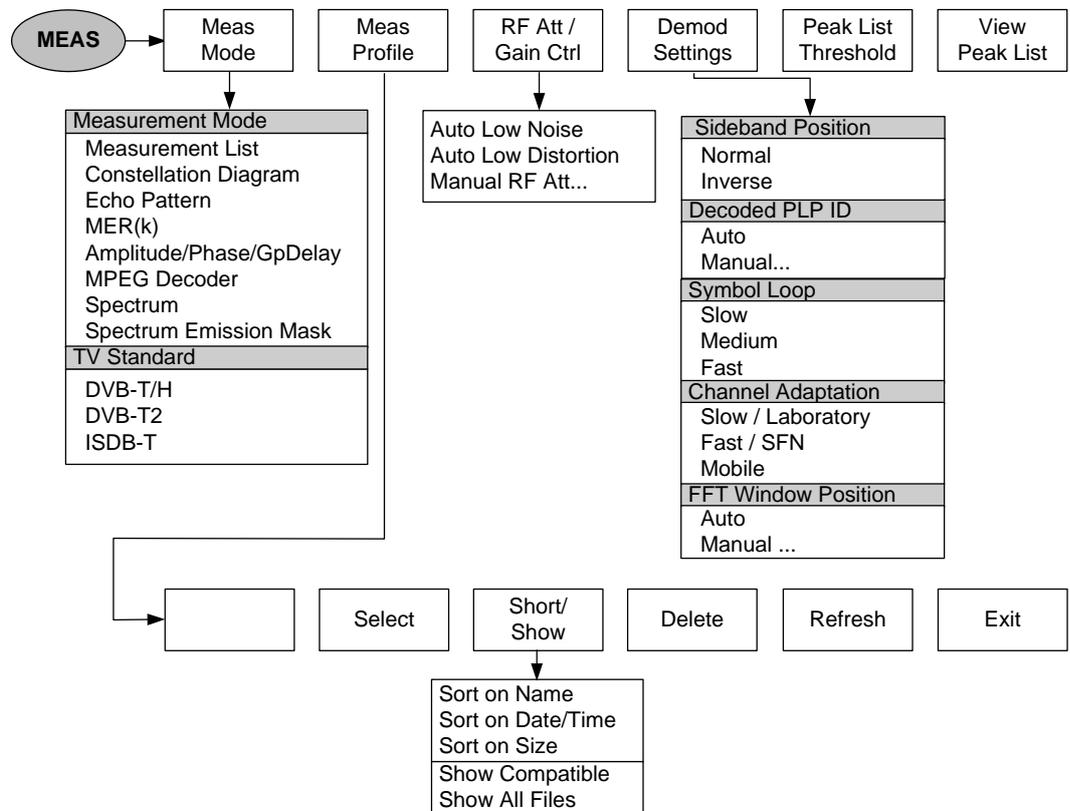


Fig. 1-56: MEAS menu for DVB-T2 Echo Pattern

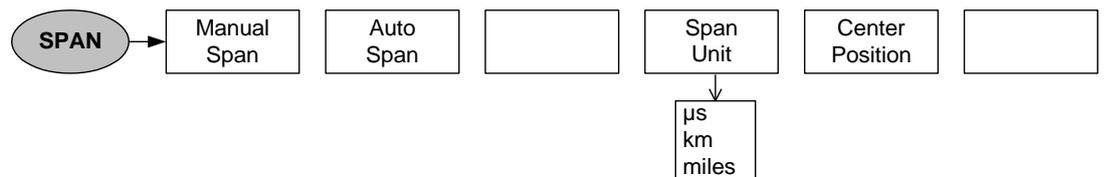


Fig. 1-57: SPAN menu for DVB-T2 Echo Pattern

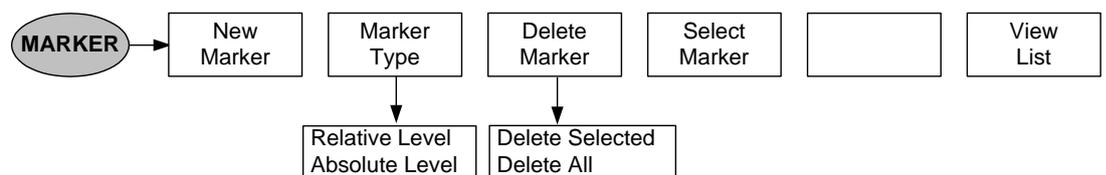


Fig. 1-58: MARKER menu for DVB-T2 Echo Pattern

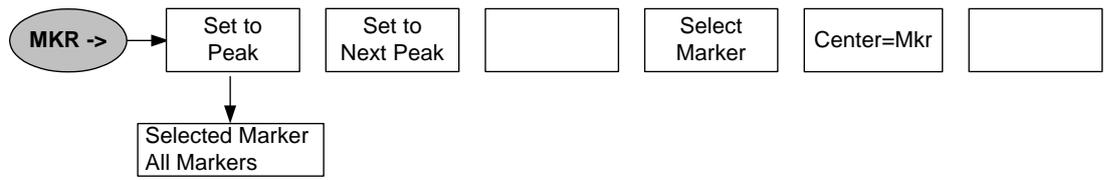


Fig. 1-59: Marker position (MKR menu) for DVB-T2 Echo Pattern

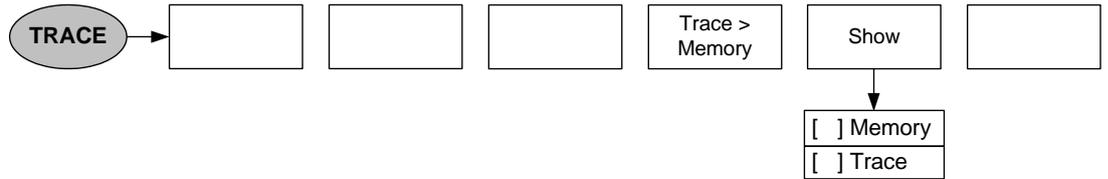


Fig. 1-60: TRACE menu for DVB-T2 Echo Pattern

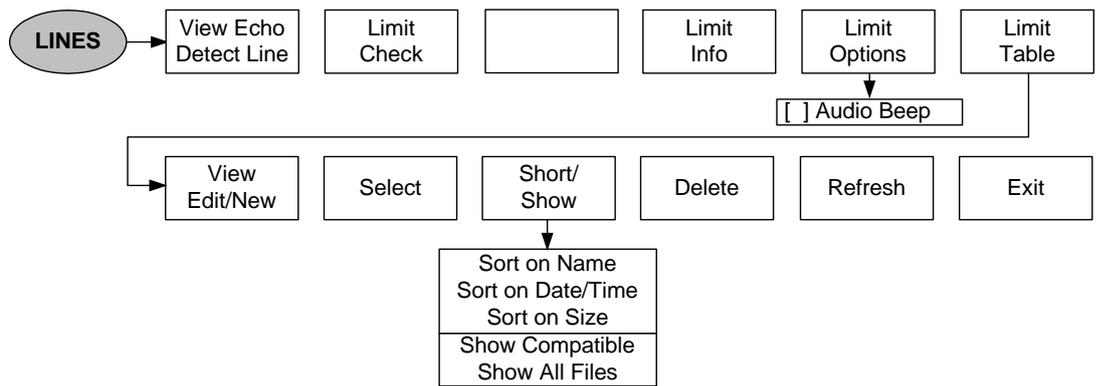


Fig. 1-61: Echo detection line (LINES menu) for DVB-T2 Echo Pattern

### 1.4.4.5 DVB-T2 Echo Pattern Peak List

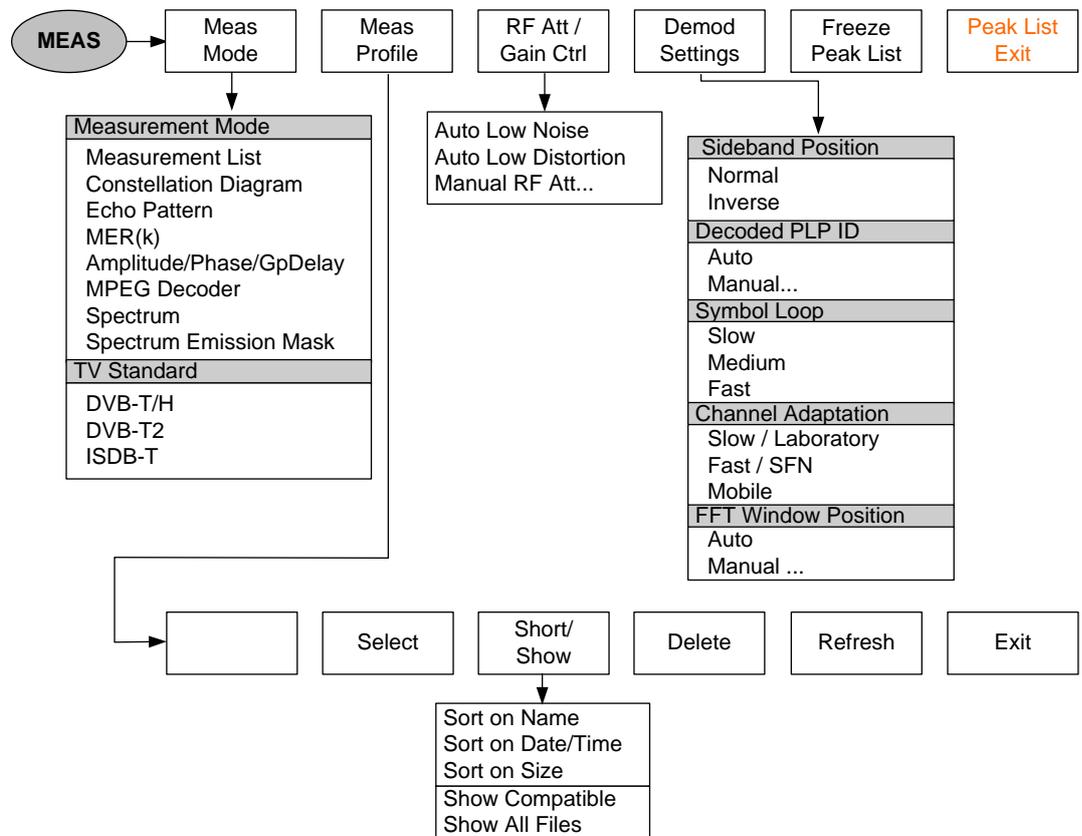


Fig. 1-62: MEAS menu for DVB-T2 Echo Pattern Peak List

1.4.4.6 DVB-T2 MER(k)

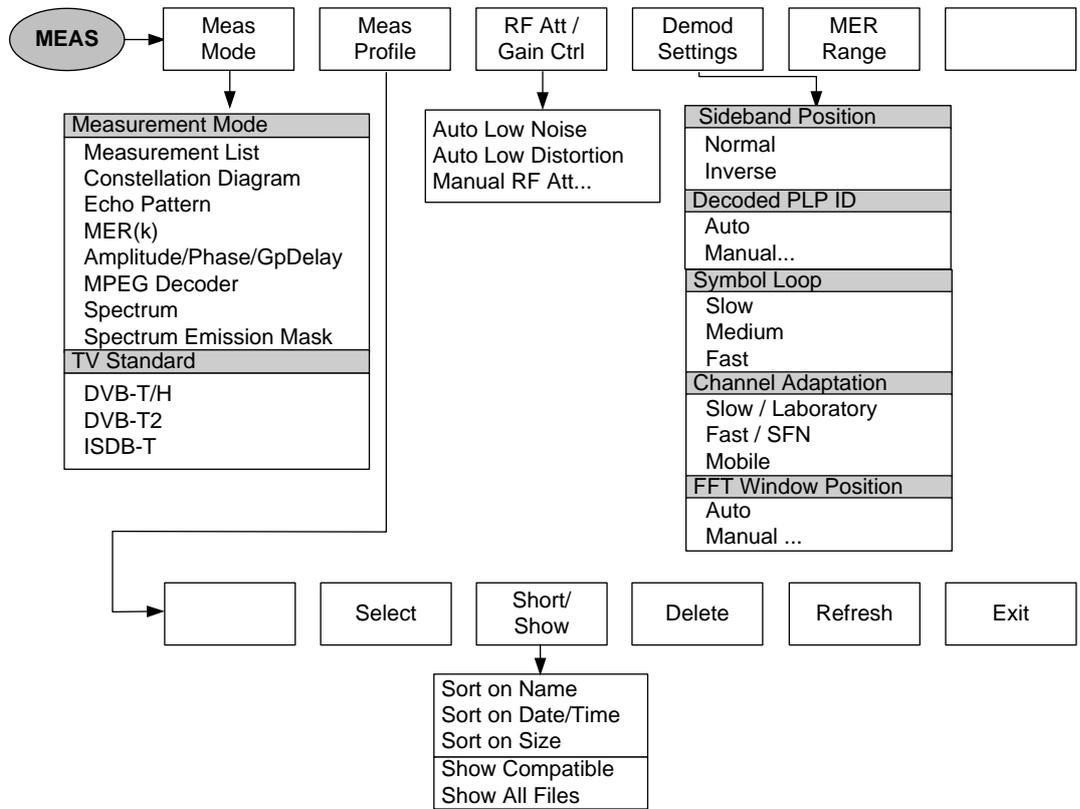


Fig. 1-63: MEAS menu for DVB-T2 MER(k)

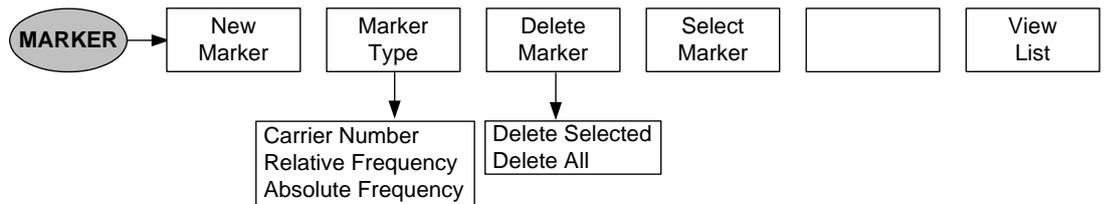


Fig. 1-64: MARKER menu for DVB-T2 MER(k)

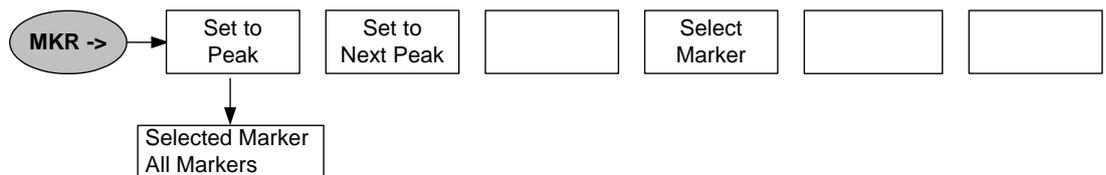


Fig. 1-65: Marker position (MKR menu) for DVB-T2 MER(k)

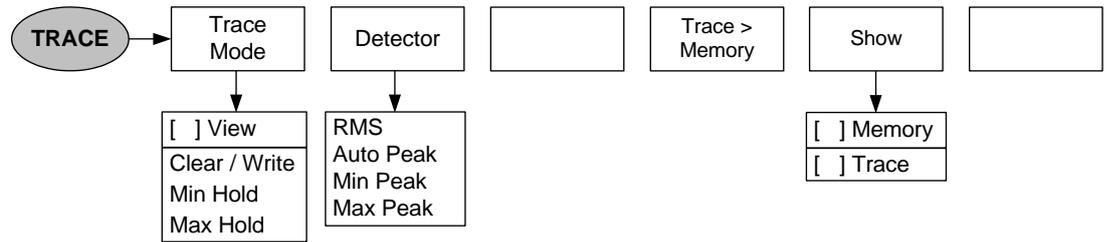
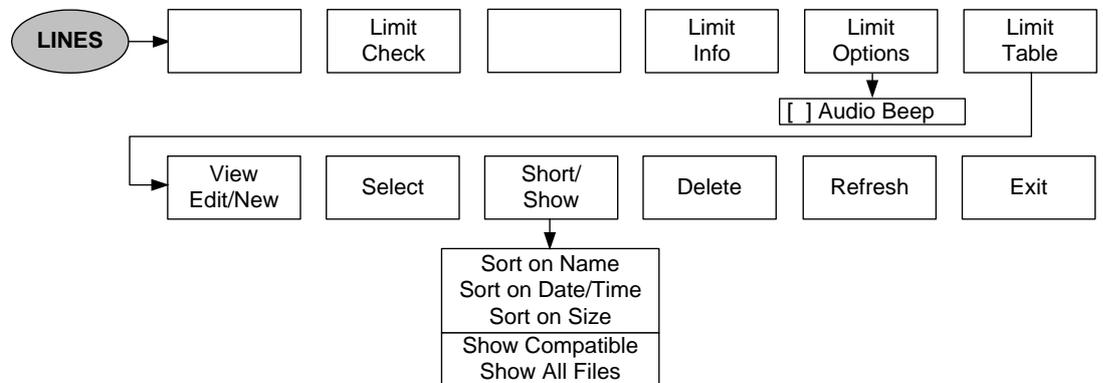
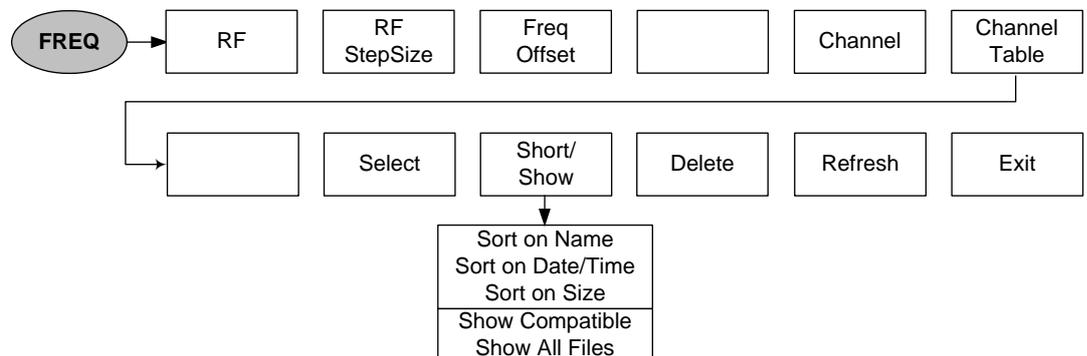


Fig. 1-66: TRACE menu for DVB-T2 MER(k)

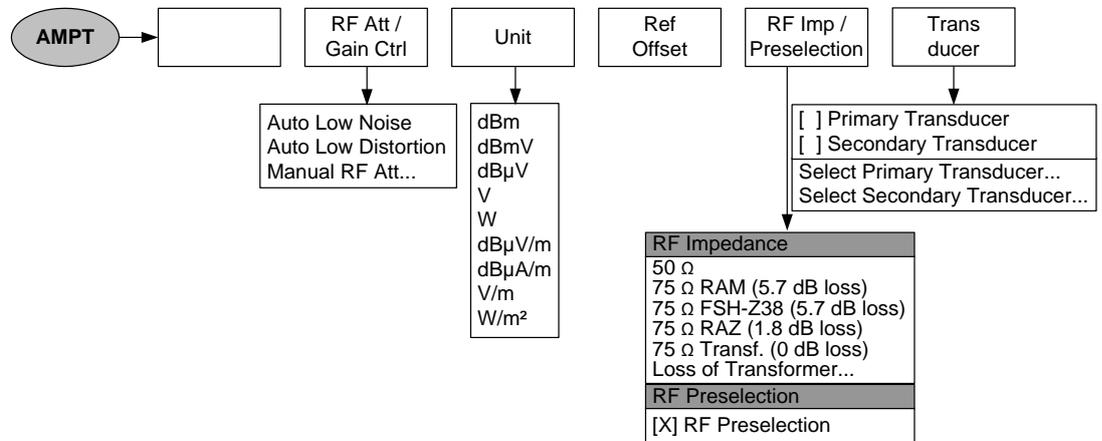
### 1.4.4.7 Limit Control of DVB-T2 Measurement Parameters



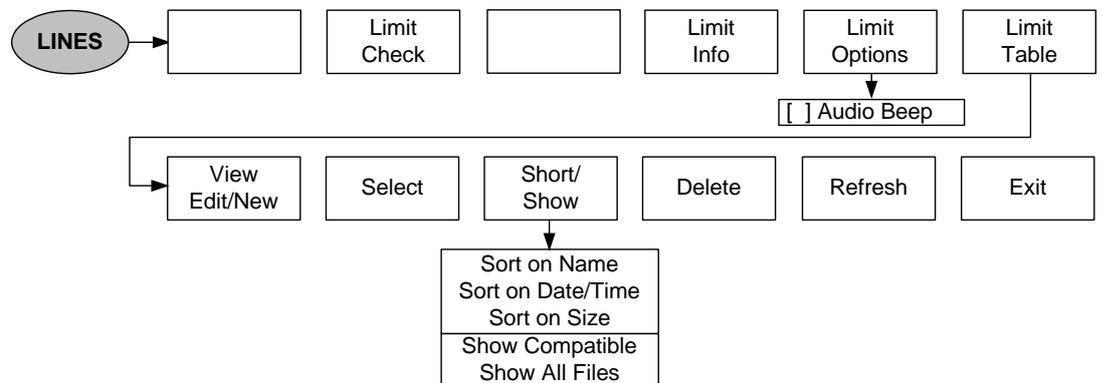
### 1.4.4.8 Frequency Entry for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.4.9 Level Settings for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.4.10 Limit Control of Measurement Parameters for Measurement List, Constellation Diagram, MER(k), and Echo Pattern



### 1.4.5 Menus of the TV Analyzer Amplitude/Phase/GpDelay Measurement

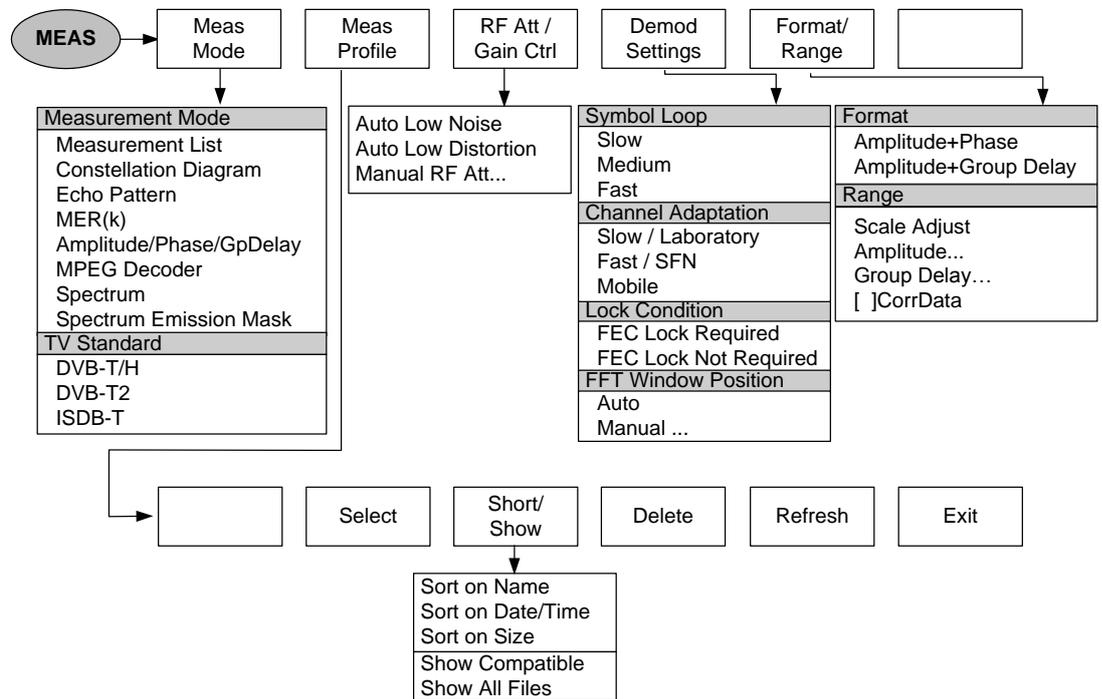


Fig. 1-67: MEAS menu for Amplitude/Phase/Group Delay Measurement

### 1.4.6 Menus of the TV Analyzer MPEG Decoder Measurement

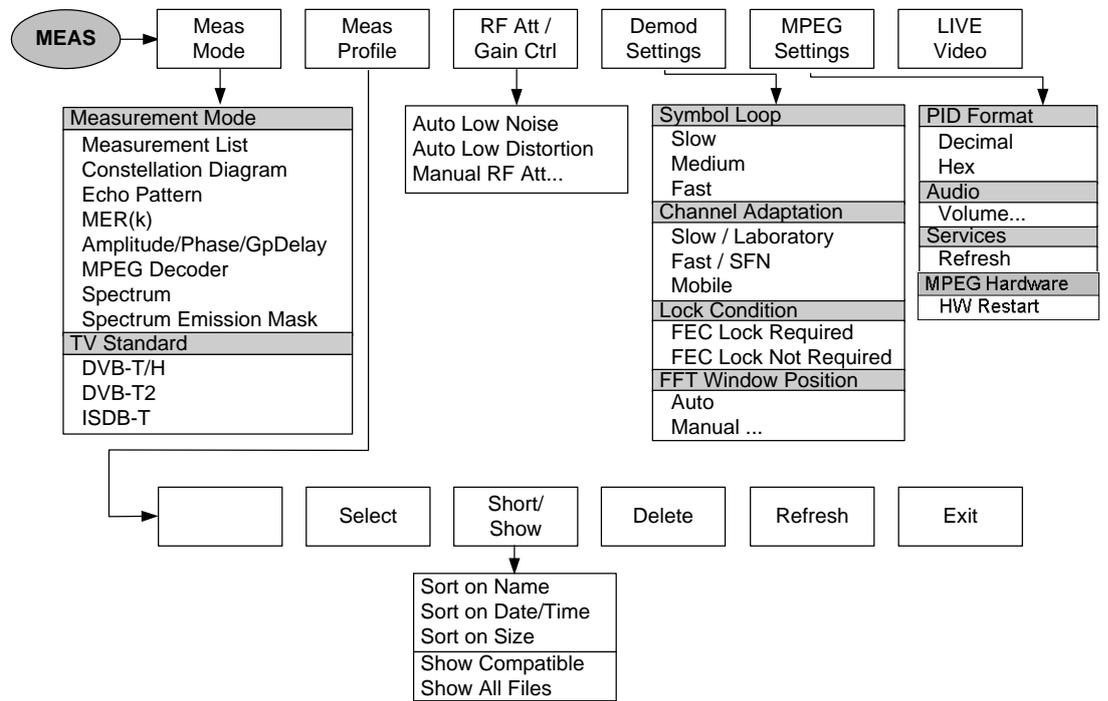


Fig. 1-68: MEAS menu for MPEG Decoder Measurement

### 1.4.7 Menus of the TV Analyzer Spectrum Measurements

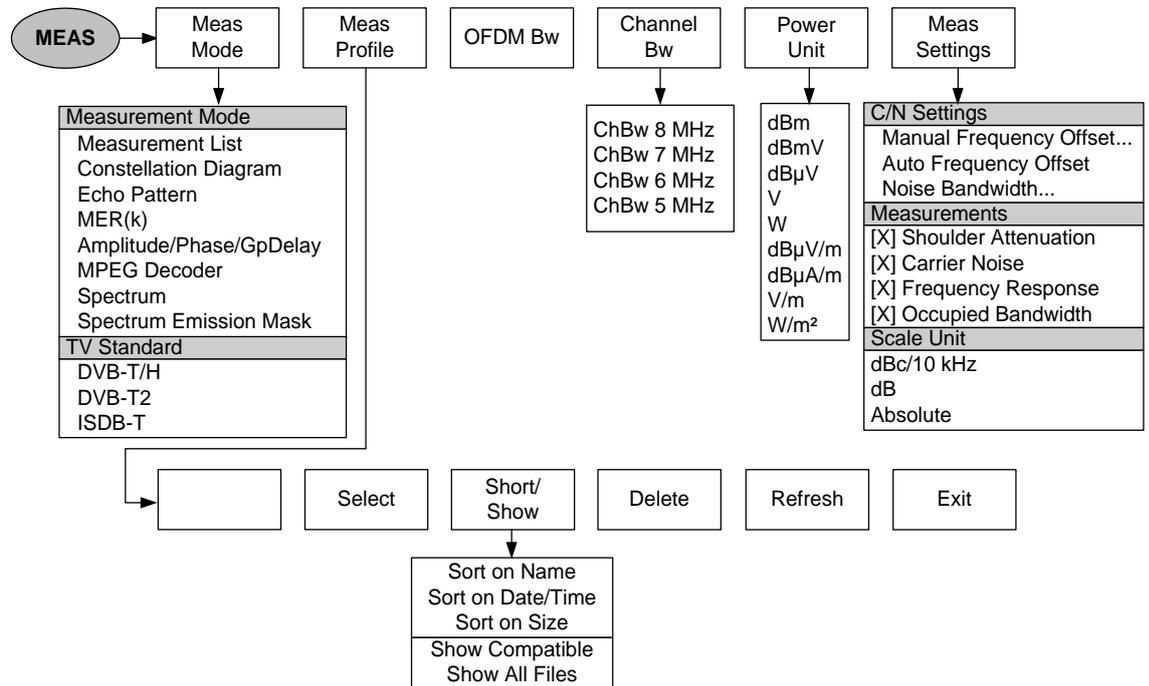


Fig. 1-69: MEAS menu for TV Spectrum

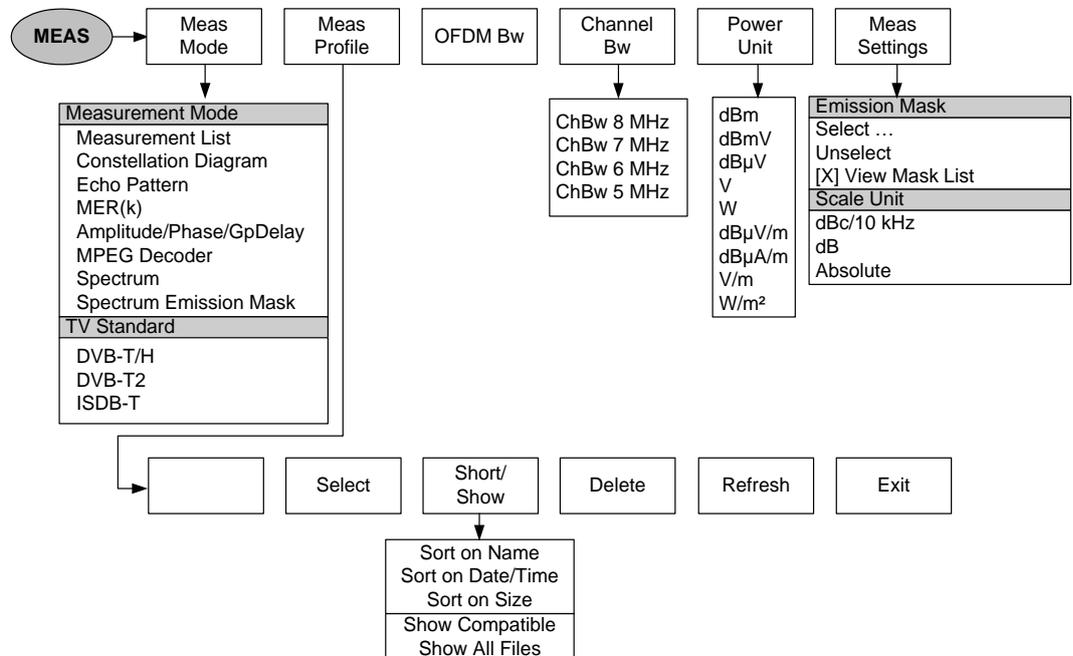


Fig. 1-70: MEAS menu for TV Spectrum Emission Mask

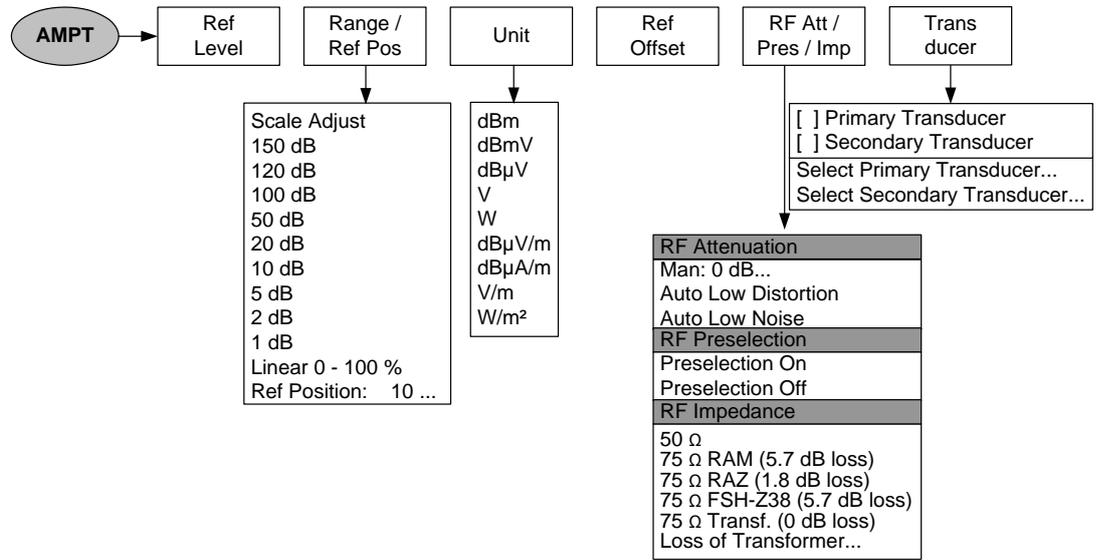


Fig. 1-71: Level settings (AMPT menu)



Fig. 1-72: Frequency settings (SPAN menu)



Fig. 1-73: Bandwidth settings (BW menu)

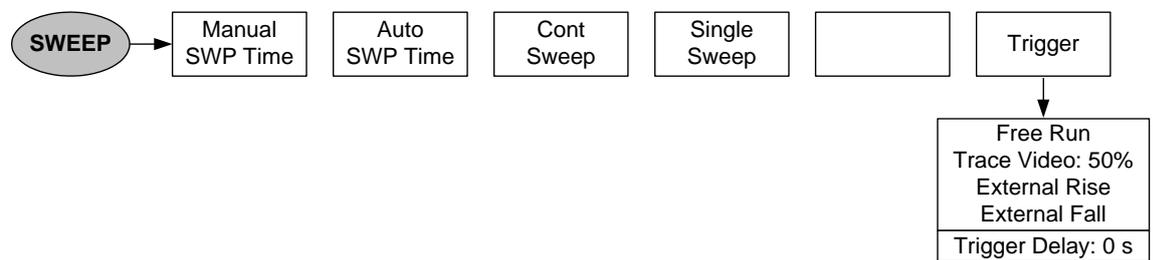


Fig. 1-74: SWEEP menu

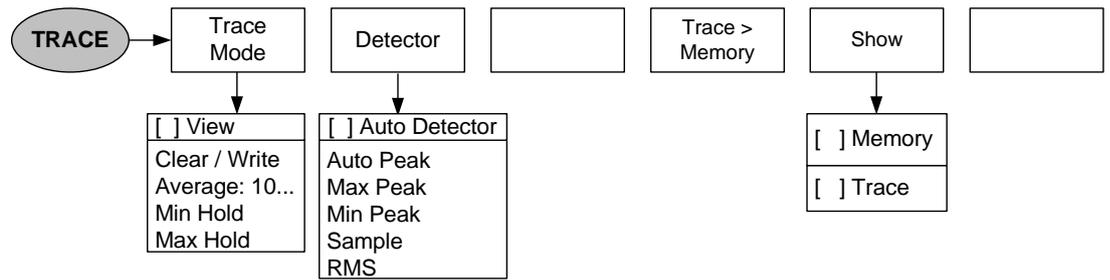


Fig. 1-75: TRACE menu

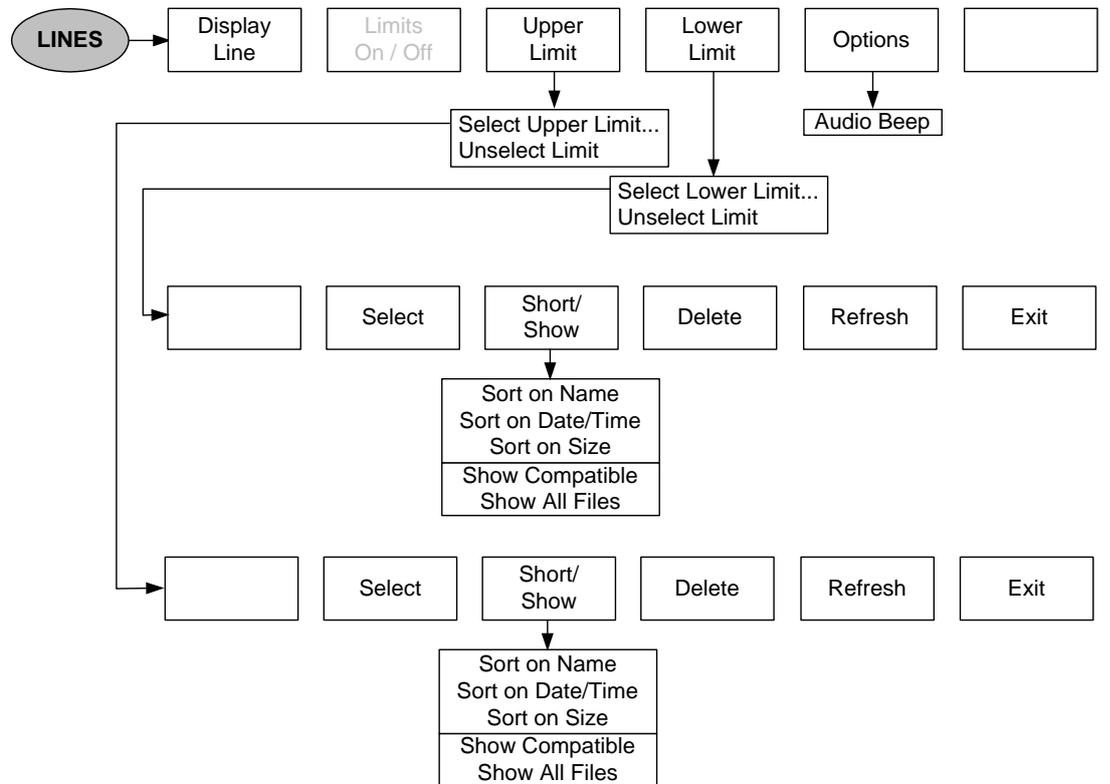


Fig. 1-76: Limit lines (LINES menu)

### 1.4.8 Menus of the Spectrum Analyzer

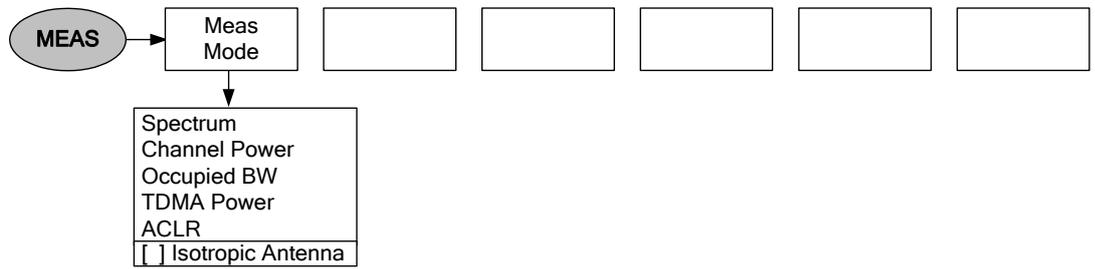


Fig. 1-77: MEAS menu for Spectrum

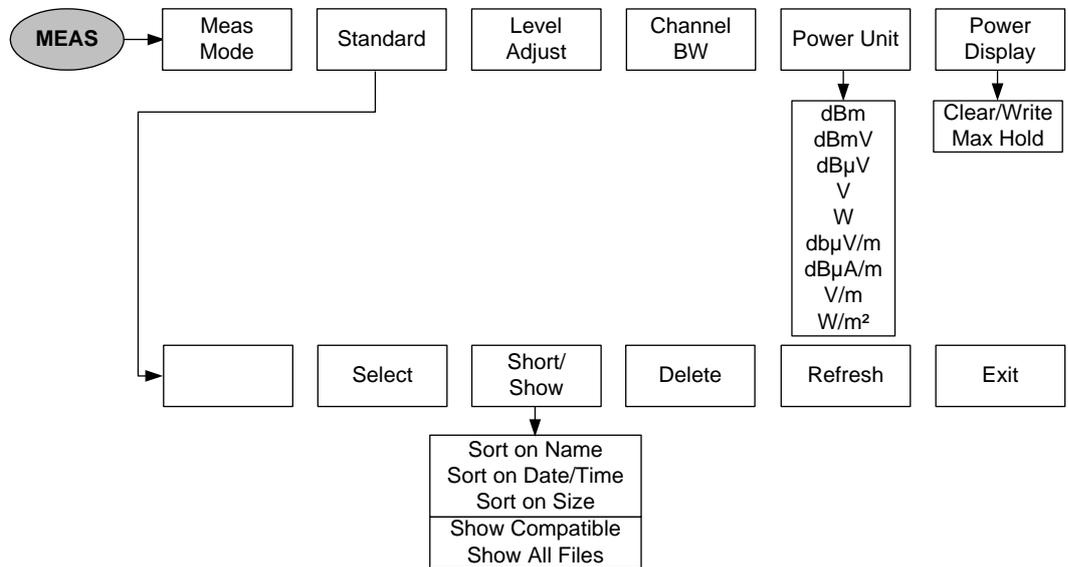


Fig. 1-78: MEAS menu for Channel Power

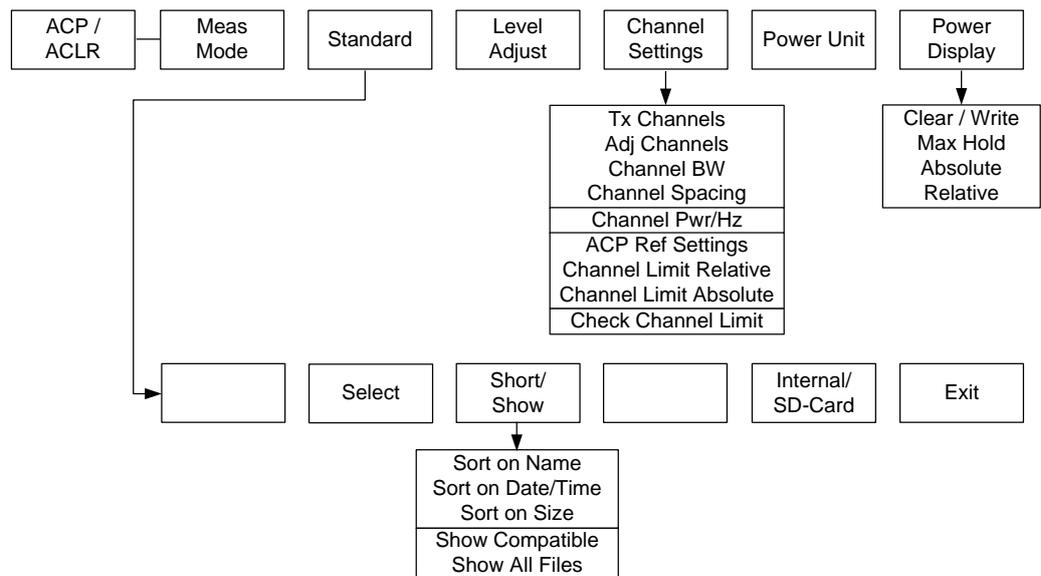


Fig. 1-79: MEAS menu for Adjacent Channel Power ACP / ACLR

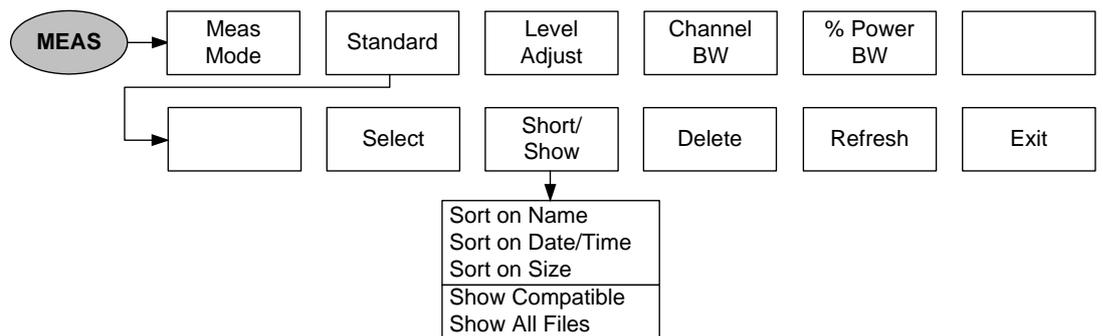


Fig. 1-80: MEAS menu for Occupied Bandwidth

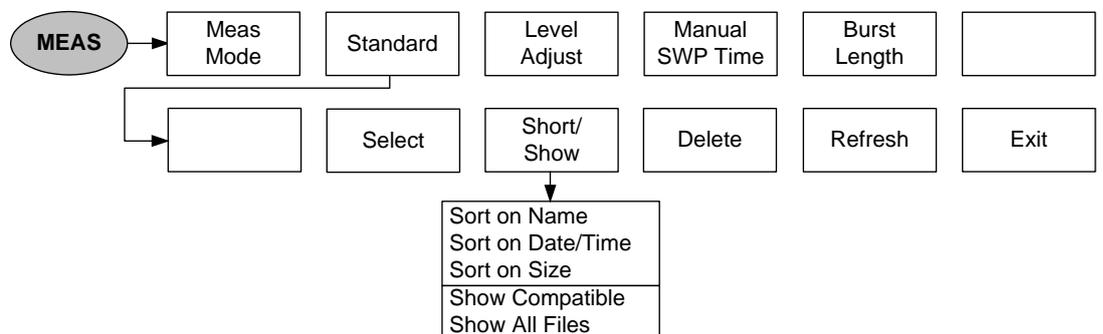


Fig. 1-81: MEAS menu for TDMA Power

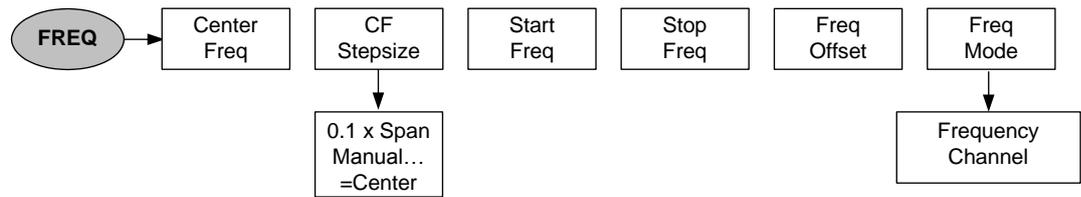


Fig. 1-82: FREQ menu

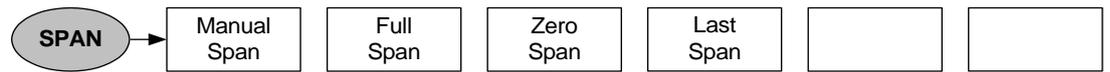


Fig. 1-83: Frequency span (SPAN menu)

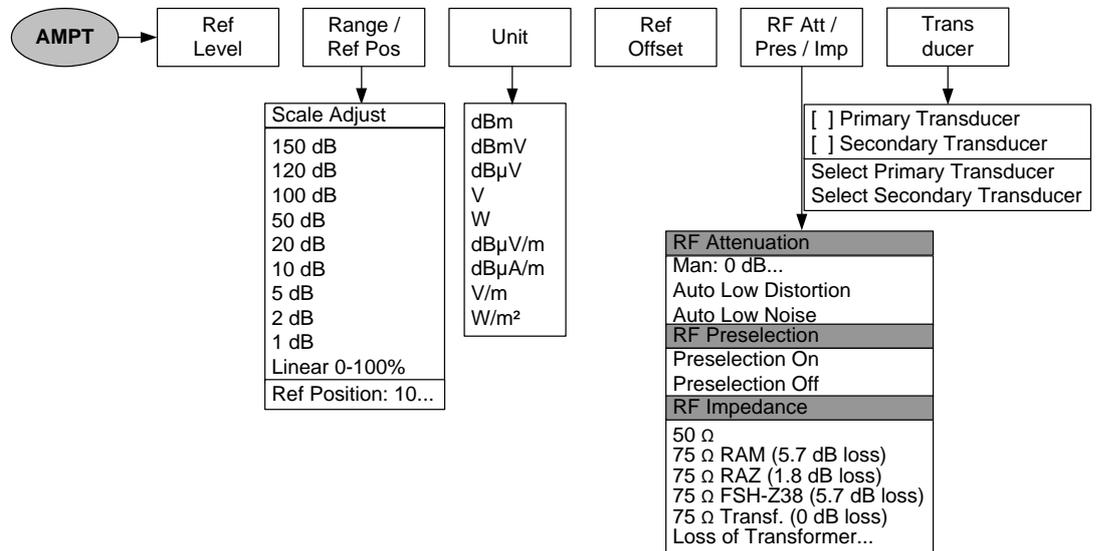


Fig. 1-84: Level settings (AMPT menu)



Fig. 1-85: Bandwidth settings (BW menu)

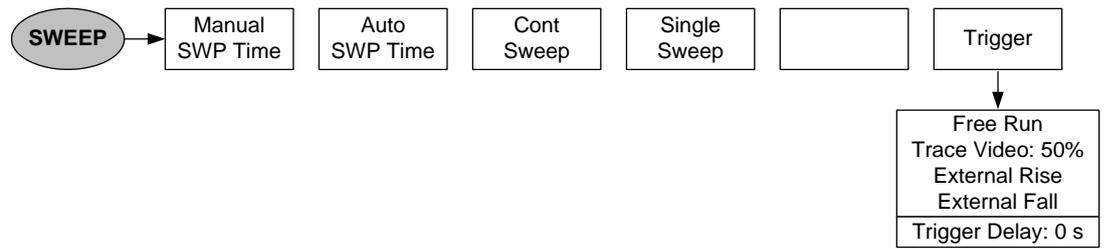


Fig. 1-86: SWEEP menu

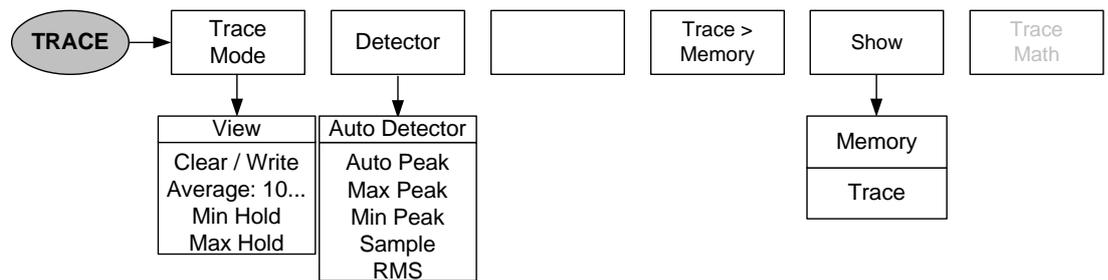


Fig. 1-87: TRACE menu

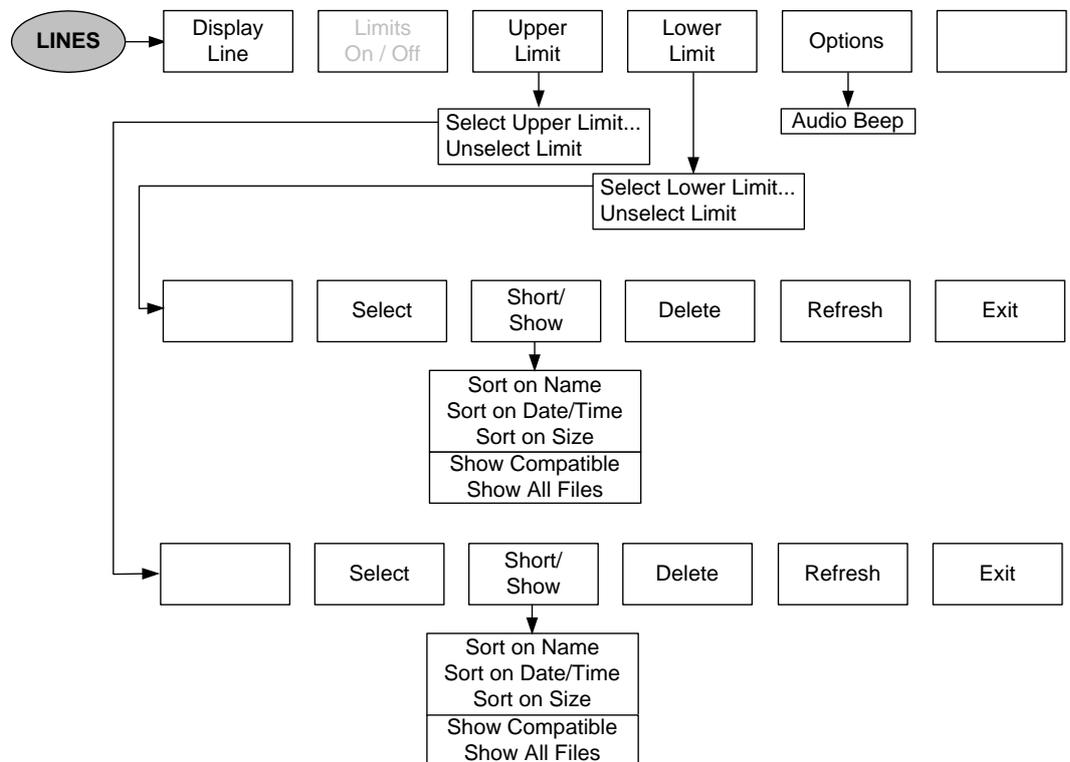


Fig. 1-88: Limit lines (LIMITS menu)

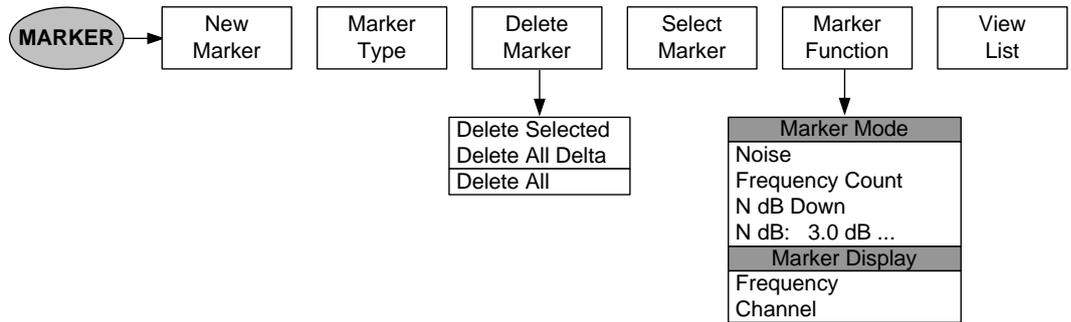


Fig. 1-89: MARKER menu

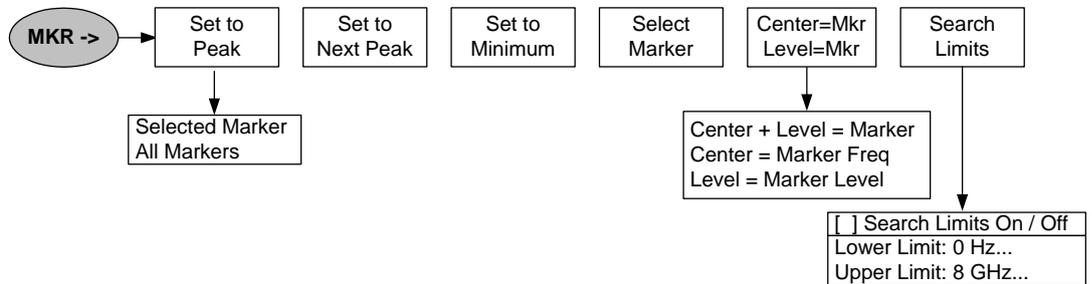


Fig. 1-90: Marker position (MKR menu)

### 1.4.9 Menus of the Network Analyzer

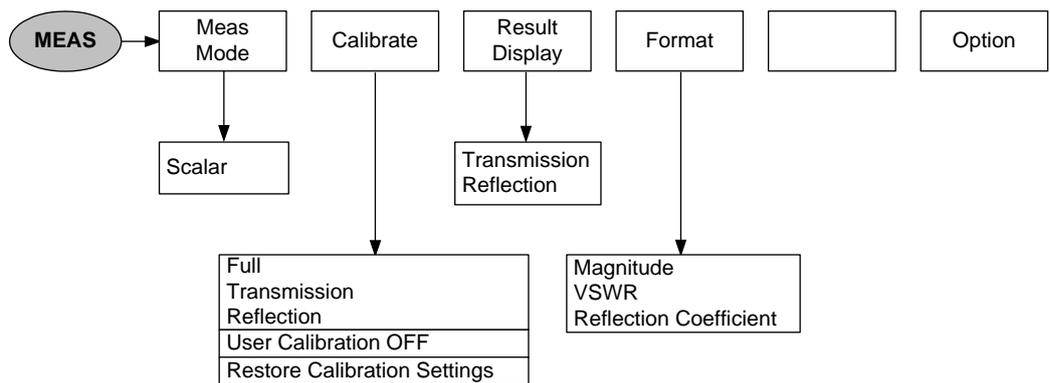


Fig. 1-91: MEAS menu for Network Analyzer scalar measurements

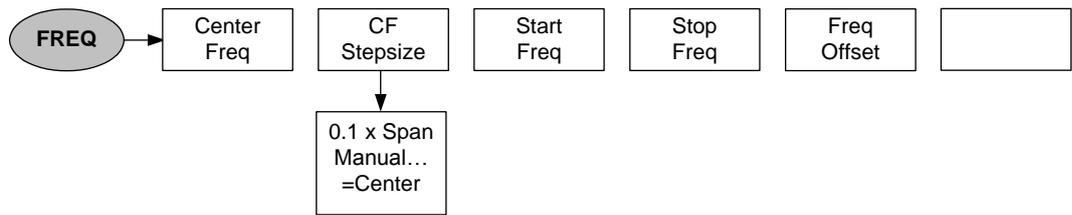


Fig. 1-92: FREQ menu for Network Analyzer scalar measurements

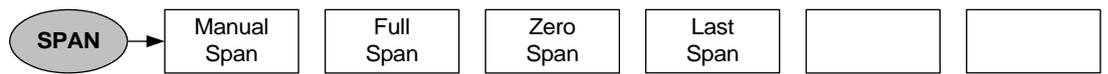


Fig. 1-93: SPAN menu for Network Analyzer scalar measurements

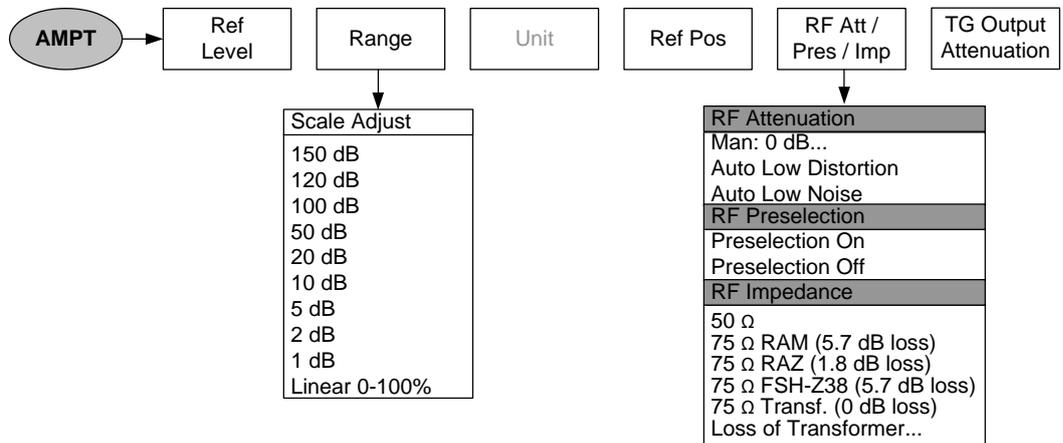


Fig. 1-94: Level settings (AMPT menu) for Network Analyzer scalar measurements

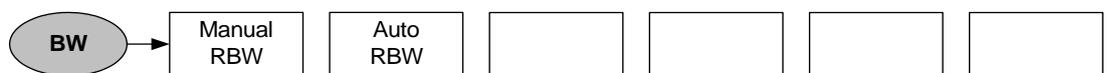


Fig. 1-95: Bandwidth settings (BW menu) for Network Analyzer scalar measurements

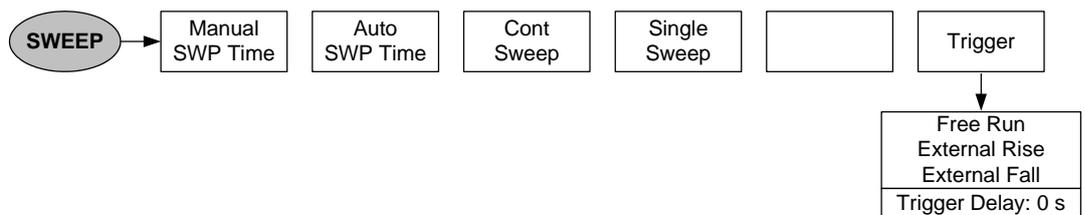


Fig. 1-96: SWEEP menu for Network Analyzer scalar measurements

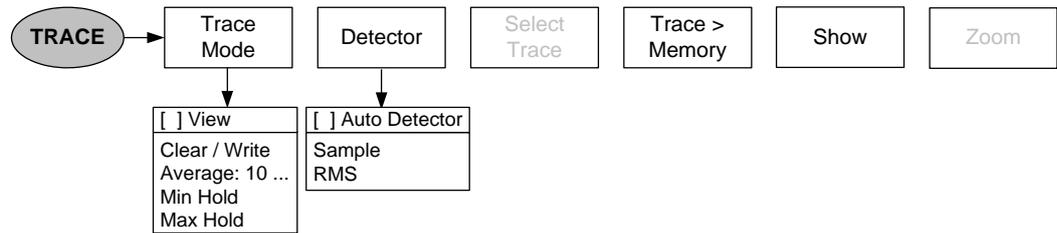


Fig. 1-97: TRACE menu for Network Analyzer scalar measurements

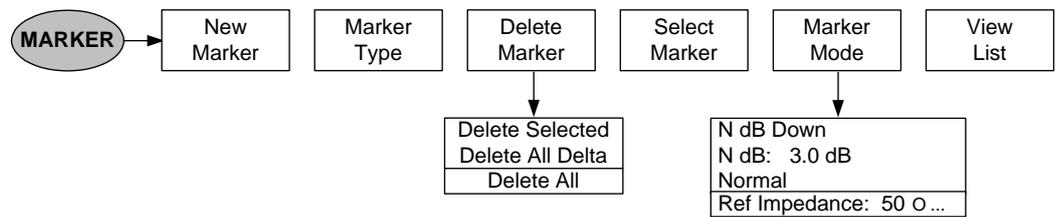


Fig. 1-98: MARKER menu for Network Analyzer scalar measurements

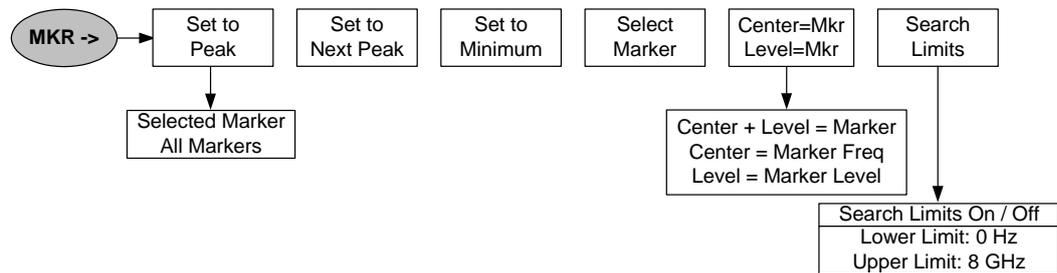


Fig. 1-99: Marker position (MKR menu) for Network Analyzer scalar measurements

### 1.4.10 Menus of the Power Sensor

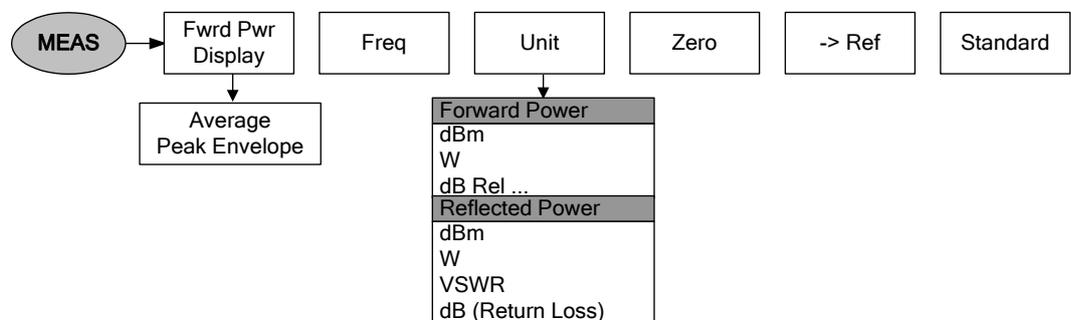


Fig. 1-100: MEAS menu for Power Sensor



Fig. 1-101: FREQ menu for Power Sensor

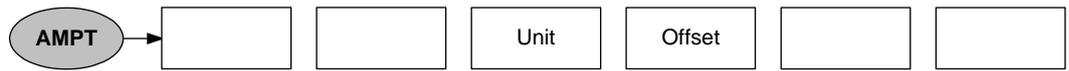


Fig. 1-102: AMPT menu for Power Sensor

## 2 TV Analyzer Measurements

The R&S ETC has an FPGA-based real-time test demodulator. The test demodulator determines the level and crest factor of the received signal, the carrier frequency offset, the symbol rate offset, the modulation error, the bit error ratios before the Viterbi decoder and before the Reed Solomon decoder, the MPEG transport stream rate, and the transmission parameter signaling (TPS) respectively the transmission and multiplexing configuration control (TMCC) and PLP signaling information. The test demodulator is configured automatically on the basis of the received TPS respectively TMCC information.

Besides these measurement parameter lists, the R&S ETC displays the constellation diagram, the modulation error ratio versus the OFDM carriers (MER(k)) and the echo profile of the received signal. The TV receiver measurement modes are described in detail in the chapter "[TV Receiver Measurements](#)".

In addition to the receiver measurements, the R&S ETC provides special spectrum measurements. The TV Analyzer Spectrum measurement displays the channel power, the amplitude frequency response, the shoulder attenuations, the carrier-to-noise ratio, and the 99% occupied bandwidth. The TV Analyzer Spectrum Emission Mask measurement compares the spectrum emissions with custom-defined masks. The TV spectrum measurement modes are described in detail in the chapter "[TV Spectrum Measurements](#)".

### Selecting the Measurement Mode

1. Press the MODE key.
2. Tap TV ANALYZER.

The R&S ETC starts the most recently selected measurement of the TV Analyzer.

## 2.1 Changing the TV Standard

The R&S ETC supports the following TV standards:

- DVB-T/H Analyzer (R&S ETC-K140 option required)
- ISDB-T Analyzer (R&S ETC-K160 option required)
- DVB-T2 Analyzer (R&S ETC-K240 and ETC-B300 option required)

1. Press the MODE key.
2. Tap TV ANALYZER.
3. Press the MEAS key.
4. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions and the TV standard selection.

5. Select the desired TV standard (selected TV standard is highlighted in red).

**Note:** If the SPECTRUM or SPECTRUM EMISSION MASK mode is set, you cannot change the TV standard. Change to one of the receiver modes first.

## 2.2 Using Measurement Profile

To simplify operation, the R&S ETC provides measurement profiles. The measurement profile contains the setting parameters which the R&S ETC 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 and DVB-T2 standard
- Spectrum measurement (frequency span, resolution bandwidth, video bandwidth, sweep time)

The R&S ETC 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 ETC View software for editing.

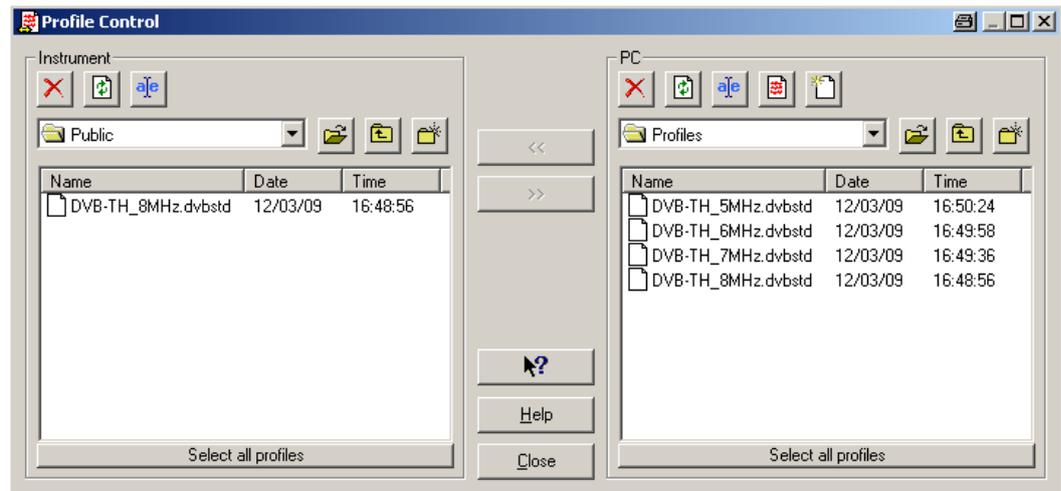
For examples how to set the measurement profile for a selected standard see the following chapters:

- DVB-T/H: chapter [2.4.1.1](#)
- ISDB-T: chapter [2.4.2.1](#)
- DVB-T2: chapter [2.4.3.1](#)

### Copying Measurement Profiles to the R&S ETC

1. Install the supplied R&S ETC View software on a PC or laptop.
2. Connect the R&S ETC to the PC or laptop using the LAN or USB cable.
3. Make the PC settings as described in the getting started manual.
4. Start the R&S ETC View software.
5. Set up the connection between the R&S ETC and R&S ETC View software.
6. Using PROFILE CONTROL, copy the desired measurement profile to the R&S ETC. In this example, DVB-TH\_8MHz.DVBSTD.

An in-depth instruction is described in the R&S ETC View software manual.



### Activating the Measuring Profile in the R&S ETC

1. Press the MEAS key.
2. Tap MEAS PROFILE.  
The R&S ETC opens the browser.
3. Select the desired measuring profile.  
The R&S ETC set the setting parameters according to the measurement profile.

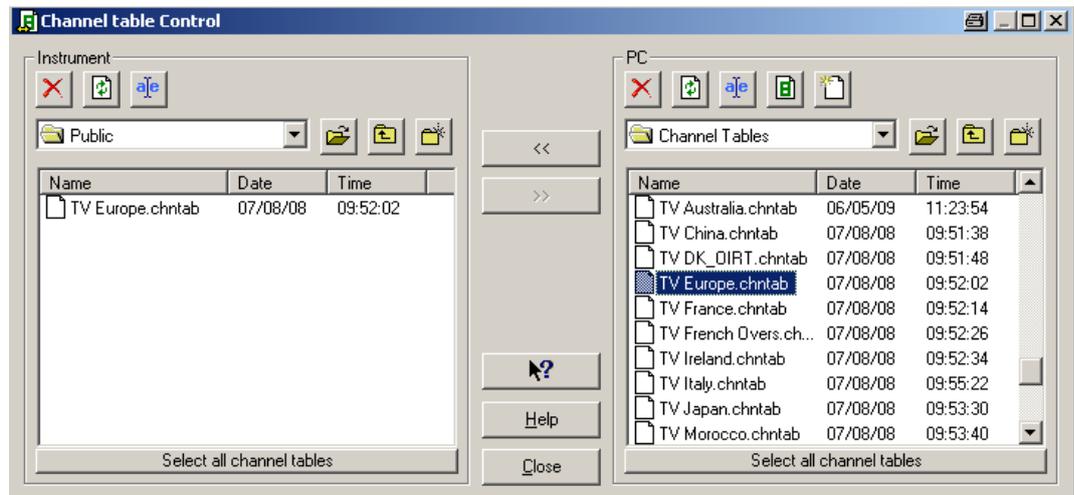
## 2.3 Using Channel Tables

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

### Copying Channel Tables to the R&S ETC

1. Install the supplied R&S ETC View software on a PC or laptop.
2. Connect the R&S ETC to the PC or laptop using the LAN or USB cable.
3. Make the PC settings as described in the getting started manual.
4. Start the R&S ETC View software.
5. Set up the connection between the R&S ETC and R&S ETC View software.
6. Using CHANNEL TABLE CONTROL, copy the desired channel table to the R&S ETC. In this example, TV EUROPE.CHNTAB.

An in-depth instruction is described in the R&S ETC View software manual.



### Selecting and Activating the Channel Table

1. Press the **FREQ** key.
2. Tap **CHANNEL TABLE**.  
The R&S ETC opens the browser.
3. Select the "TV EUROPE.CHNTAB" channel table.

In the status area of the measurement window, the R&S ETC 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 Channel

1. Tap **CHANNEL**.
2. Set the required channel number.

## 2.4 TV Receiver Measurements

The R&S ETC supports the following TV standards:

- [DVB-T/H Analysis](#) (R&S ETC-K140 option required)
- [ISDB-T Analysis](#) (R&S ETC-K160 option required)
- [DVB-T2 Analysis](#) (R&S ETC-K240 option and ETC-B300 required)

Besides these TV receiver measurement modes, the R&S ETC offers TV spectrum measurement modes that are described in detail in the chapter "[TV Spectrum Measurements](#)".

### 2.4.1 DVB-T/H Analysis

The R&S ETC offers the following TV receiver measurement modes:

- Measurement List, chapter [2.4.1.5](#)
- TPS Parameters, chapter [2.4.1.6](#)
- Constellation Diagram, chapter [2.4.1.7](#)
- Echo Pattern, chapter [2.4.1.8](#)
- Echo Pattern Peak List, chapter [2.4.1.9](#)
- MER(k), chapter [2.4.1.10](#)
- Amplitude/Phase/Group Delay, chapter [2.4.1.11](#)
- Data Logging, chapter [2.4.1.16](#)

You can configure the test demodulator for specific measurement tasks as follows.

With the LOCK CONDITION : FEC LOCK REQUIRED setting, a locked forward error correction (FEC) decoder is required for demodulator synchronization. If this condition is disabled, you can synchronize the test demodulator even with test signals that do not generate a valid MPEG data stream. The test demodulator even synchronizes to receive signals whose useful power is lower than the noise power in the transmission channel.

With the CHANNEL ADAPTION setting, you can adapt the OFDM demodulator to the receive conditions. With the FAST setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. With this setting, the demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels. For measurements at transmitters and in the lab, it is recommended to use the SLOW setting because with this setting the control loops react only slowly to changes in the receive signal. Possible errors in the DVB-T/H signal are thus detected. With the MEDIUM setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels which may occur in single frequency networks (SFN) when the same signal is received by several transmitters.

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

With the BITSTREAM setting, it is possible (in the case of hierarchical modulation) to select whether the bit error measurements and MPEG TS bit rate measurement are performed on the "high priority" or "low priority" data stream. The setting also determines the transport stream at the TS ASI output.

The bit error measurements are automatically reset and restarted when the demodulator is resynchronized. With BER RESET, the bit error measurements can be reset and restarted manually.

The accuracy of the carrier frequency drift and symbol rate corresponds to the accuracy of the internal reference. The R&S ETC provides the possibility of feeding in an external 10 MHz reference frequency signal. The accuracy of frequency measurement then corresponds to the accuracy of this reference.

The R&S ETC supports the R&S HA-Z240 GPS receiver. If the GPS receiver is connected, the R&S ETC shows the geographical data on the measurement screen. In addition, the 1 ppm signal is used to increase the frequency measurement accuracy.

To simplify operation, the R&S ETC provides the possibility of organizing the measurement settings in a measurement profile. The selected measurement profile contains the measurement settings which the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile defines the settings for the test demodulator, the bandwidths, the detector and the displayed dimensional unit. The supplied R&S ETC View software contains predefined measurement profiles. R&S ETC View software can also be used to create customer-specific measurement profiles and to load them in the R&S ETC. The measurement profiles stored in the R&S ETC when shipped can be deleted if necessary.

Limits can be preset for the measurement parameters. If the limit check function is activated, the measurement parameter result is displayed in red if the limit is exceeded. An acoustic warning signal can additionally be activated. The limits are defined using the supplied R&S ETC View software.

The MEASUREMENT LIST measurement presents a clear overview of the measurement parameters together with the most important settings.

The CONSTELLATION DIAGRAM measurement shows the I/Q values in a Cartesian coordinate system together with the most important measurement parameters and instrument settings. To permit simple qualitative evaluation of the signal quality, the R&S ETC also indicates the decision thresholds, the levels of which are adapted automatically to the modulation mode.

The TPS screen presents the transmission parameter signaling information.

The ECHO PATTERN measurement presents the echo profile of the receive channel. Extensive marker functions make it easier to detect echoes. Besides the graphic display, the R&S ETC lists the detected echoes, sorted by level, in the ECHO PEAK LIST.

The MER(k) measurement shows the modulation error ratios versus the modulated OFDM carriers (k). Extensive marker functions facilitate operation and make it easier to detect disturbances.

During the MEASUREMENT LIST, CONSTELLATION DIAGRAM, MER(k) and ECHO PATTERN measurements, the R&S ETC makes the asynchronous transport stream TS-ASI of the received DVB-T/H signal available at the BNC connector TS OUT.

### 2.4.1.1 Selecting a Measurement Profile

To simplify operation, the R&S ETC provides measurement profiles. The measurement profile contains the setting parameters that the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile contains the settings for all measurements available in the selected TV standard.

You can use the supplied R&S ETC View software to create additional customer-specific measurement profiles, to load them in the R&S ETC and to delete the

measurement profiles. How to create measurement profiles and to load these profiles in the R&S ETC is described in the R&S ETC View software manual.

1. Press the MEAS key.
2. Tap MEAS PROFILE.

The R&S ETC opens the browser and shows the measurement profile definition files (DVBSTD file extension) available for the selected DVB-T/H standard.

Stat	Name	Size	Date	Time
<	\Public \Standards\..			
	\Public			
	\Storage Card			
	DVB-T/H 5MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 5MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 5MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 6MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 6MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 6MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 7MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 7MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 7MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 8MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 8MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H 8MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H_5MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H_6MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H_7MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-T/H_8MHz.dvbstd	1 kB	14/11/2011	15:02
	mm.dvbstd	1 kB	09/02/2011	17:29

Free: 9 MB

View Edit / New Select Sort / Show Delete Refresh Exit

3. Select the required measurement profile.

The measurement profile defines the following setting parameters.

Profile Editor - DVB-TH 8MHz Transmitter.dvbstd

Profile Name: DVB-TH 8MHz Transmitter .DVBSTD

Description (optional): DVB-TH 8MHz Transmitter applic

TV Standard: DVB-T/H

DVB-T/H

Resolution Bandwidth:  Auto 30000 Hz

Video Bandwidth:  Auto 0 Hz

Sweeptime:  Auto 2 s

Span:  Auto 24000000 Hz

Trace Detector: RMS

Channel Bandwidth: 8,E+6 Hz

Power Unit: dBm

Bitstream: High Priority

Symbol Loop: Slow

Channel Adaption: Slow

Lock Condition: FEC Lock Required

New

Open

Save

Close

### 2.4.1.2 Setting the Frequency

The frequency is set on the R&S ETC using the FREQ key. It can be set by entering the carrier frequency or by entering a channel. If a channel is entered, a channel frequency table must be loaded in the R&S ETC using the supplied R&S ETC View software. How to create the channel tables is described in the R&S ETC View software manual.

### Setting the Receive Frequency

1. Press the **FREQ** key.

The R&S ETC opens the frequency menu.

- If the frequency was last set by entering the carrier frequency, the entry field for the frequency value is already activated and the frequency that has just been set is displayed in the entry field. You can enter a new frequency immediately.
- If the frequency was last set by entering a channel, the entry field for the channel value is already activated, allowing immediate entry of the channel. To enter the carrier frequency, press the **RF**.

2. Tap **RF**.

**Note:** Only necessary if the frequency was last set by entering the channel.

3. Set the required frequency.

The R&S ETC sets the entered frequency as the new receive frequency. The entry field remains active to allow further entries to be made.

DVB-T/H		Meas List		<No Profile>		17/04/12 21:05	
	RF	500 MHz					
	Band	---					
	Channel Table	---					
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB					
	OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz					
Measurement Parameter				Result			
Power				-29.94 dBm			
Crest Factor				12.12 dB			
Demodulator				locked			
Sideband Position				normal			
Transmission Parameter Signaling				8K 1/32 QAM64 NH			
Carrier Frequency Offset				66.9 Hz			
Symbol Rate Offset				0.1 ppm			
Modulation Error Ratio				rms 43.6 dB		peak 26.8 dB	
Error Vector Magnitude				rms 0.43 %		peak 2.99 %	
FEC Decoder				locked			
BER before Viterbi / Reed Solomon				0.0E-08		0.0E-08	
Packet Error Ratio				0.0E-05			
Packet Errors				RF: 500 MHz			
MPEG TS Bitrate				27.144389 Mbit/s			
RF		RF StepSize		Freq Offset		Channel	
						Channel Table	

### Working with a Frequency Offset

For measurements on frequency converters, it is often useful to reference the results to the frequency prior to conversion. The R&S ETC provides a frequency offset for this purpose. It offsets the center frequency mathematically to higher or lower frequencies so that the R&S ETC displays the input frequency of the DUT.

The possible range for the positive frequency offset is 1 Hz to 100 GHz in 1 Hz steps. The permitted negative frequency offset depends on the frequency setting. The frequency at the RF input of the R&S ETC must be positive.

1. Press the **FREQ** key.
2. Tap **FREQ OFFSET**.

The R&S ETC opens the entry field for the frequency offset.

DVB-T/H		Meas List	<No Profile>	17/04/12	21:12
RF				500 MHz	
Band				---	
Channel Table				---	
Gain Control / RF Attenuation				Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw				7.6071429 MHz / 8 MHz	
Measurement Parameter		Result			
Power				-30.06	dBm
Crest Factor				12.46	dB
Demodulator				locked	
Sideband Position				normal	
Transmission Parameter Signaling				8K	1/32 QAM64 NH
Carrier Frequency Offset				73.7 Hz	
Symbol Rate Offset				0.2 ppm	
Modulation Error Ratio	rms	43.6	dB	peak	26.4 dB
Error Vector Magnitude	rms	0.43	%	peak	3.14 %
FEC Decoder				locked	
BER before Viterbi / Reed Solomon				0.0E-08	0.0E-08
Packet Error Ratio				0.0E-06	
Packet Errors				Offset:	0 Hz
MPEG TS Bitrate				27.144389	Mbit/s
RF	RF StepSize	Freq Offset		Channel	Channel Table

3. Set the required frequency offset.

The R&S ETC adds the frequency offset to the set center frequency. A red dot next to the receive frequency indicates that a frequency offset has been set.

4. To cancel the frequency offset again, enter an offset of 0 Hz.

### Setting the Receive Frequency Step Size

The frequency step size is freely selectable. It enables the analysis of DVB-T/H signals with regular frequency spacing (e.g. channel spacing).

1. Tap RF STEPSIZE.

The entry field containing the value for the current step size opens.

DVB-T/H		Meas List	<No Profile>	17/04/12	21:15
RF				500 MHz	
Band				---	
Channel Table				---	
Gain Control / RF Attenuation				Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw				7.6071429 MHz / 8 MHz	
Measurement Parameter		Result			
Power				-30.07	dBm
Crest Factor				12.02	dB
Demodulator				locked	
Sideband Position				normal	
Transmission Parameter Signaling				8K	1/32 QAM64 NH
Carrier Frequency Offset				75.0 Hz	
Symbol Rate Offset				0.2 ppm	
Modulation Error Ratio	rms	43.7	dB	peak	25.9 dB
Error Vector Magnitude	rms	0.43	%	peak	3.30 %
FEC Decoder				locked	
BER before Viterbi / Reed Solomon				0.0E-09	0.0E-09
Packet Error Ratio				0.0E-06	
Packet Errors				RF Step:	1 MHz
MPEG TS Bitrate				27.144389	Mbit/s
RF	RF StepSize	Freq Offset		Channel	Channel Table

2. Set the step size.

### Working with Channel Tables

Almost all transmission systems divide the frequency range that they have been assigned into channels, whereby the channels are each assigned one frequency. To simplify operation, the R&S ETC therefore provides the possibility of defining channel assignments based on terms familiar to users.

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. The R&S ETC can store more than 100 different channel tables which can be activated as required from the front panel. The maximum number of channel tables may be lower if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

How to create channel tables and to transmit the channel table to the R&S ETC is described in the R&S ETC View software manual.

### Selecting the Channel Frequency Table

1. Press the **FREQ** key.
2. Tap **CHANNEL TABLE**.

The R&S ETC opens the browser for selecting the channel table.

Select Channel Table					17/04/12 21:18
Stat	Name	Size	Date	Time	
	TV Australia.chntab	1 kB	14/11/2011	15:02	
	TV Brazil.chntab	1 kB	14/11/2011	15:02	
	TV China.chntab	1 kB	14/11/2011	15:02	
	TV DK_OIRT.chntab	1 kB	14/11/2011	15:02	
	TV Europe.chntab	1 kB	14/11/2011	15:02	
	TV France.chntab	1 kB	14/11/2011	15:02	
	TV French Overs.chntab	1 kB	14/11/2011	15:02	
	TV Ireland.chntab	1 kB	14/11/2011	15:02	
	TV Italy.chntab	1 kB	14/11/2011	15:02	
	TV Japan ISDB-T.chntab	1 kB	14/11/2011	15:02	
	TV Japan.chntab	1 kB	14/11/2011	15:02	
	TV Morocco.chntab	1 kB	14/11/2011	15:02	
	TV South Africa.chntab	1 kB	14/11/2011	15:02	
	TV UK negative offset.chntab	1 kB	14/11/2011	15:02	
	TV UK positive offset.chntab	1 kB	14/11/2011	15:02	
	TV UK.chntab	1 kB	14/11/2011	15:02	
	TV USA Air.chntab	1 kB	14/11/2011	15:02	
	TV USA CATV.chntab	1 kB	14/11/2011	15:02	
	TV USA HRC.chntab	1 kB	14/11/2011	15:02	
	TV USA IRC.chntab	1 kB	14/11/2011	15:02	

Free: 9 MB

View Edit / New    Select    Sort / Show    Delete    Refresh    Exit

3. To sort the table entries by name/date/size, press the **SORT/SHOW**. You can also hide entries that are incompatible with the current instrument setup.
4. Select the required channel table.
5. Tap **SELECT** to activate it.

The R&S ETC opens the channel entry field.

### Setting the Channel

1. Press the **FREQ** key.
2. Tap **CHANNEL**.

The R&S ETC opens the channel entry field.

DVB-T/H		Meas List	<No Profile>		17/04/12	21:20
RF		498 MHz				
Channel / Band		24 / UHF 4/5				
Channel Table		TV Europe				
Gain Control / RF Attenuation		Auto Low Noise / 0 dB				
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz				
Measurement Parameter				Result		
Power				-30.13 dBm		
Crest Factor				12.21 dB		
Demodulator				locked		
Sideband Position				normal		
Transmission Parameter Signaling				8K 1/32 QAM64 NH		
Carrier Frequency Offset				76.4 Hz		
Symbol Rate Offset				0.1 ppm		
Modulation Error Ratio				rms 43.9 dB peak 26.4 dB		
Error Vector Magnitude				rms 0.42 % peak 3.13 %		
FEC Decoder				locked		
BER before Viterbi / Reed Solomon				0.0E-08 0.0E-08		
Packet Error Ratio				0.0E-05		
Packet Errors				Channel: 24		
MPEG TS Bitrate				27.144389 Mbit/s		
RF	RF StepSize	Freq Offset	Channel	Channel Table		

- Set the required channel number.

The R&S ETC sets the receive frequency of the entered channel.

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

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. Assignment of channel numbers to frequencies is as follows:

- The first channel is assigned a channel number and a frequency.
- All subsequent channels have ascending numbers.
- The frequency spacing between the channels is fixed. It can also be negative, i.e. as the channel number increases, the center frequency of the R&S ETC decreases.
- In the case of transmission systems with gaps in the frequency range (e.g. television), a channel table can be composed of several ranges.

How to create channel tables and to load these tables in the R&S ETC is described in the R&S ETC View software manual.

### 2.4.1.3 Setting the Amplitude Parameters

At the RF input, the R&S ETC has an RF attenuator which, in the AUTO LOW NOISE and AUTO LOW DISTORTION settings, is controlled automatically in 5 dB steps depending on the receive level.

- AUTO LOW DISTORTION

The R&S ETC sets a 5 dB higher attenuation (related to the AUTO LOW NOISE setting). As a result, the load on the input mixer is 5 dB lower for the given reference level. In the case of an input spectrum with high signal density, intrinsic interference products of the input mixer are reduced. However, the receiver noise

factor of the R&S ETC increases owing to the higher attenuation upstream of the input mixer. Due to the headroom of more than 5 dB, this setting is also recommended for mobile reception.

- **AUTO LOW NOISE**

The R&S ETC sets a 5 dB lower attenuation (related to the AUTO LOW DISTORTION setting). This increases the sensitivity of the R&S ETC, i.e. the receiver noise factor drops owing to the lower attenuation upstream of the input mixer. This setting is also recommended for measurements at the transmitter as here large headrooms are not necessary.

In the DVB-T/H demodulation mode, the R&S ETC provides a routine to determine the optimum attenuator setting. This routine adjusts the attenuator so that the demodulated signal produces the smallest possible modulation error. On completion of the routine, the attenuator setting assumes the "manual control" state.

As an alternative to automatic control, the RF input attenuator can be manually preset in 5 dB steps. The current RF attenuation setting is shown in the status display of the measurement window.

By default, the measured receive level is displayed in dBm. However, it is also possible to select the units dBmV, dB $\mu$ V, watt and volt.

A reference offset (REF OFFSET) can be defined for the measured receive level. The reference offset adds a settable value to the reference level. This is useful if, for example, an attenuator or an amplifier is used upstream of the RF input. The R&S ETC includes this attenuation or gain in the level display, making manual conversion unnecessary. Attenuation upstream of the RF input must be entered as a positive value and gain as a negative value.

As an option, the R&S ETC features internal RF preselection for the suppression of unwanted receive 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. To improve sensitivity, signals are passed through a low-noise amplifier after preselection. This 15 dB amplifier improves sensitivity by approx. 10 dB.

For measurements on 75  $\Omega$  systems, the R&S ETC provides the possibility of switching over to 75  $\Omega$ . Here, however, it does not switch the RF input to 75  $\Omega$ , but instead simply switches to a 75  $\Omega$  matching pad that is located at the RF input. The 50/75  $\Omega$  matching pads R&S RAZ, R&S RAM and R&S FSH-Z38 are available for impedance matching to 75  $\Omega$  (see the recommended accessories). If configured accordingly, the R&S ETC automatically takes the conversion factor of the matching pad into consideration.

Other matching pads can be implemented by using a transducer factor. How to generate transducer factors is described in the R&S ETC View software manual.

### **Setting the RF Attenuation**

1. Press the AMPT key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

DVB-T/H		Meas List	<No Profile>		17/04/12 21:21	
RF				498 MHz		
Channel / Band				24 / UHF 4/5		
Channel Table				TV Europe		
Gain Control / RF Attenuation				Auto Low Noise / 0 dB		
OFDM Bw / Channel Bw				7.6071429 MHz / 8 MHz		
Measurement Parameter				Result		
Power				-30.13 dBm		
Crest Factor				12.27 dB		
Demodulator				locked		
Sideband Position				normal		
Transmission Parameter Signaling				8K 1/32 QAM64 NH		
Carrier Frequency Offset				76.9 Hz		
Symbol Rate Offset				0.2 ppm		
Modulation Error Ratio				rms	44.1 dB	peak 25.3 dB
Error Vector Magnitude				rms	0.41 %	peak 3.54 %
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				27.144389 Mbit/s		
RF Att / Gain Ctrl		Unit	Ref Offset	RF Imp / Preselection	Transducer	

The RF attenuation can be either preset in 5 dB steps (MANUAL RF ATT) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION) or to high input sensitivity (AUTO LOW NOISE).

3. Select the required item.

### Setting the Display Unit for Level

1. Press the AMPT key.
2. Tap UNIT.

The R&S ETC opens a submenu to select the various dimensional units for the receive level.

DVB-T/H		Meas List	<No Profile>		29/04/12 14:21	
RF				498 MHz		
Channel / Band				24 / UHF 4/5		
Channel Table				TV Europe		
Gain Control / RF Attenuation				Auto Low Noise / 0 dB		
OFDM Bw / Channel Bw				7.6071429 MHz / 8 MHz		
Measurement Parameter				Result		
Power				-30.14 dBm		
Crest Factor				12.08 dB		
Demodulator				locked		
Sideband Position				normal		
Transmission Parameter Signaling				8K 1/32 QAM64 NH		
Carrier Frequency Offset				77.4 Hz		
Symbol Rate Offset				0.1 ppm		
Modulation Error Ratio				rms	43.8 dB	peak 24.9 dB
Error Vector Magnitude				rms	0.42 %	peak 3.73 %
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				27.144389 Mbit/s		
RF Att / Gain Ctrl		Unit	Ref Offset	RF Imp / Preselection	Transducer	

3. Select the required unit.

**Note:** The R&S ETC sets the unit selected for receive level. The units dB $\mu$ V/m, dB $\mu$ A/m, V/m and W/m<sup>2</sup> are only available if a transducer with corresponding unit is activated.

**Setting the Reference Offset**

1. Press the AMPT key.
2. Tap REF OFFSET.
3. Set a reference offset.

The reference offset is always entered in dB, even if the reference level is set to a different unit.

**Note:** A light blue asterisk appears at the top left of the measurement window to indicate that a reference offset that is not equal to 0 dB has been entered.

**Activating the RF Preselection**

Only available with the R&S ETC-K1 option.

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select RF PRESELECTION and RF IMPEDANCE.

DVB-T/H		Meas List		DVB-TH 8MHz		12/08/13 15:48	
		RF		610 MHz			
		Band		---			
		Channel Table		---			
		Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
		OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Measurement Parameter				Result			
Power				-50.05 dBm			
Crest Factor				12.21 dB			
Demodulator				locked			
Sideband Position				normal			
Transmission Parameter Signaling				RF Impedance			
Carrier Frequency Offset				50 $\Omega$			
Symbol Rate Offset				75 $\Omega$ RAM (5.7 dB loss)			
Modulation Error Ratio				rms 75 $\Omega$ FSH-Z38 (5.7 dB loss)			
Error Vector Magnitude				rms 75 $\Omega$ RAZ (1.8 dB loss)			
FEC Decoder				75 $\Omega$ Transf. (0 dB loss)			
BER before Viterbi / Reed Solomon				0			
Packet Error Ratio				Loss of Transformer...			
Packet Errors				RF Preselection			
MPEG TS Bitrate				[ ] RF Preselection			
		RF Att / Gain Ctrl	Unit	Ref Offset	RF Imp / Preselection	Transducer	

3. Select RF PRESELECTION.

**Note:** If RF preselection is already activated, RF PRESELECTION is highlighted in green and an [X] is shown between the square brackets to the left of the entry. If RF preselection is activated, PRESELECTION is displayed in the status area of the measurement window.

4. To deactivate the RF preselection, deselect the respective item.

### Setting the Input Impedance

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select 50  $\Omega$  and 75  $\Omega$  as the input impedance.

DVB-T/H		Meas List		DVB-TH 8MHz		12/08/13 15:48	
		RF		610 MHz			
		Band		---			
		Channel Table		---			
		Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
		OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Measurement Parameter				Result			
Power				-50.05 dBm			
Crest Factor				12.21 dB			
Demodulator				locked			
Sideband Position				normal			
Transmission Parameter Signaling				RF Impedance			
Carrier Frequency Offset				50 $\Omega$			
Symbol Rate Offset				75 $\Omega$ RAM (5.7 dB loss)			
Modulation Error Ratio				rms 75 $\Omega$ FSH-Z38 (5.7 dB loss)			
Error Vector Magnitude				rms 75 $\Omega$ RAZ (1.8 dB loss)			
FEC Decoder				75 $\Omega$ Transf. (0 dB loss)			
BER before Viterbi / Reed Solomon				0			
Packet Error Ratio				Loss of Transformer...			
Packet Errors				RF Preselection			
MPEG TS Bitrate				[ ] RF Preselection			
RF Att / Gain Ctrl		Unit		Ref Offset		RF Imp / Preselection	
						Transducer	

3. Select the required input impedance.

**Note:** If the input is set to 75  $\Omega$ , it is essential to connect the appropriate matching pad upstream of the RF input. The level displayed by the R&S ETC will otherwise be incorrect.

Note: For 75  $\Omega$  Transf. (xx dB loss), user can connect a transformer and indicate the transformer loss via the "Loss of Transformer..." menu. An entry box will appear to allow user-defined loss to be entered.

### Selecting the Transducer Factor

In many cases, the R&S ETC is not connected directly to the output of the DUT. Instead the measurement signal is fed to the R&S ETC via cables, amplifiers or antenna, or a combination of these items.

The R&S ETC can include the frequency responses of up to two upstream accessory units in the measurement result. For this purpose, "transducer factors" are defined and loaded in the R&S ETC using the R&S ETC View software. Each transducer factor consists of a list of frequency/level pairs which describe the frequency response of the test accessory unit. In the case of antennas, the dimensional unit for the measured electrical or magnetic field strength is also included.

Two entries (primary/secondary transducer) can be activated from the list of transducer factors loaded in the R&S ETC so that, for example, a combination consisting of cable+antenna or cable+amplifier can be taken into consideration. It is important to note that only one of the two selected transducers can define a dimensional unit other than dB.

How to use transducer factors is described in the chapter "Measuring with Transducer Factors".

How to create transducer tables and to load them in the R&S ETC is described in the R&S ETC View software manual.

#### 2.4.1.4 Setting the Channel Bandwidth

The DVB-T/H demodulator of the R&S ETC processes OFDM signals with signal bandwidths of 1 MHz to 8 MHz. To allow the demodulator to synchronize, it must be informed of the OFDM signal bandwidth of the receive signal. The OFDM signal bandwidth OFDM BW corresponds to the current bandwidth of the OFDM signal, i.e. it is the frequency spacing between the first and last OFDM carrier.

In most transmission systems, the OFDM signal bandwidth is described by the channel spacing. To simplify operation, the OFDM signal bandwidth can be set directly for the channel spacing (CHANNEL BW) 5 MHz, 6 MHz, 7 MHz and 8 MHz. The R&S ETC calculates the OFDM signal bandwidth OFDM BW from the selected channel bandwidth (CHANNEL BW):

$$OFDM\_Bw = \frac{213}{224} \cdot Channel\_Bw$$

##### Setting the OFDM Signal Bandwidth

The OFDM signal bandwidth OFDM BW corresponds to the current bandwidth of the OFDM signal, i.e. the frequency spacing between the first and last OFDM carrier.

1. Press the BW key.
2. Tap OFDM BW.

The R&S ETC opens the entry field for the OFDM signal bandwidth containing the currently set value.

DVB-T/H		Meas List	<No Profile>		29/04/12	14:24	
RF				498 MHz			
Channel / Band				24 / UHF 4/5			
Channel Table				TV Europe			
Gain Control / RF Attenuation				Auto Low Noise / 0 dB			
OFDM Bw				7.6071429 MHz			
Measurement Parameter				Result			
Power				-30.15 dBm			
Crest Factor				12.13 dB			
Demodulator				locked			
Sideband Position				normal			
Transmission Parameter Signaling				8K 1/32 QAM64 NH			
Carrier Frequency Offset				77.7 Hz			
Symbol Rate Offset				0.2 ppm			
Modulation Error Ratio				rms	44.0 dB	peak	25.6 dB
Error Vector Magnitude				rms	0.41 %	peak	3.44 %
FEC Decoder				locked			
BER before Viterbi / Reed Solomon				0.0E-10		0.0E-10	
Packet Error Ratio				0.0E-06			
Packet Errors				OFDM Bw: 7.6071429 MHz			
MPEG TS Bitrate				27.144389 Mbit/s			
Ch Bw	Ch Bw	Ch Bw	Ch Bw	OFDM Bw			
8 MHz	7 MHz	6 MHz	5 MHz				

- Set the required OFDM signal bandwidth.

### Setting the OFDM Signal Bandwidth by Selecting the Channel Bandwidth

The channel bandwidth CHANNEL BW corresponds to the channel spacing. The R&S ETC uses this to calculate the OFDM signal bandwidth OFDM BW.

- Press the BW key.
- Tap CHBW 5 MHz, CHBW 6 MHz, CHBW 7 MHz or CHBW 8 MHz.

The R&S ETC calculates the OFDM signal bandwidth from the entry and sets this bandwidth.

DVB-T/H		Meas List		<No Profile>		29/04/12 14:25	
RF		498 MHz					
Channel / Band		24 / UHF 4/5					
Channel Table		TV Europe					
Gain Control / RF Attenuation		Auto Low Noise / 0 dB					
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz					
Measurement Parameter				Result			
Power				-30.16 dBm			
Crest Factor				12.21 dB			
Demodulator				locked			
Sideband Position				normal			
Transmission Parameter Signaling				8K 1/32 QAM64 NH			
Carrier Frequency Offset				77.7 Hz			
Symbol Rate Offset				0.2 ppm			
Modulation Error Ratio				rms 43.8 dB peak 25.3 dB			
Error Vector Magnitude				rms 0.42 % peak 3.54 %			
FEC Decoder				locked			
BER before Viterbi / Reed Solomon				0.0E-10		0.0E-10	
Packet Error Ratio				0.0E-06			
Packet Errors				0 /s			
MPEG TS Bitrate				27.144389 Mbit/s			
Ch Bw	Ch Bw	Ch Bw	Ch Bw	OFDM Bw			
8 MHz	7 MHz	6 MHz	5 MHz				

#### 2.4.1.5 Working with the Measurement Parameter List

In the MEASUREMENT LIST measurement, the R&S ETC functions as the test demodulator. The measurement parameter list provides an overview of the most important instrument settings, the receive signal status and the quality of the received DVB-T/H signal. The sequence in which the measurement parameters are shown corresponds to the sequence of synchronization steps in the demodulator. The first measurement parameter in the list are the receive level and the crest factor measured in the receive channel. These parameters are always measured, irrespective of whether synchronization of the demodulator takes place. In the DEMODULATOR line, the R&S ETC indicates whether the test demodulator is synchronized to the received signal. The SIDEBAND POSITION and CARRIER FREQUENCY OFFSET measurement parameters, the TPS information and the modulation error are only determined and displayed if the test demodulator is synchronized to the receive signal. A synchronized forward error correction (FEC) decoder is necessary for measurement of the bit error ratios and the transport stream rate.

- Press the MEAS key.
- Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the DVB-T/H Analyzer mode.

3. Select MEASUREMENT LIST (MEASUREMENT LIST highlighted in red).

The R&S ETC displays the measurement parameter list of the DVB-T/H test receiver.

Mode
Measurement
Profile

Display field for status information

DVB-T/H Meas List DVB-T/H 8MHz Tran		06/04/12 16:49	
RF	666 MHz		
Channel / Band	45 / UHF 4/5		
Channel Table	TV Europe		
Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz		
Measurement Parameter		Result	
Power	-50.25 dBm		
Crest Factor	12.25 dB		
Demodulator	locked		
Sideband Position	normal		
Transmission Parameter Signaling	8K	1/32	QAM64 NH
Carrier Frequency Offset	39.0 Hz		
Symbol Rate Offset	0.1 ppm		
Modulation Error Ratio	rms 36.9 dB	peak 23.0 dB	
Error Vector Magnitude	rms 0.94 %	peak 4.62 %	
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	27.144387 Mbit/s		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings
			BER Reset
			TPS Info

DVB-T/H receiver setting parameters

Measurement parameters

Measurement parameters	Explanation
Level	Power or level of the receive signal inside the channel bandwidth in the preset unit of measurement.  This parameter is measured and displayed independently of the received signal.
Crest Factor	Crest factor of the demodulated baseband signal.  This parameter is measured and displayed independently of the received signal.
Demodulator	Status of the test demodulator is displayed.  If the demodulator is not synchronized to the receive signal ("unlocked"), the following measurement parameters cannot be determined.
Sideband Position	Sideband position of the received DVB-T/H signal.  This parameter is only displayed if the demodulator is synchronized.

Measurement parameters	Explanation
Transmission Parameter Signaling	<p>"FFT" and "Guard Interval" TPS parameters and the modulation mode. All TPS parameters are displayed in the TPS Info measurement window; see the chapter "<a href="#">Working with the TPS Parameter List</a>".</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Carrier Frequency Offset	<p>Absolute carrier frequency offset of the received DVB-T/H signal relative to the set receive frequency.</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Symbol Rate Offset	<p>Relative symbol rate offset. It is given in ppm (parts per million). The offset is of equal importance for the sampling rate offset of the OFDM signal, the length of the guard interval and the bit rate of the MPEG transport stream.</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Modulation Error Ratio	<p>Average modulation error of all OFDM data carriers (MER = modulation error ratio). The RMS value and the peak value of the error power of the demodulated I/Q components are shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Error Vector Magnitude	<p>Average modulation error of all OFDM data carriers (EVM = error vector magnitude). The RMS value and the peak value of the error power of the demodulated IQ components are shown in relation to the peak power of an OFDM data carrier in the linear quantity (%).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
FEC Decoder	<p>Status of the forward error correction (FEC) decoder is displayed.</p> <p>If the FEC decoder is not synchronized to the receive signal (" "), the following measurement parameters cannot be determined.</p>

Measurement parameters	Explanation
<p>Bit Error Ratio Before Viterbi</p> <p>Bit Error Ratio Before Viterbi (High Priority)</p> <p>Bit Error Ratio Before Viterbi (Low Priority)</p>	<p>Bit error ratio of the incorrectly transmitted bits to the transmitted bits which are located upstream of the Viterbi decoder. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with measurement time or with the number of transmitted bits.</p> <p>In the hierarchical transmission mode, the bit error ratio is referenced to either the High Priority data stream or the Low Priority data stream. Select the reference in the DEMOD SETTING : BITSTREAM menu.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
<p>Bit Error Ratio before RS Decoder</p> <p>Bit Error Ratio before RS Decoder (High Priority)</p> <p>Bit Error Ratio before RS Decoder (Low Priority)</p>	<p>Bit error ratio of the incorrectly transmitted bits in relation to the transmitted bits of the data stream upstream of the Reed Solomon (RS) decoder. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with measurement time or with the number of transmitted bits.</p> <p>In the hierarchical transmission mode, the bit error ratio is referenced to either the High Priority data stream or the Low Priority data stream. Select the reference in the DEMOD SETTING : BITSTREAM menu.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>

Measurement parameters	Explanation
Packet error ratio Packet Error Ratio (High Priority) Packet Error Ratio (Low Priority)	<p>Bit error ratio of the incorrectly transmitted bits in relation to the transmitted bits of the MPEG transport stream. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with measurement time or with the number of transmitted bits.</p> <p>In the hierarchical transmission mode, the bit error ratio is referenced to either the High Priority data stream or the Low Priority data stream. Select the reference in the DEMOD SETTING : BITSTREAM menu.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
Packet Errors (High Priority) Packet Errors (Low Priority) Packet Errors	<p>Number of errored MPEG transport stream packets in the last second.</p> <p>In the hierarchical transmission mode, the number of packet errors is referenced to either the High Priority data stream or the Low Priority data stream. Select the reference in the DEMOD SETTING : BITSTREAM menu.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
MPEG TS Bitrate MPEG TS Bitrate (High Priority) MPEG TS Bitrate (Low Priority)	<p>Transmission rate of the MPEG transport stream.</p> <p>In the hierarchical transmission mode, the bit error ratio is referenced to either the High Priority data stream or the Low Priority data stream. Select the reference in the DEMOD SETTING : BITSTREAM menu.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>

### Setting the RF Attenuation

1. Press the MEAS key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

DVB-T/H		Meas List	<No Profile>	29/04/12 14:36	
RF		498 MHz			
Channel / Band		24 / UHF 4/5			
Channel Table		TV Europe			
Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Measurement Parameter			Result		
Power			-30.19 dBm		
Crest Factor			12.46 dB		
Demodulator			locked		
Sideband Position			normal		
Transmission Parameter Signaling			8K 1/32 QAM64 NH		
Carrier Frequency Offset			78.5 Hz		
Symbol Rate Offset			0.2 ppm		
Modulation Error Ratio			rms 44.2 dB	peak 26.4 dB	
Error Vector Magnitude			rms 0.40 %	peak 3.14 %	
FEC Decoder			locked		
BER before Viterbi / Reed Solomon			0.0E-10	0.0E-10	
Packet Error Ratio			0.0E-07		
Packet Errors			0 /s		
MPEG TS Bitrate			27.144389 Mbit/s		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

The RF attenuation can be either preset in 5 dB steps (MAN setting) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION setting) or to high input sensitivity (AUTO LOW NOISE setting).

3. Select the required item.

### Selecting the Bit Data Stream with Hierarchical Transmission Mode

With the BITSTREAM setting, it is possible (in the case of hierarchical modulation) to select whether the bit error measurements and MPEG TS bit rate measurement are performed on the "high priority" or "low priority" data stream. The setting also determines the transport stream at the TS ASI output.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select BITSTREAM, SYMBOL LOOP, CHANNEL ADAPTATION and LOCK CONDITION.

DVB-T/H		Meas List	DVB-TH 8MHz	12/08/13	15:48
	RF		610 MHz		
	Band		---		
	Channel Table		---		
	Gain Control / RF Attenuation		Auto Low Noise / 0 dB		
	OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		
Measurement Parameter		Bitstream			
		High Priority			
Power		Low Priority		Bm	
Crest Factor				B	
Demodulator		Symbol Loop			
Sideband Position		Slow			
Transmission Parameter Signaling		Medium		AM64 NH	
Carrier Frequency Offset		Fast		z	
Symbol Rate Offset		Channel Adaptation		pm	
Modulation Error Ratio		Slow/Laboratory		eak 20.5 dB	
Error Vector Magnitude		Fast/SFN		eak 6.21 %	
FEC Decoder		Mobile			
BER before Viterbi / Reed Solomon		Lock Condition		0.0E-08	
Packet Error Ratio				5	
Packet Errors		FEC Lock Required		s	
MPEG TS Bitrate		FEC Lock Not Required		lbit/s	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

- Under BITSTREAM, select HIGH PRIORITY or LOW PRIORITY.

**Note:** The setting is irrelevant in the case of nonhierarchical transmission.

### Setting the Symbol Loop

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select BITSTREAM, SYMBOL LOOP, CHANNEL ADAPTATION and LOCK CONDITION.

DVB-T/H		Meas List	DVB-T/H 8MHz	12/08/13 15:48	
	RF		610 MHz		
	Band		---		
	Channel Table		---		
	Gain Control / RF Attenuation		Auto Low Noise / 0 dB		
	OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		
Measurement Parameter			Bitstream		
Power			High Priority		t
Crest Factor			Low Priority		Bm
Demodulator			Symbol Loop		B
Sideband Position			Slow		
Transmission Parameter Signaling			Medium		AM64 NH
Carrier Frequency Offset			Fast		z
Symbol Rate Offset			Channel Adaptation		pm
Modulation Error Ratio			Slow/Laboratory		eak 20.5 dB
Error Vector Magnitude			Fast/SFN		eak 6.21 %
FEC Decoder			Mobile		
BER before Viterbi / Reed Solomon			Lock Condition		0.0E-08
Packet Error Ratio			FEC Lock Required		5
Packet Errors			FEC Lock Not Required		s
MPEG TS Bitrate					lbit/s
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

- Under SYMBOL LOOP, select SLOW, MEDIUM or FAST.

### Setting the Channel Adaptation

With the CHANNEL ADAPTATION setting, the OFDM demodulator can be adapted to receive conditions.

With the MOBILE setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. With this setting, the demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels.

For measurements at transmitters and in the lab, it is recommended to use the SLOW / LABORATORY setting because in this setting the channel filtering is optimized for MER performance which has especially influence to the channel border carriers of the OFDM signal. The control loops react only slowly to changes in the receive signal. Possible errors in the DVB-T/H signal are thus detected.

With the FAST / SFN setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels which may occur in single frequency networks (SFN) when the same signal is received by several transmitters. The channel filtering is optimized for reception of signals with strong echoes. The setting degrades the inherent MER performance slightly.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select BITSTREAM, SYMBOL LOOP, CHANNEL ADAPTATION and LOCK CONDITION.

DVB-T/H		Meas List	DVB-T/H 8MHz	12/08/13	15:48
	RF		610 MHz		
	Band		---		
	Channel Table		---		
	Gain Control / RF Attenuation		Auto Low Noise / 0 dB		
	OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		
Measurement Parameter		Bitstream			
			High Priority		t
Power			Low Priority		Bm
Crest Factor					B
Demodulator			Symbol Loop		
Sideband Position			Slow		l
Transmission Parameter Signaling			Medium		AM64 NH
Carrier Frequency Offset			Fast		z
Symbol Rate Offset			Channel Adaptation		pm
Modulation Error Ratio			Slow/Laboratory		eak 20.5 dB
Error Vector Magnitude			Fast/SFN		eak 6.21 %
FEC Decoder			Mobile		
BER before Viterbi / Reed Solomon			Lock Condition		0.0E-08
Packet Error Ratio					5
Packet Errors			FEC Lock Required		s
MPEG TS Bitrate			FEC Lock Not Required		lbit/s
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

- Under CHANNEL ADAPTATION, select SLOW/LABORATORY, FAST/SFN or MOBILE.

### Setting the Demodulator Synchronization Condition

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select BITSTREAM, SYMBOL LOOP, CHANNEL ADAPTATION and LOCK CONDITION.

DVB-T/H		Meas List	DVB-T/H 8MHz	12/08/13 15:48	
		RF	610 MHz		
		Band	---		
		Channel Table	---		
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
		OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz		
Measurement Parameter		Bitstream			
Power		High Priority		t	
Crest Factor		Low Priority		Bm	
Demodulator		Symbol Loop		B	
Sideband Position		Slow			
Transmission Parameter Signaling		Medium		AM64 NH	
Carrier Frequency Offset		Fast		z	
Symbol Rate Offset		Channel Adaptation		pm	
Modulation Error Ratio		Slow/Laboratory		eak 20.5 dB	
Error Vector Magnitude		Fast/SFN		eak 6.21 %	
FEC Decoder		Mobile			
BER before Viterbi / Reed Solomon		Lock Condition		0.0E-08	
Packet Error Ratio		FEC Lock Required		5	
Packet Errors		FEC Lock Not Required		s	
MPEG TS Bitrate				Mbit/s	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

- Under LOCK CONDITION, select FEC LOCK REQUIRED or FEC LOCK NOT REQUIRED.

### Resetting the BER Measurement

If a new synchronization to a DVB-T/H signal takes place (change of FEC decoder lock status from "unlocked" to "locked"), the BER measurements are reset and restarted.

With the BER RESET function, the BER measurements are reset and restarted manually.

- Press the MEAS key.
- Tap BER RESET.

The R&S ETC resets the bit error measurement irrespective of the status of the FEC decoder and restarts it.

DVB-T/H		Meas List	DVB-T/H 8MHz Tran	06/04/12 16:49	
		RF	666 MHz		
		Channel / Band	45 / UHF 4/5		
		Channel Table	TV Europe		
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
		OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz		
Measurement Parameter		Result			
Power		-50.25 dBm			
Crest Factor		12.25 dB			
Demodulator		locked			
Sideband Position		normal			
Transmission Parameter Signaling		8K	1/32	QAM64 NH	
Carrier Frequency Offset		39.0 Hz			
Symbol Rate Offset		0.1 ppm			
Modulation Error Ratio		rms 36.9 dB	peak 23.0 dB		
Error Vector Magnitude		rms 0.94 %	peak 4.62 %		
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		27.144387 Mbit/s			
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TPS Info

### 2.4.1.6 Working with the TPS Parameter List

The DVB-T/H transmitters transmit the TPS transmission parameters (Transmission Parameter Signaling), such as FFT mode, guard interval, QAM order, hierarchy and code rate, with a high level of error protection. The R&S ETC decodes the TPS information and adjusts the test demodulator accordingly.

In addition to the transmission parameters, information such as network cell identification, interleaver mode, MPE-FEC, time slicing and length indicator is also transmitted. The R&S ETC displays the TPS parameters in a list.

1. Press the MEAS key.
2. Tap TPS INFO.

The R&S ETC lists the TPS parameters.

DVB-T/H		TPS Info	DVB-T/H 8MHz Tran		06/04/12 17:03
	RF		666 MHz		
	Channel / Band		45 / UHF 4/5		
	Channel Table		TV Europe		
	Gain Control / RF Attenuation		Auto Low Noise / 10 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			
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings		TPS Info Exit

3. Tap TPS INFO EXIT to redisplay the previously set measurement.

Mode Measurement Profile

Display field for status information

DVB-T/H Receiver		TPS Info	DVB-T 8MHz	18/09/08 15:31
		RF	498 MHz	
	*	Band	UHF 4/5	
		Channel Table	TV Europe	
		Gain Control / RF Attenuation	Manual RF Attenuator / 0 dB	
		Occupied Bw / Channel Bw	7.6071429 MHz / 8 MHz	
TPS Parameter		Value		
FFT		8K		
Guard Interval		1/32		
Constellation		64 QAM H4		
Code Rate High Priority		5/6		
Code Rate Low Priority		7/8		
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		0x21		
Measure	Standard	RF Att / Gain Ctrl	Demod Settings	TPS Info Exit

DVB-T/H receiver setting parameters

TPS parameters

Back to the last measurement

### Requirement for displaying the TPS parameters



The requirement for displaying the TPS parameters is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays **no** TPS parameters

#### 2.4.1.7 Working with the Constellation Diagram

The CONSTELLATION DIAGRAM measurement shows the demodulated I/Q values in a Cartesian coordinate system together with the most important measurement parameters and instrument settings.

To permit simple qualitative evaluation of the signal quality, the decision boundaries are plotted in the coordinate system. The decision boundaries depend on the order of the constellation and the hierarchy. The R&S ETC sets the decision boundaries automatically on the basis of the TPS information from the received DVB-T/H signal.

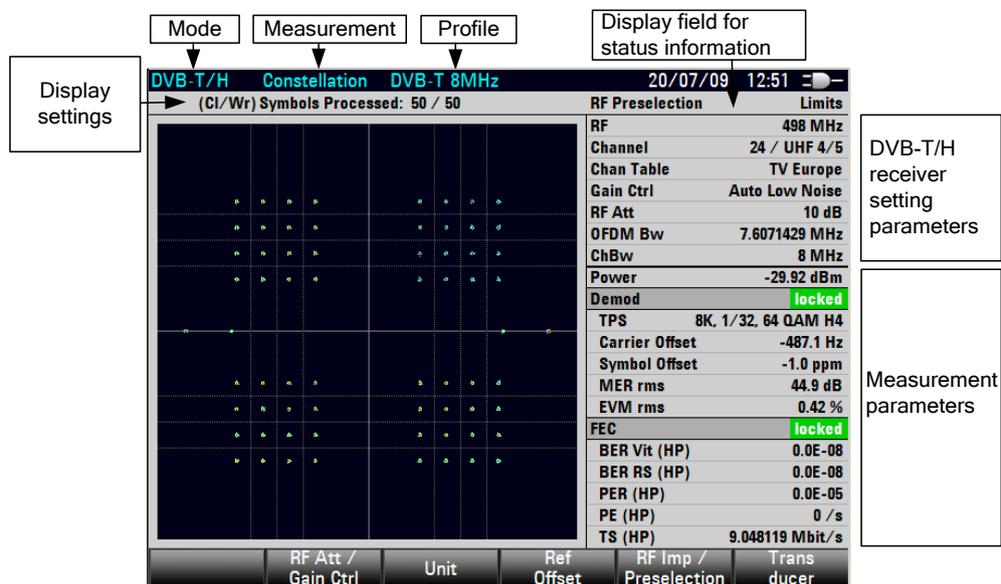
With the exception of the sideband position, the minimum MER peak measurement value and the maximum EVM peak measurement value, the measurement parameters displayed are the same as those in the MEASUREMENT LIST measurement. The most important instrument settings are displayed above the measurement parameters. The measurement parameters are described in the chapter "[Working with the Measurement Parameter List](#)".

1. Press the MEAS key.
2. Tap MEAS MODE.
3. The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

Measurement Parameter		Result
Power		-30.19 dBm
Measurement Mode		12.17 dB
Measurement List		locked
Constellation Diagram		normal
Echo Pattern	scaling	8K 1/32 QAM64 NH
MER (k)		78.6 Hz
Spectrum		0.2 ppm
Spectrum Emission Mask		rms 44.2 dB peak 26.3 dB
TV Standard		rms 0.41 % peak 3.15 %
DVB-T/H	locked	
DVB-T2	lomon	0.0E-10 0.0E-10
ISDB-T		0.0E-06
		0 /s
		27.144389 Mbit/s

4. Select CONSTELLATION DIAGRAM (CONSTELLATION DIAGRAM highlighted in red).

The R&S ETC shows the constellation diagram of the DVB-T/H test receiver.



For a description of the measurement parameters, see the chapter "Working with the Measurement Parameter List".

### Requirement for displaying the constellation



The minimum requirement for displaying the constellation is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays evenly distributed noise in the measurement diagram.

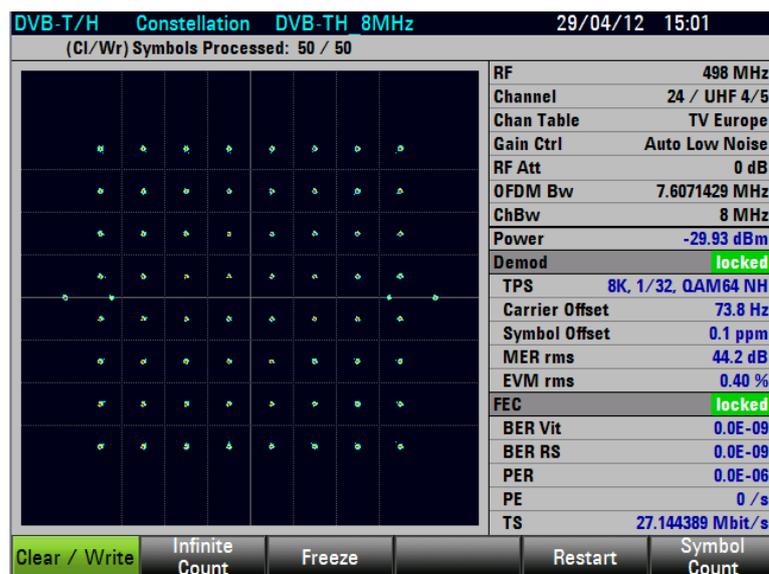
If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful display a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Setting the Constellation Diagram Parameters

With the CLEAR/WRITE setting, the displayed symbols are substituted by currently received symbols when the preset symbol count is reached. The number of displayed symbols is user-selectable. With the INFINITE COUNT setting, the symbols are added until a synchronization loss exists, the trace setting changes or the measurement is closed. With FREEZE, the addition of symbols is stopped and the current display is retained until the measurement is closed. With RESTART, the constellation diagram is reset and addition of the symbols is restarted.

### Selecting the Constellation Diagram

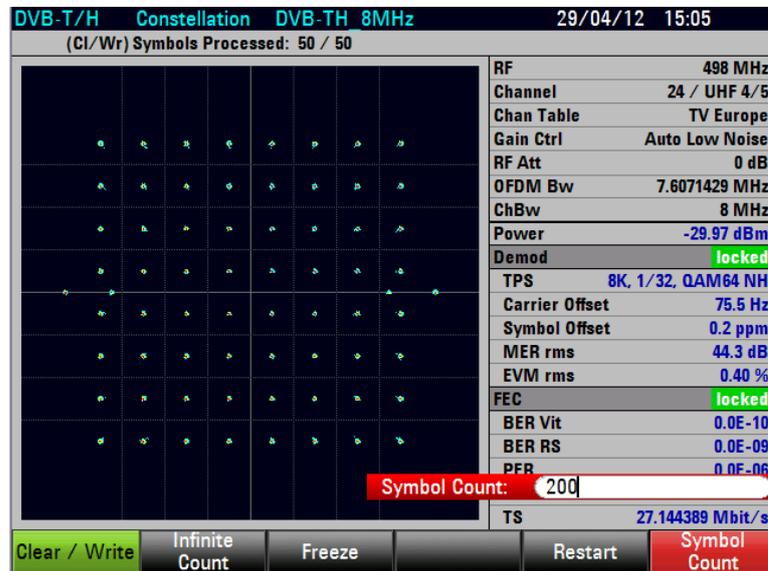
1. Press the TRACE key.
2. Tap CLEAR/WRITE, INFINITE COUNT or FREEZE to select the required diagram.



In the CLEAR/WRITE trace setting, you can adjust the number of symbols to be displayed.

3. Tap SYMBOL COUNT.

The R&S ETC opens the entry field for the symbol count.



4. Set the required number of symbols.

### 2.4.1.8 Working with the Echo Pattern Measurement

The ECHO PATTERN measurement presents the echo profile of the receive channel. Echoes are caused by reflections on building, for example. In single-frequency networks (SFN), the receive signal with the highest level is the useful signal. The receive signals of the other SFN transmitters also appear as echoes.

The R&S ETC sets the largest receive signal as the reference signal (0 dB, 0  $\mu$ s). It sets the guard interval automatically as a function of the receive signal. The echo detection line (i.e. the level threshold starting from which echoes are taken into account for positioning the guard interval) is also automatically defined by the analyzer. If desired, this threshold is shown in the diagram as a horizontal line. The guard start and guard stop times set by the demodulator are displayed as vertical lines in the diagram.

The time axis is displayed by the R&S ETC alternatively as a distance axis calibrated in kilometers or miles. To make estimation simple, the time display range is set in steps of 1, 2 and 5. As a result, it may occur that some subranges contain no data. These ranges are indicated by a different diagram background.

In the default setting, the value range corresponds to the third part of an OFDM symbol, since the echo profile is derived from the scattered pilots.

In the EXTENDED SPAN setting, the time display range corresponds to the length of an OFDM symbol. The I/Q values are routed to the demapper after the channel equalizer. The ideal I/Q position is sent back to the channel equalizer. This information is used to extend the display range to the length of an OFDM symbol. If mistakes occur

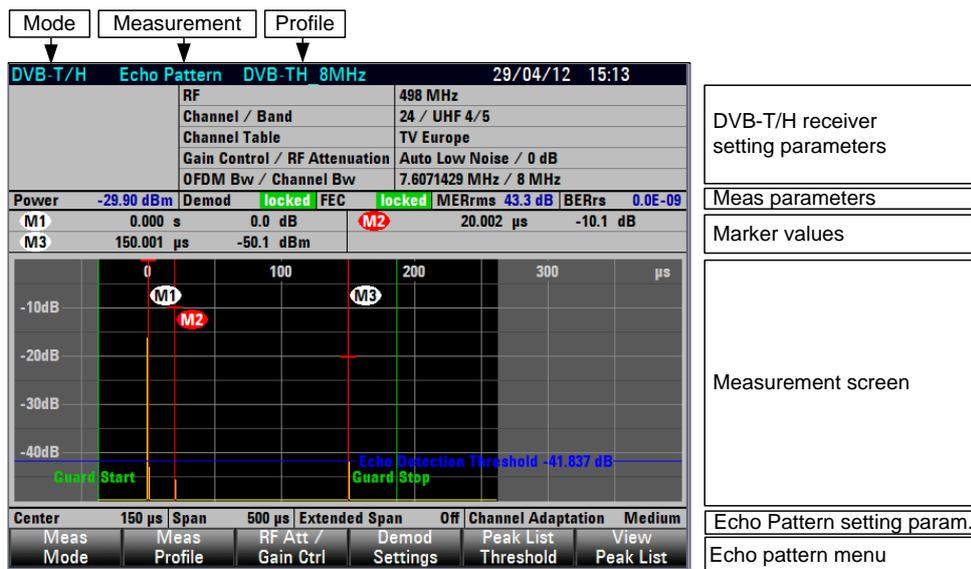
in the demapper, this will result in a detrimental reduction of the dynamic range and pseudo-echoes.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select ECHO PATTERN (ECHO PATTERN highlighted in red).

The R&S ETC displays the echo pattern measurement diagram.



DVB-T/H receiver setting parameters
Meas parameters
Marker values
Measurement screen
Echo Pattern setting param.
Echo pattern menu

### Requirement for the echo measurement

The minimum requirement for displaying echoes is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.



If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Zooming the Display Range

In the default setting, the R&S ETC determines the possible display range automatically and displays it. The R&S ETC allows zooming of the time axis.

1. Press the SPAN key.

2. Tap MANUAL SPAN.
3. Tap CENTER POSITION.
4. Set the center position.
5. Tap MANUAL SPAN.

The display range can be changed in steps of 1, 2 and 5.

6. Set the display range.

The R&S ETC zooms the echo pattern measurement diagram about the center position.

**Note:** The level display range is always 0 dB to –50 dB. It cannot be set. The receive path with the highest level is always set to 0 dB.

### Extending the Display Range

In the default setting, the value range corresponds to the third part of an OFDM symbol. In the EXTENDED SPAN settings, the time display range is extended to the length of an OFDM symbol.



Due to mistakes in the demapper, this may result in reduced dynamic range and pseudo-echoes in the EXTENDED SPAN settings

---

1. Press the SPAN key.
2. Tap EXTENDED SPAN.
3. Set the display range.

### Selecting the Time or Distance Unit

The R&S ETC displays the x axis calibrated either to time or distance. As time axis, the unit is always  $\mu\text{s}$ . The distance axis can be calibrated in kilometers or miles.

1. Press the SPAN key.
2. Tap SPAN UNIT.
3. Select the unit.

### Displaying the Echo Detector Threshold

The R&S ETC positions the guard interval automatically. The level threshold can be shown as display line. It indicates from which level the demodulator echoes are taken into account for positioning.

1. Press the LINES key.
2. Tap VIEW ECHO DETECTION LINE.
3. Tap the menu a second time to hide the display line gain.

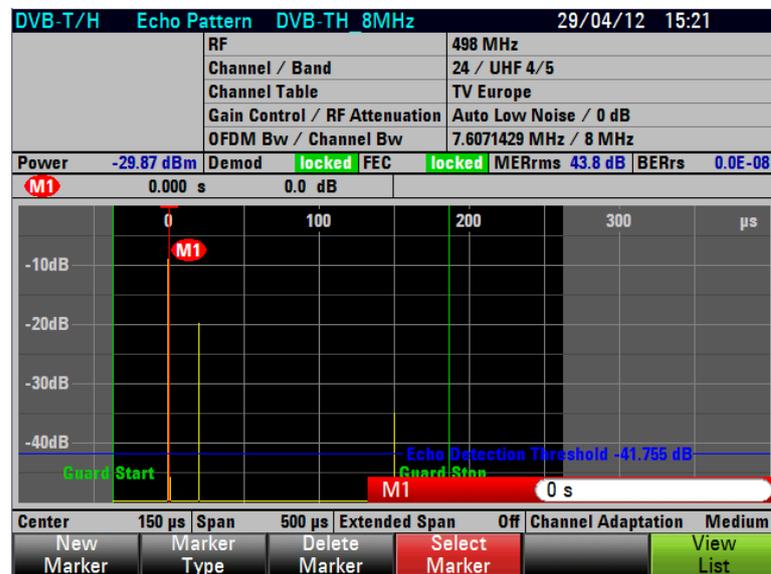
## Using the Markers

To evaluate the trace, the R&S ETC provides up to six markers, five of which can be used either as markers or delta markers.

The markers are always bound to the trace and show the distance to the main path and, depending on the setting, the relative or absolute level at the respective points on the trace. The position of the marker is indicated by a vertical line over the entire length of the measurement diagram. The numeric values for distance and level are displayed on the screen. The units for level and distance are determined by the set units.

1. Press the MARKER key.

The R&S ETC opens the marker menu. If no marker is activated yet, the R&S ETC automatically activates MARKER 1 and sets it to the highest echo level. The distance to the main path and the level is displayed in the selected units above the measurement diagram. The value entry field for the marker frequency is open.



2. The following steps are possible:

- Set the marker position.
- Tap NEW MARKER to activate a further marker.
- Tap MARKER TYPE to select the level unit of the markers (relative or absolute).
- Tap VIEW LIST to deactivate the numeric display of the markers. Tap the menu a second time to activate the marker list again.
- Tap DELETE MARKER to deactivate the marker.



The relative level unit is always given in dB. It is referenced to the receive path with the highest level.

The absolute level unit is determined by the selection in the AMPT : UNIT menu.

The unit of the distance to the main receive path depends on the selection made in the SPAN : SPAN UNIT menu

### Automatic Positioning of the Marker

To simplify operation, the R&S ETC provides functions for positioning the markers.

- PEAK

This function sets the marker at the highest value of the trace. The function always affects the active marker, whose menu is highlighted in red.

- NEXT PEAK

This function sets the marker, starting from its current position, to the next lower value of the trace.

- CENTER = MRK FREQ

In a zoomed display (MANUAL SPAN), the R&S ETC sets the position of the active marker (menu highlighted in red) in the center of the measurement diagram. This function is useful especially when an echo with a smaller display range is to be examined in greater detail. For this purpose, first set the marker in the center of the display range and then reduce the display range.

### 2.4.1.9 Working with the Echo Peak List

In addition to the graphic display, the R&S ETC displays the detected echoes in the ECHO PEAK LIST, sorted by level.

#### Setting the Level Threshold

To selectively restrict the entries, set a threshold value in the range from -50 dB to 0 dB. Only the echoes that exceed the threshold value are listed.

1. Press the MEAS key.
2. Tap PEAK LIST THRESHOLD.
3. Set the threshold value.

#### Displaying the Echo Peak List

1. Press the MEAS key.
2. Tap VIEW PEAK LIST.



### 2.4.1.10 Working with the MER(k) Measurement

In the MER(k) measurement, the R&S ETC shows the modulation error ratios of the modulated OFDM carriers (k). In the measurement screen, the modulated OFDM carriers are evenly distributed among the 631 pixel columns. The display of the OFDM carriers always corresponds to the frequency. The selected 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. This reading can thus be used to adjust the modulator's residual carrier.

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.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the MER(k) menu item (MER(k) SPECTRUM highlighted in red).

The R&S ETC displays the measurement window for the MER(k) measurement.

Mode

Measurement

Profile

DVB-T/H		MER (k)		DVB-T/H 8MHz		29/04/12 15:35	
RF		498 MHz		Channel / Band		24 / UHF 4/5	
Channel Table		TV Europe		Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		Power		-29.92 dBm	
Demod		locked		FEC		locked	
MERrms		44.2 dB		BERrs		0.0E-08	
M1	498.000 MHz	39.1 dB	M2	499.001 MHz	43.1 dB		
M3	1.001 MHz	43.1 dB	M4	Carrier 4305	43.1 dB		

DVB-T/H receiver setting parameters

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Meas parameters

---

Marker values

---

MER(k) measurement screen

---

MER(k) setting parameters

---

MER(k) menu

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### Requirement for the MER(k) measurement



The minimum requirement for displaying the MER(k) measurement parameter is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

---

### Setting the MER Measurement Range

An MER measurement range of 50 dB, 20 dB or 10 dB can be selected. The display range can be shifted by setting the MER reference. The MER reference corresponds to the uppermost grid line. The Scale Adjust function automatically sets the reference and measurement range as a function of the MER value of the receive signal. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap MER RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the MER reference and MER measurement range such that the MER values of all carriers are displayed. It sets the smallest possible measurement range.

### Setting the Detector

The MER measurement screen shows the modulation errors of all modulated OFDM carriers. 631 pixel columns are available for the display. For this reason, several OFDM carriers are grouped in a pixel column.

The selected detector determines the display of the MER value. In the RMS setting, the root-mean-square value of the MER values per pixel column are determined and displayed. In the MIN und 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.

An important parameter of DVB-T/H transmitters is the residual carrier. The residual carrier is determined on the basis of the center carrier. Since this carrier is not modulated, no MER value can be determined for this carrier. However, the residual carrier essentially determines the MER values of the adjacent carriers. If the Min Peak detector is used, the MER value at the carrier frequency (middle pixel column) corresponds to that of the residual carrier.

To set the Min Peak detector, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select MIN PEAK.

The R&S ETC displays the minimum (worst) MER values of the OFDM carriers of each pixel column.

### Trace Modes

Traces can be displayed in different ways (modes):

- CLEAR/WRITE

The R&S ETC deletes the previous trace. This is its default setting.

- MIN HOLD

The trace displays the maximum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the maximum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals in the spectrum or the minimum value in the case of fluctuating signals can be located well with MIN HOLD.

- MAX HOLD

The trace displays the minimum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the minimum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals can be suppressed with MAX HOLD.

- VIEW

The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured MER(k) traces with the marker at a later time.

### Setting the Trace

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the MER trace.

### Using Markers

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the trace and display the marker position and the MER value in a logarithmic scale at the corresponding point of the trace. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the MER value are

displayed above the measurement screen. The unit of the marker position is determined by the marker type setting.

### Setting the Marker Type

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

To set the marker position to absolute frequency specification, proceed as follows:

1. Press the MARKER key.
2. Tap MARKER TYPE.
3. Select ABSOLUTE FREQUENCY.

The R&S ETC specifies the marker position of the active marker as an absolute frequency.

### Automatic Positioning of the Marker

The R&S ETC provides marker functions that make it easier to set the marker:

- PEAK  
This function sets the marker to the minimum value of the trace. It always applies to the active marker, whose marker label is highlighted in red.
- NEXT PEAK  
This function sets the active marker, starting from its momentary position, to the next highest value of the trace.

To position the marker to the minimum MER value, proceed as follows:

1. Press the MKR-> key.
2. Tap SELECT MARKER repeatedly until the desired marker is active.
3. Tap SET TO PEAK.

The R&S ETC positions the active marker to the OFDM carrier with the worst MER value.

#### 2.4.1.11 Working with the Amplitude/Phase/Group Delay Measurement

In the Amplitude/Phase/Group Delay measurement, the R&S ETC determines the magnitude, phase and group delay of the channel transfer function in respect to the corresponding frequency.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

- Select the Amplitude/Phase/GrpDelay menu item (Amplitude/Phase/GrpDelay highlighted in red).

Measurement Parameter		Result	
Measurement Mode		-49.99 dBm	
Measurement List		12.57 dB	
Constellation Diagram		locked	
Echo Pattern	ling	normal	
MER (k)		2K	1/32 QPSK NH
Amplitude/Phase/GrpDelay		56.0 Hz	
Spectrum		rms 37.2 dB	peak 21.3 dB
Spectrum Emission Mask		rms 1.37 %	peak 8.59 %
TV Standard		locked	
DVB-T/H	mon	0.0E-09	0.0E-08
DVB-T2		0.0E-05	
ISDB-T		0 /s	
		6.032086 Mbit/s	

The R&S ETC displays the measurement window for the Amplitude/Phase/GrpDelay measurement.

Mode

Measurement

Profile

DVB-T/H receiver setting parameters

Meas parameters

Marker values

Amplitude/Phase/GrpDelay measurement screen

APGD setting parameters

APGD menu

### Setting the Amplitude/Phase/GrpDelay Measurement Format and Range

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the "Forma/Range" softkey.

For switching of measurement view, proceed as follows:

- Press the MEAS key.
- Tap FORMAT / RANGE.

3. Select AMPLITUDE+PHASE or AMPLITUDE+GROUP DELAY.

A measurement range of 100 dB, 50dB, 20 dB or 10 dB can be selected for amplitude. A measurement range of 360°, 180°, 90°, 45°, 20° and 10° can be selected for phase. A measurement range of 50nsec, 100nsec, 200nsec, 500nsec, 1usec, 2usec, 5usec, 10usec, 20usec, 50usec and 100usec can be selected for group delay.

For adjusting of the measurement range, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select the corresponding trace AMPLITUDE..., PHASE... or GROUP DELAY... for adjustment of the individual trace range.

The Scale Adjust function automatically sets the measurement range of the measurement for the two traces that appear on the screen. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the measurement range such that the minimum and maximum values are visible on the screen.

### Setting the Detector

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the "Forma/Range" softkey.

For selection of trace detector type, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select RMS or Auto Peak for the corresponding trace for amplitude, phase or group delay.

The R&S ETC sets the desired detector type for the selected trace.

### Trace Modes

Trace can be displayed in different ways (modes):

- VIEW  
The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured amplitude/phase/group delay traces with the marker at a later time.
- CLEAR/WRITE  
The R&S ETC deletes the previous trace. This is its default setting.

- **AVERAGE : XX**  
The trace displays the result over the average number set by user where XX indicates the average count that user has entered. On the left top corner, user will be able to see the current average number of the measurement is performing.
- **BLANK**  
The selected trace will be hidden but the measurement is still on-going in the background. This is to allow user to see one trace and have a better view.

### Setting the Trace

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the selected trace.

### Using Markers

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the two traces that are selected and displayed on the screen. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the corresponding value are displayed above the measurement screen. The unit of the marker position is determined by the marker type setting and the current format display of Amplitude/Phase or Amplitude/Group Delay.

### Setting the Marker Type

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

To set the marker position to absolute frequency specification, proceed as follows:

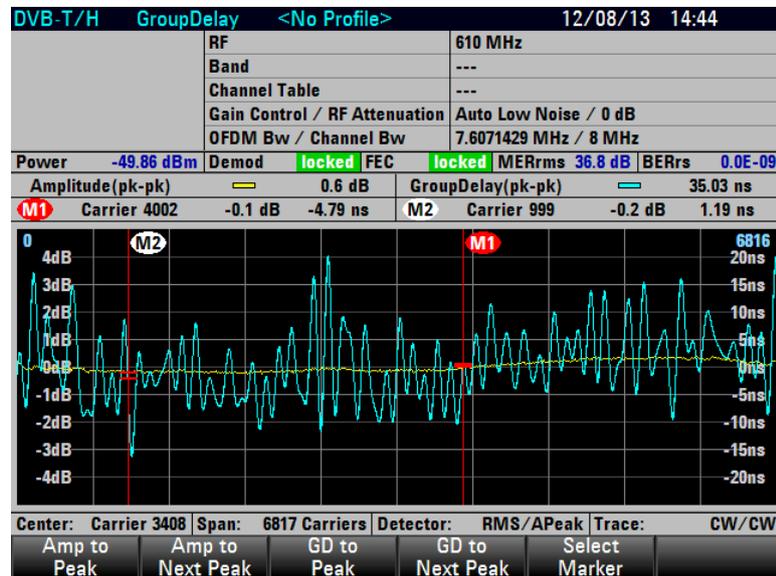
1. Press the MARKER key.
2. Tap MARKER TYPE.
3. Select the desired marker type for the trace.

The R&S ETC set the marker position of the active marker to the desired marker type.

### Automatic Positioning of the Marker

The R&S ETC provides marker functions that make it easier to set the marker. The AMP TO PEAK is always available for selection. PHASE TO PEAK / PHASE TO NEXT PEAK or GD TO PEAK / GD TO NEXT PEAK depends on the current format type of

Amplitude/Group Delay that is selected for display. When moving the selected marker to the next peak of the desired trace, the marker will also indicate the corresponding value for the other trace which in this case might not be the peak value.



- **AMP TO PEAK**  
This function sets the marker to the maximum value of the amplitude trace. It always applies to the active marker, whose marker label is highlighted in red.
- **AMP TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the amplitude trace.
- **PHASE TO PEAK**  
This function sets the marker to the maximum phase value of the phase trace. It always applies to the active marker, whose marker label is highlighted in red.
- **PHASE TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the phase trace.
- **GD TO PEAK**  
This function sets the marker to the maximum value of the group delay trace. It always applies to the active marker, whose marker label is highlighted in red.
- **GD TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the group delay trace.

To position the marker to the peak value of the group delay trace, proceed as follows:

1. Press the MKR-> key.
2. Tap SELECT MARKER repeatedly until the desired marker is active.

3. Tap GD TO PEAK.

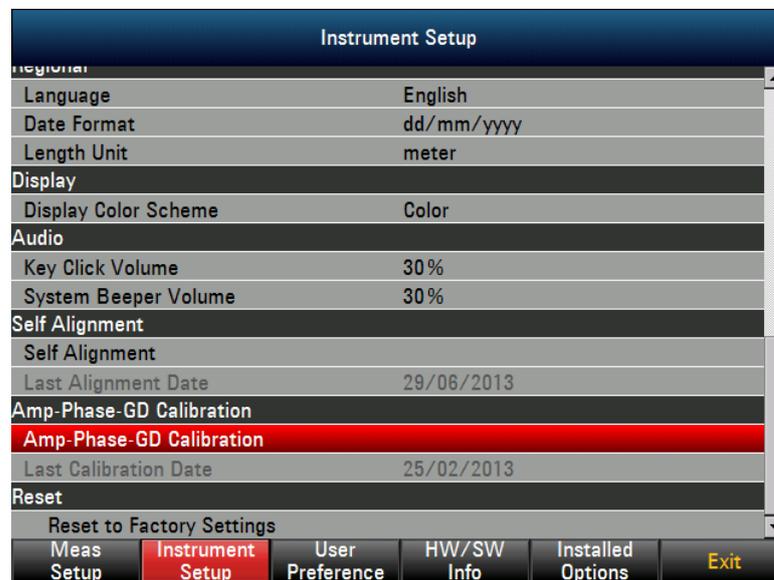
The R&S ETC positions the active marker to the OFDM carrier with the peak value for group delay trace.

### Performing alignment for Amplitude / Phase / Group Delay

The R&S ETC need to perform a calibration in order for accurate measurement. The R&S ETC comes with a factory default alignment data. It is highly recommended to perform the calibration once before starting the measurement.

To perform the alignment, proceed as follows :

1. Press SETUP key.
2. Tap INSTRUMENT SETUP tab.
3. Scroll down to AMP-PHASE-GD CALIBRATION and press ENTER. Follow the instruction on screen to complete the calibration.



#### 2.4.1.12 Working with Measurement Value Monitoring

You can preset limits for the measurement parameters. If the limit check function is activated and the limit is exceeded, the measurement parameter result is displayed in red. Additionally, you can activate an acoustic warning signal. Set the volume of the acoustic warning signal in the SETUP : Instrument Setup menu under Audio : System Beeper Volume.

The R&S ETC can store more than 100 different limit tables. You can activate them using the front panel. The maximum number of limit tables may become smaller if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

Use the supplied R&S ETC View software to create limit tables and to load them in the R&S ETC. Refer to the R&S ETC View software manual.

### Selecting the Limit Table

1. Press the LINES key.
2. Tap LIMIT TABLE.

The R&S ETC opens the list of limit tables that have been loaded using R&S ETC View software.

DVB-T/H Meas List DVB-T/H 8MHz		29/04/12 15:38	
RF	498 MHz		
Channel / Band	24 / UHF 4/5		
Channel Table	TV Europe		
Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz		
Measurement Parameter		Result	
Power	-29.92 dBm		
Crest Factor	12.31 dB		
Demodulator	locked		
Sideband Position	normal		
Transmission Parameter Signaling	8K	1/4	QAM64 NH
Carrier Frequency Offset	78.1 Hz		
Symbol Rate Offset	0.2 ppm		
Modulation Error Ratio	rms 44.2 dB	peak 25.2 dB	
Error Vector Magnitude	rms 0.40 %	peak 3.60 %	
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	19.905885 Mbit/s		
	Limit Check	Limit Info	Limit Options
			Limit Table

3. Select the required limit table.
4. Tap SELECT to activate it.

Select Limit Line					29/04/12 15:39	
Stat	Name	Size	Date	Time		
<	\Public\Limit Lines\..					
>	\Public					
>	\Storage Card					
	My Limit Table.dvblim	1 kB	14/11/2011	15:02		
					Free: 9 MB	
view	Select	Sort / Show	Delete	Refresh	Exit	
Edit / New						

5. To sort the table entries by name/date/size, press the SORT/SHOW. You can also use this menu to hide entries that are incompatible with the current instrument setup.

### Activating the Measurement Value Monitoring

1. Press the LINES key.
2. Tap LIMIT CHECK.

The limit check function is activated. The color of the LIMIT CHECK menu changes to green. "Limits" is displayed in the status field of the measurement window.

DVB-T/H		Meas List	DVB-TH 8MHz		29/04/12	15:40
		RF	498 MHz			
		Channel / Band	24 / UHF 4/5			
		Channel Table	TV Europe			
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB			
Limits		OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz			
Measurement Parameter			Result			
Power			-29.92 dBm			
Crest Factor			12.80 dB			
Demodulator			locked			
Sideband Position			normal			
Transmission Parameter Signaling			8K	1/4	QAM64 NH	
Carrier Frequency Offset			78.1 Hz			
Symbol Rate Offset			0.2 ppm			
Modulation Error Ratio			rms 44.2 dB	peak 26.0 dB		
Error Vector Magnitude			rms 0.40 %	peak 3.28 %		
FEC Decoder			locked			
BER before Viterbi / Reed Solomon			0.0E-10	0.0E-09		
Packet Error Ratio			0.0E-06			
Packet Errors			0 /s			
MPEG TS Bitrate			19.905885 Mbit/s			
		Limit Check	Limit Info	Limit Options	Limit Table	

3. Tap LIMIT CHECK again to deactivate the limit check function.

### Viewing the Limit Settings and the Table Information

1. Press the LINES key.
2. Tap LIMIT INFO.

The file name and the edited description of the currently selected limit table are displayed.

DVB-T/H		Meas List	DVB-TH 8MHz	29/04/12	15:42
Limits	RF	498 MHz			
	Channel / Band	24 / UHF 4/5			
	Channel Table	TV Europe			
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB			
	OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz			
Measurement Parameter			Result		
Power			-29.92 dBm		
Crest Factor			12.28 dB		
Demodulator			locked		
Sideband Position			normal		
Transmission Parameter Signaling			8K	1/4	QAM64 NH
Carrier Frequency Offset			78.0 Hz		
Symbol Rate Offset			0.2 ppm		
Limit Table Info					
Name: My Limit Table					
Description: example					
Status: Valid					
OK					

3. Tap OK to deactivate the table information.

### Activating the Acoustic Measurement Value Monitoring

1. Press the LINES key.
2. Tap LIMIT OPTIONS.
3. Select AUDIO BEEP.

If a measurement value limit is violated and the limit check is active, an acoustic warning signal is additionally output.

DVB-T/H		Meas List	DVB-TH 8MHz	29/04/12	15:43
Limits	RF	498 MHz			
	Channel / Band	24 / UHF 4/5			
	Channel Table	TV Europe			
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB			
	OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz			
Measurement Parameter			Result		
Power			-29.93 dBm		
Crest Factor			12.88 dB		
Demodulator			locked		
Sideband Position			normal		
Transmission Parameter Signaling			8K	1/4	QAM64 NH
Carrier Frequency Offset			78.0 Hz		
Symbol Rate Offset			0.2 ppm		
Modulation Error Ratio			rms 44.2 dB	peak 26.4 dB	
Error Vector Magnitude			rms 0.40 %	peak 3.14 %	
FEC Decoder			locked		
BER before Viterbi / Reed Solomon			0.0E-10	0.0E-09	
Packet Error Ratio			0.0E-06		
Packet Errors			0 /s		
MPEG TS Bitrate			[ ] Audio BEEP		
Limit Check		Limit Info	Limit Options	Limit Table	

If the audio beep is activated, [X] is displayed to the left of AUDIO BEEP.

**Note:** Set the volume of the warning signal under SETUP : INSTRUMENT SETUP : AUDIO : SYSTEM BEEPER VOLUME.

4. To close the menu without changing the warning signal setting, press the CANCEL key.

#### Deactivating the Acoustic Warning Signal

1. Tap LIMIT OPTIONS.
2. Press the ENTER key or tap LIMIT OPTIONS to deselect AUDIO BEEP.

### 2.4.1.13 Measuring the Shoulder Attenuation

When performing a DVB-T/H SPECTRUM measurement, the R&S ETC 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 ETC 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 ETC 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.

---

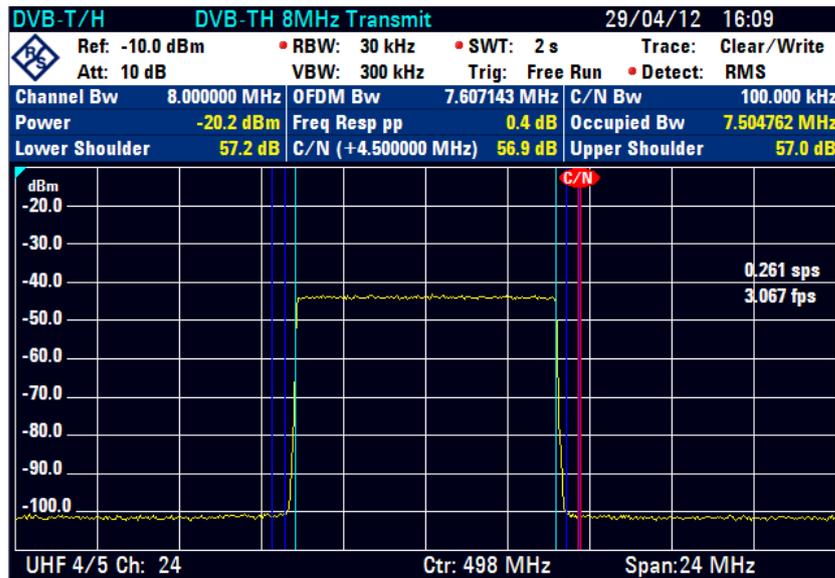
The following example shows the individual steps for efficiently measuring the shoulder attenuation with the R&S ETC.

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.

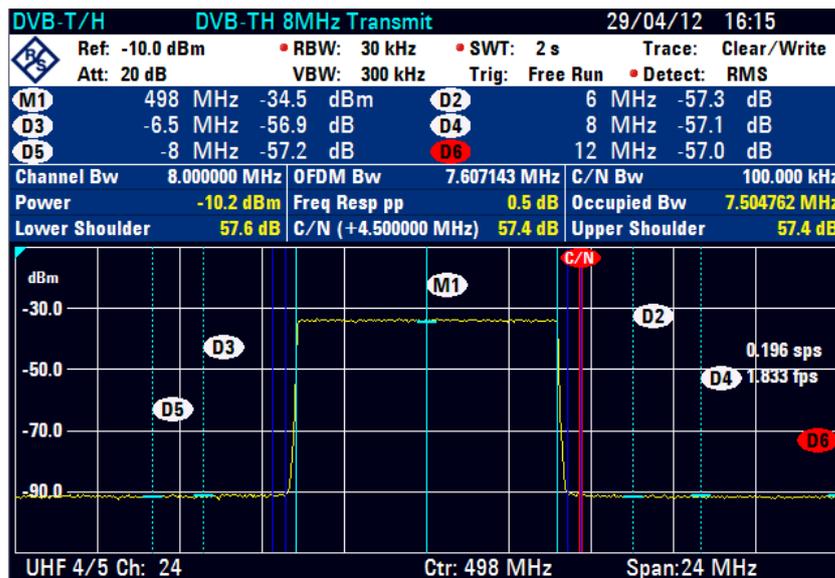
1. Tap MEAS MODE.
2. Select DVB-T/H SPECTRUM.

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 ETC presents the measurement results above the measurement screen.



3. In addition, you can set up to 6 markers.



### 2.4.1.14 Measuring the In-Channel Frequency Response

When performing a DVB-T/H SPECTRUM measurement, the R&S ETC 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. Tap MANUAL SWT TIME.
3. Set the sweep time.



The R&S ETC 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.

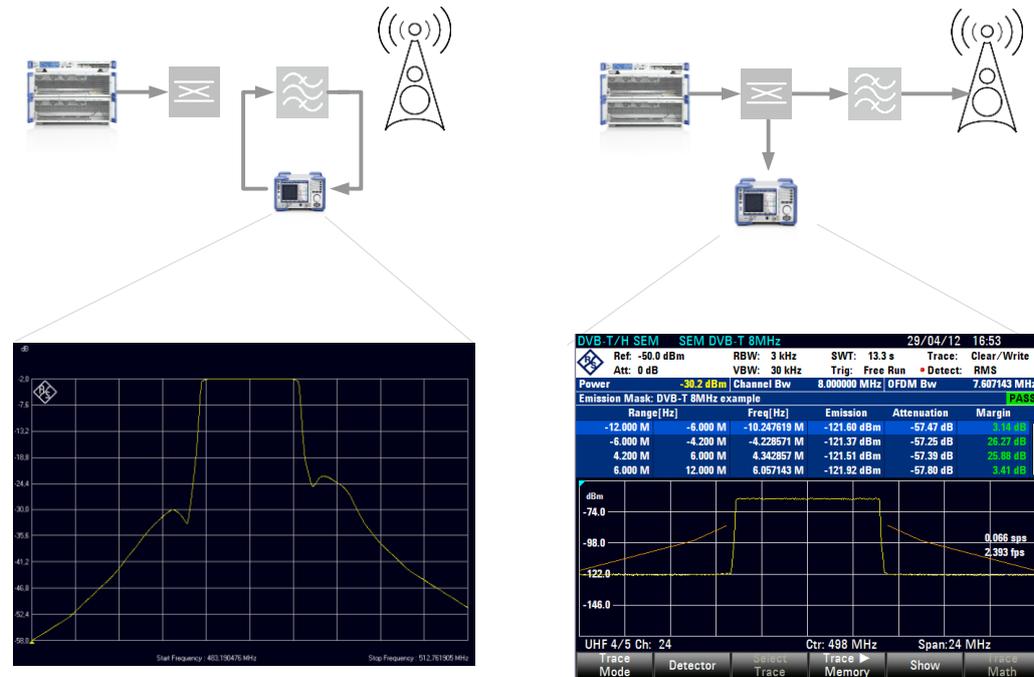
The TS ASI transport stream of the incoming DVB-T/H signal is **not** available in the DVB-T/H SPECTRUM measurement.

### 2.4.1.15 Applying Output Filter Characteristic for Determining 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 ETC 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 ETC with tracking generator (model .04 or .08). For detailed information refer to chapter "Measuring with Transducer Factors".



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 ETC.

### Enabling a Transducer Data Set

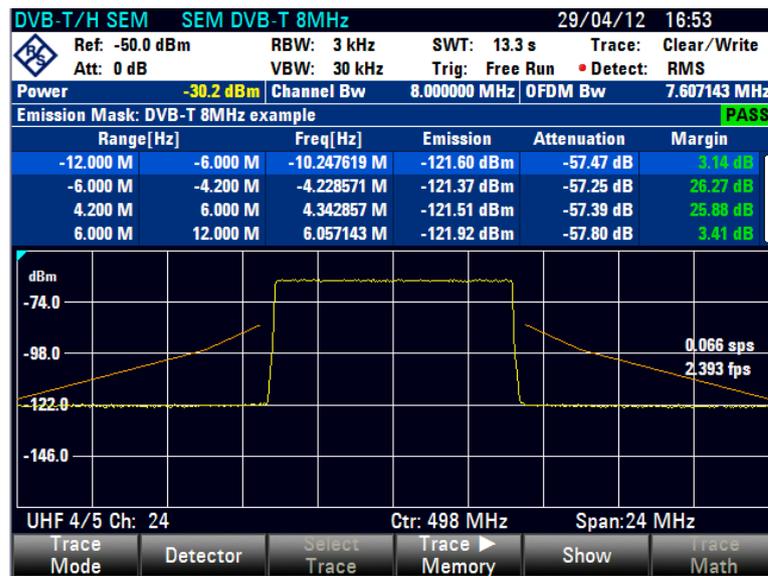
1. Press the AMPT key.
2. Tap TRANSDUCER.
3. Select SELECT SECONDARY TRANSDUCER.

The R&S ETC opens the browser.

4. Select the "MeasTransducer" dataset of the transmitter output filter.

### Setting a Proper Amplitude Scaling

1. Press the AMPT key.
2. Tap RANGE/REF POS.
3. Select SCALE ADJUST.



#### 2.4.1.16 Working with Data Logging

Data logging on the device can be activated via the setup screen. The data that is logged (csv format) for DVB-T/H are :

Level, MER(rms), BER before Viterbi, BER before RS and GPS

To start the data logging, select "On" under the Data logging Activate menu item in the Measurement Setup Screen (via Setup->Meas Setup). The duration and time interval to log data can be set in this screen too. The data logging will be saved to USB, internal SD card or the internal memory with the highest priority of USB storage. The csv file will be in the format of "DeviceSerialNumber\_Date\_Time".csv.

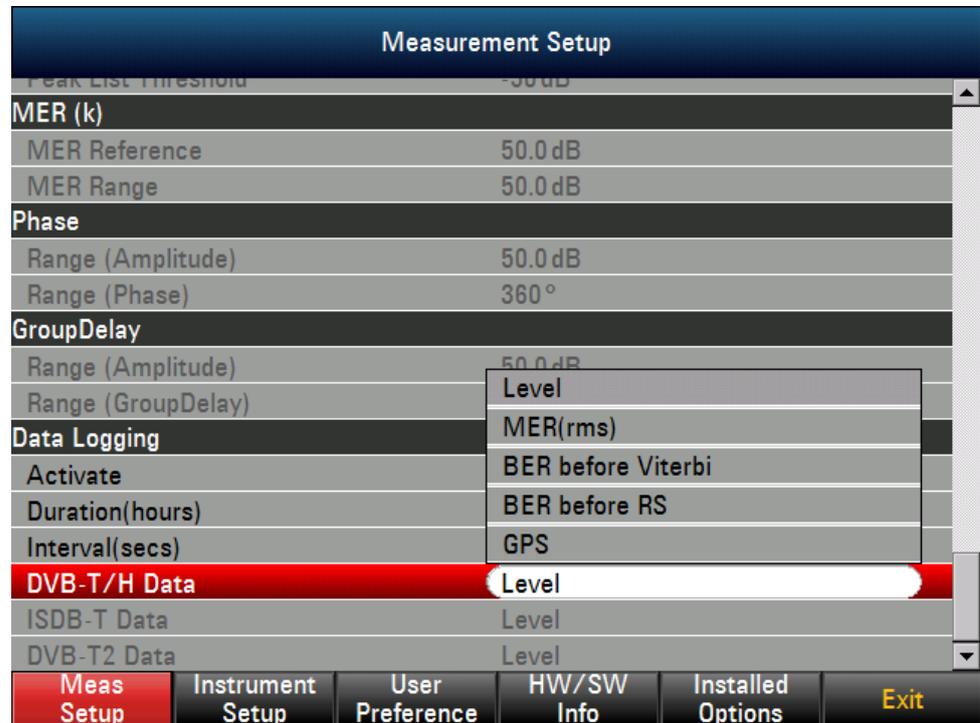
In the event that the file is saved in the SD card or internal memory, ETC view can be used to extract or copy out the saved file.

Measurement Setup	
Peak List Threshold	-50 dB
<b>MER (k)</b>	
MER Reference	50.0 dB
MER Range	50.0 dB
<b>Phase</b>	
Range (Amplitude)	50.0 dB
Range (Phase)	360 °
<b>GroupDelay</b>	
Range (Amplitude)	50.0 dB
Range (GroupDelay)	50.000 µs
<b>Data Logging</b>	
Activate	Off
Duration(hours)	Off
Interval(secs)	On
DVB-T/H Data	Level
ISDB-T Data	Level
DVB-T2 Data	Level
Meas Setup	Instrument Setup
User Preference	HW/SW Info
Installed Options	Exit

Measurement Setup	
Peak List Threshold	-50 dB
<b>MER (k)</b>	
MER Reference	50.0 dB
MER Range	50.0 dB
<b>Phase</b>	
Range (Amplitude)	50.0 dB
Range (Phase)	360 °
<b>GroupDelay</b>	
Range (Amplitude)	50.0 dB
Range (GroupDelay)	50.000 µs
<b>Data Logging</b>	
Activate	Off
Duration(hours)	1
Interval(secs)	1 s
DVB-T/H Data	Level
ISDB-T Data	Level
DVB-T2 Data	Level
Meas Setup	Instrument Setup
User Preference	HW/SW Info
Installed Options	Exit

During logging, different measurement screen can be selected except the Spectrum and Spectrum Emission Mask. Switching over to this measurement will cause the logging to be stopped. In order to switch to other instrument mode like Spectrum or Network Analyzer, data logging has to be stopped first if it is started.

When the data logging has completed, the top right corner will show the complete icon.



Data Logging icon	Explanation
	This icon indicates that data logging has completed.
	This icon indicates that data logging encountered some errors.
	This icon indicates that data logging is in progress.
	This icon indicates that data logging is stopped by user.

### 2.4.2 ISDB-T Analysis

The R&S ETC offers the following TV receiver measurement modes:

- Measurement List, chapter [2.4.2.4](#)
- TMCC Parameters, chapter [2.4.2.5](#)
- Constellation Diagram, chapter [2.4.2.6](#)
- Echo Pattern, chapter [2.4.2.7](#)

- Echo Pattern Peak List, chapter [2.4.2.8](#)
- MER(k), chapter [2.4.2.9](#)
- Amplitude/Phase/Group Delay, chapter [2.4.2.10](#)
- Data Logging, chapter [2.4.2.13](#)

The R&S ETC has an FPGA-based real-time test demodulator. The test demodulator determines the level and crest factor of the received signal, the carrier frequency offset, the symbol rate offset, the modulation error, the bit error ratios before the Viterbi decoder and before the Reed Solomon decoder, the packet error ratio of the decoded MPEG transport stream, the MPEG transport stream rate and the transmission and multiplexing configuration control (TMCC) information. The test demodulator is configured automatically on the basis of the received TPS information.

The test demodulator can be configured for specific measurement tasks.

With the LOCK CONDITION : FEC LOCK REQUIRED setting, a locked forward error correction (FEC) decoder is required for demodulator synchronization. This condition can be disabled to enable the test demodulator to be synchronized even when test signals which do not generate a valid MPEG data stream are being received. With this setting, the test demodulator even synchronizes to receive signals whose useful power is lower than the noise power in the transmission channel.

With the CANNEL ADAPTION setting, the OFDM demodulator can be adapted to receive conditions. With the MOBILE setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. With this setting, the demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels. For measurements at transmitters and in the lab, it is recommended to use the SLOW / LABORATORY setting because with this setting the control loops react only slowly to changes in the receive signal. Possible errors in the ISDB-T signal are thus detected. With the FAST / SFN setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels which may occur in single frequency networks (SFN) when the same signal is received by several transmitters.

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

The bit error measurements are automatically reset and restarted when the demodulator is resynchronized. With BER RESET, the bit error measurements can be reset and restarted manually.

The accuracy of the carrier frequency drift and symbol rate corresponds to the accuracy of the internal reference. The R&S ETC provides the possibility of feeding in an external 10 MHz reference frequency signal. The accuracy of frequency measurement then corresponds to the accuracy of this reference.

The R&S ETC supports the R&S HA-Z240 GPS receiver. If the GPS receiver is connected, the R&S ETC shows the geographical data on the measurement screen. In addition, the 1 ppm signal is used to increase the frequency measurement accuracy.

To simplify operation, the R&S ETC provides the possibility of organizing the measurement settings in a measurement profile. The selected measurement profile contains the measurement settings which the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile defines the settings for the test demodulator, the bandwidths, the detector and the displayed dimensional unit. The supplied R&S ETC View software contains predefined measurement profiles. R&S ETC View software can also be used to create customer-specific measurement profiles and to load them in the R&S ETC. The measurement profiles stored in the R&S ETC when shipped can be deleted if necessary.

Limits can be preset for the measurement parameters. If the limit check function is activated, the measurement parameter result is displayed in red if the limit is exceeded. An acoustic warning signal can additionally be activated. The limits are defined using the supplied R&S ETC View software.

The MEASUREMENT LIST measurement presents a clear overview of the measurement parameters together with the most important settings.

The CONSTELLATION DIAGRAM measurement shows the I/Q values in a Cartesian coordinate systems separated for the layers A, B and C. The most important measurement parameters and instrument settings are shown in addition. To permit simple qualitative evaluation of the signal quality, the R&S ETC also indicates the decision thresholds, the levels of which are adapted automatically to the modulation mode.

The TMCC screen presents the transmission and multiplexing configuration control signal information.

The ECHO PATTERN measurement presents the echo profile of the receive channel. Extensive marker functions make it easier to detect echoes. Besides the graphic display, the R&S ETC lists the detected echoes, sorted by level, in the ECHO PEAK LIST.

The MER(k) measurement shows the modulation error ratios versus the modulated OFDM carriers (k). Extensive marker functions facilitate operation and make it easier to detect disturbances.

During the MEASUREMENT LIST, CONSTELLATION DIAGRAM, MER(k) and ECHO PATTERN measurements, the R&S ETC makes the asynchronous transport stream TS-ASI of the received ISDB-T signal available at the BNC connector TS OUT.

### 2.4.2.1 Selecting the Measurement Profile

To simplify operation, the R&S ETC provides measurement profiles. The measurement profile contains the setting parameters that the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile contains the settings for all measurements available in the selected TV standard.

You can use the supplied R&S ETC View software to create additional customer-specific measurement profiles, to load them in the R&S ETC and to delete the measurement profiles. How to create measurement profiles and to load these profiles in the R&S ETC is described in the R&S ETC View software manual.

1. Press the MEAS key.
2. Tap MEAS PROFILE.

The R&S ETC opens the browser and shows the measurement profile definition files (ISDSTD file extension) that can be used in the selected ISDB-T standard.



3. Select the required measurement profile.

The measurement profile defines the following setting parameters.

Profile Editor - Transmitter.isdstd

Profile Name: Transmitter .ISDSTD

Description (optional): transmitter measurements

TV Standard: ISDB-T

ISDB-T

Resolution Bandwidth:  Auto 30000 Hz

Video Bandwidth:  Auto 0 Hz

Sweeptime:  Auto 5 s

Span:  Auto 18000000 Hz

Trace Detector: Auto Peak

Channel Bandwidth: 6,E+6 Hz

Power Unit: dBm

Symbol Loop: Slow

Channel Adaption: Slow

Lock Condition: FEC Lock Required

FFT Window Position:  Auto 0 %

Buttons: New, Open, Save, Close

### 2.4.2.2 Setting the Frequency

The frequency is set on the R&S ETC using the FREQ key. It can be set by entering the carrier frequency or by entering a channel. If a channel is entered, a channel frequency table must be loaded in the R&S ETC using the supplied R&S ETC View

software. How to create the channel tables is described in the R&S ETC View software manual.

### Setting the Receive Frequency

1. Press the **FREQ** key.

The R&S ETC opens the frequency menu.

- If the frequency was last set by entering the carrier frequency, the entry field for the frequency value is already activated and the frequency that has just been set is displayed in the entry field. You can enter a new frequency immediately.
- If the frequency was last set by entering a channel, the entry field for the channel value is already activated, allowing immediate entry of the channel. To enter the carrier frequency, press the **RF**.

2. Tap **RF**.

**Note:** Only necessary if the frequency was last set by entering the channel.

3. Set the required frequency.

The R&S ETC sets the entered frequency as the new receive frequency. The entry field remains active to allow further entries to be made.

### Working with a Frequency Offset

In the case of measurements on frequency converters, it is often useful to reference the results to the frequency prior to conversion. The R&S ETC provides a frequency offset for this purpose. It offsets the center frequency mathematically to higher or lower frequencies so that the R&S ETC displays the input frequency of the DUT.

The possible range for the positive frequency offset is 1 Hz to 100 GHz in 1 Hz steps. The permitted negative frequency offset depends on the frequency setting. The frequency at the **RF** input of the R&S ETC must be positive.

1. Press the **FREQ** key.

2. Tap **FREQ OFFSET**.

The R&S ETC opens the entry field for the frequency offset.

3. Set the required frequency offset.

The R&S ETC adds the frequency offset to the set center frequency. A red dot next to the receive frequency indicates that a frequency offset has been set.

4. To cancel the frequency offset again, enter an offset of 0 Hz.

### Setting the Receive Frequency Step Size

The frequency step size is freely selectable. It enables the analysis of ISDB-T signals with regular frequency spacing (e.g. channel spacing).

1. Tap **RF STEPSIZE**.

The entry field containing the value for the current step size opens.

2. Set the step size.

## Working with Channel Tables

Almost all transmission systems divide the frequency range that they have been assigned into channels, whereby the channels are each assigned one frequency. To simplify operation, the R&S ETC therefore provides the possibility of defining channel assignments based on terms familiar to users.

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. The R&S ETC can store more than 100 different channel tables which can be activated as required from the front panel. The maximum number of channel tables may be lower if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

How to create channel tables and to transmit the channel table to the R&S ETC is described in the R&S ETC View software manual.

## Selecting the Channel Frequency Table

1. Press the **FREQ** key.
2. Tap **CHANNEL TABLE**.

The R&S ETC opens the browser for selecting the channel table.

Select Channel Table					17/04/12 21:18
Stat	Name	Size	Date	Time	
	TV Australia.chntab	1 kB	14/11/2011	15:02	▲
	TV Brazil.chntab	1 kB	14/11/2011	15:02	
	TV China.chntab	1 kB	14/11/2011	15:02	
	TV DK_OIRT.chntab	1 kB	14/11/2011	15:02	
	TV Europe.chntab	1 kB	14/11/2011	15:02	
	TV France.chntab	1 kB	14/11/2011	15:02	
	TV French Overs.chntab	1 kB	14/11/2011	15:02	
	TV Ireland.chntab	1 kB	14/11/2011	15:02	
	TV Italy.chntab	1 kB	14/11/2011	15:02	
	TV Japan ISDB-T.chntab	1 kB	14/11/2011	15:02	
	TV Japan.chntab	1 kB	14/11/2011	15:02	
	TV Morocco.chntab	1 kB	14/11/2011	15:02	
	TV South Africa.chntab	1 kB	14/11/2011	15:02	
	TV UK negative offset.chntab	1 kB	14/11/2011	15:02	
	TV UK positive offset.chntab	1 kB	14/11/2011	15:02	
	TV UK.chntab	1 kB	14/11/2011	15:02	
	TV USA Air.chntab	1 kB	14/11/2011	15:02	
	TV USA CATV.chntab	1 kB	14/11/2011	15:02	
	TV USA HRC.chntab	1 kB	14/11/2011	15:02	
	TV USA IRC.chntab	1 kB	14/11/2011	15:02	▼

Free: 9 MB

View	Select	Sort / Show	Delete	Refresh	Exit
Edit / New					

3. To sort the table entries by name/date/size, press the **SORT/SHOW**. You can also hide entries that are incompatible with the current instrument setup.
4. Select the required channel table.
5. Tap **SELECT** to activate it.

The R&S ETC opens the channel entry field.

## Setting the Channel

1. Press the **FREQ** key.
2. Tap **CHANNEL**.

The R&S ETC opens the channel entry field.

3. Set the required channel number.

The R&S ETC sets the receive frequency of the entered channel.

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

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. Assignment of channel numbers to frequencies is as follows:

- The first channel is assigned a channel number and a frequency.
- All subsequent channels have ascending numbers.
- The frequency spacing between the channels is fixed. It can also be negative, i.e. as the channel number increases, the center frequency of the R&S ETC decreases.
- In the case of transmission systems with gaps in the frequency range (e.g. television), a channel table can be composed of several ranges.

How to create channel tables and to load these tables in the R&S ETC is described in the R&S ETC View software manual.

### 2.4.2.3 Setting the Amplitude Parameters

At the RF input, the R&S ETC has an RF attenuator which, in the AUTO LOW NOISE and AUTO LOW DISTORTION settings, is controlled automatically in 5 dB steps depending on the receive level.

- AUTO LOW DISTORTION

The R&S ETC sets a 5 dB higher attenuation (related to the AUTO LOW NOISE setting). As a result, the load on the input mixer is 5 dB lower for the given reference level. In the case of an input spectrum with high signal density, intrinsic interference products of the input mixer are reduced. However, the receiver noise factor of the R&S ETC increases owing to the higher attenuation upstream of the input mixer. Due to the headroom of more than 5 dB, this setting is also recommended for mobile reception.

- AUTO LOW NOISE

The R&S ETC sets a 5 dB lower attenuation (related to the AUTO LOW DISTORTION setting). This increases the sensitivity of the R&S ETC, i.e. the receiver noise factor drops owing to the lower attenuation upstream of the input mixer. This setting is also recommended for measurements at the transmitter as here large headrooms are not necessary.

In the ISDB-T demodulation mode, the R&S ETC provides a routine to determine the optimum attenuator setting. This routine adjusts the attenuator so that the demodulated signal produces the smallest possible modulation error. On completion of the routine, the attenuator setting assumes the "manual control" state.

As an alternative to automatic control, the RF input attenuator can be manually preset in 5 dB steps. The current RF attenuation setting is shown in the status display of the measurement window.

By default, the measured receive level is displayed in dBm. However, it is also possible to select the units dBmV, dB $\mu$ V, watt and volt.

A reference offset (REF OFFSET) can be defined for the measured receive level. The reference offset adds a settable value to the reference level. This is useful if, for example, an attenuator or an amplifier is used upstream of the RF input. The R&S ETC includes this attenuation or gain in the level display, making manual conversion unnecessary. Attenuation upstream of the RF input must be entered as a positive value and gain as a negative value.

As an option, the R&S ETC features internal RF preselection for the suppression of unwanted receive 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. To improve sensitivity, signals are passed through a low-noise amplifier after preselection. This 15 dB amplifier improves sensitivity by approx. 10 dB.

For measurements on 75  $\Omega$  systems, the R&S ETC provides the possibility of switching over to 75  $\Omega$ . Here, however, it does not switch the RF input to 75  $\Omega$ , but instead simply switches to a 75  $\Omega$  matching pad that is located at the RF input. The 50/75  $\Omega$  matching pads R&S RAZ, R&S RAM and R&S FSH-Z38 are available for impedance matching to 75  $\Omega$  (see the recommended accessories). If configured accordingly, the R&S ETC automatically takes the conversion factor of the matching pad into consideration.

Other matching pads can be implemented by using a transducer factor. How to generate transducer factors is described in the R&S ETC View software manual.

### Setting the RF Attenuation

1. Press the AMPT key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

The RF attenuation can be either preset in 5 dB steps (MAN setting) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION setting) or to high input sensitivity (AUTO LOW NOISE setting).

3. Select the required item.

### Setting the Display Unit for the Level

1. Press the AMPT key.
2. Tap UNIT.

The R&S ETC opens a submenu to select the various dimensional units for the receive level.

3. Select the required unit.

**Note:** The R&S ETC sets the unit selected for receive level. The units dB $\mu$ V/m, dB $\mu$ A/m, V/m and W/m<sup>2</sup> are only available if a transducer with corresponding unit is activated.

### Setting the Reference Offset

1. Press the AMPT key.
2. Tap REF OFFSET.
3. Set a reference offset.

The reference offset is always entered in dB, even if the reference level is set to a different unit.

**Note:** A light blue asterisk appears at the top left of the measurement window to indicate that a reference offset that is not equal to 0 dB has been entered.

### Activating the RF Preselection

Only available with the R&S ETC-K1 option.

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select RF PRESELECTION and RF IMPEDANCE.

ISDB-T		Meas List		<No Profile>		12/08/13 16:24	
RF		610 MHz		Band		---	
Channel Table		---		Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
Measurement Parameter							
Power		-49.93 dBm		Crest Factor		12.02 dB	
OFDM Demodulator		locked		FEC Decoder		locked	
ISDB-T Mode		Mode 3 (8K)		MER (total,rms)		38.5 dB	
Guard Interval		1/8		MER (total,p) RF Impedance		50 $\Omega$	
Sideband Position		normal		MER TMCC		75 $\Omega$ RAM (5.7 dB loss)	
RF Offset		30.1 Hz		MER AC		75 $\Omega$ FSH-Z38 (5.7 dB loss)	
Symbol Rate Offset		0.1 ppm		MER AC		75 $\Omega$ RAZ (1.8 dB loss)	
		Layer A		Layer B		75 $\Omega$ Transf. (0 dB loss)	
MER (Layer,rms)		37.9		---		Loss of Transformer...	
BER before Viterbi		0.1E-08		---		RF Preselection	
BER before Reed Solomon		0.0E-08		---		[ ] RF Preselection	
BER after Reed Solomon		0.0E-07		---			
Packet Errors		0		---			
MPEG TS Bitrate		21.298476		---			
RF Att / Gain Ctrl		Unit		Ref Offset		RF Imp / Preselection	
						Transducer	

3. Select RF PRESELECTION.

**Note:** If RF preselection is already activated, RF PRESELECTION is highlighted in green and an [X] is shown between the square brackets to the left of the entry. If RF preselection is activated, PRESELECTION is displayed in the status area of the measurement window.

4. To deactivate RF preselection, deselect the respective item.

### Setting the Input Impedance

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select 50  $\Omega$  and 75  $\Omega$  as the input impedance.

ISDB-T		Meas List	<No Profile>	12/08/13	16:24
RF				610 MHz	
Band				---	
Channel Table				---	
Gain Control / RF Attenuation				Auto Low Noise / 0 dB	
Measurement Parameter					
Power		-49.93 dBm		Crest Factor	12.02 dB
OFDM Demodulator		locked		FEC Decoder	locked
ISDB-T Mode		Mode 3 (8K)			
Guard Interval		1/8		MER (total,rms)	38.5 dB
Sideband Position		normal		MER (total,p	RF Impedance
RF Offset		30.1 Hz		MER TMCC	50 $\Omega$
Symbol Rate Offset		0.1 ppm		MER AC	75 $\Omega$ RAM (5.7 dB loss)
		Layer A		Layer B	75 $\Omega$ FSH-Z38 (5.7 dB loss)
MER (Layer,rms)		37.9			75 $\Omega$ RAZ (1.8 dB loss)
BER before Viterbi		0.1E-08			75 $\Omega$ Transf. (0 dB loss)
BER before Reed Solomon		0.0E-08			Loss of Transformer...
BER after Reed Solomon		0.0E-07			
Packet Errors		0			RF Preselection
MPEG TS Bitrate		21.298476			[ ] RF Preselection
	RF Att / Gain Ctrl	Unit	Ref Offset	RF Imp / Preselection	Transducer

3. Select the required input impedance.

**Note:** If the input is set to 75  $\Omega$ , it is essential to connect the appropriate matching pad upstream of the RF input. Otherwise, the level displayed by the R&S ETC will be incorrect.

Note: For 75  $\Omega$  Transf. (xx dB loss), user can connect a transformer and indicate the transformer loss via the "Loss of Transformer..." menu. An entry box will appear to allow user-defined loss to be entered.

### Selecting a Transducer Factor

In many cases, the R&S ETC is not connected directly to the output of the DUT. Instead the measurement signal is fed to the R&S ETC via cables, amplifiers or antenna, or a combination of these items.

The R&S ETC can include the frequency responses of up to two upstream accessory units in the measurement result. For this purpose, "transducer factors" are defined and loaded in the R&S ETC using the R&S ETC View software. Each transducer factor consists of a list of frequency/level pairs which describe the frequency response of the test accessory unit. In the case of antennas, the dimensional unit for the measured electrical or magnetic field strength is also included.

Two entries (Primary/Secondary Transducer) can be activated from the list of transducer factors loaded in the R&S ETC so that, for example, a combination consisting of cable+antenna or cable+amplifier can be taken into consideration. It is important to note that only one of the two selected transducers can define a dimensional unit other than dB.

How to use transducer factors is described in the chapter "Measuring with Transducer Factors". How to create transducer tables and to load them in the R&S ETC is described in the R&S ETC View software manual.

### 2.4.2.4 Working with the Measurement Parameter List

In the MEASUREMENT LIST measurement, the R&S ETC works as test demodulator. The measurement parameter list provides an overview of the most important instrument settings, the receive signal status and the quality of the received ISDB-T signal. The sequence in which the measurement parameters are shown corresponds to the sequence of synchronization steps in the demodulator. The first measurement parameter in the list are the receive level and the crest factor measured in the receive channel. These parameters are always measured, irrespective of whether synchronization of the demodulator takes place or not. In the DEMODULATOR line, the R&S ETC indicates whether the test demodulator is synchronized to the received signal. The SIDEBAND POSITION and RF OFFSET measurement parameters, the TMCC information and the modulation error are only determined and displayed if the test demodulator is synchronized to the receive signal. A synchronized forward error correction (FEC) decoder is necessary for measurement of the bit error ratios and the transport stream rate.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select MEASUREMENT LIST (MEASUREMENT LIST highlighted in red).

The R&S ETC displays the measurement parameter list of the TV Analyzer.

Mode
Measurement
Profile

ISDB-T	Meas List	Transmitter	06/04/12 17:12
		RF	695.142857 MHz
		Channel / Band	50 / UHF 4/5
		Channel Table	TV Japan ISDB-T
		Gain Control / RF Attenuation	Auto Low Noise / 10 dB
Measurement Parameter			
Power	-20.06 dBm	Crest Factor	12.45 dB
OFDM Demodulator	locked	FEC Decoder	locked
ISDB-T Mode	Mode 3 (8K)		
Guard Interval	1/8	MER (total,rms)	44.8 dB
Sideband Position	normal	MER (total,peak)	20.5 dB
RF Offset	36.5 Hz	MER TMCC	46.7 dB
Symbol Rate Offset	0.1 ppm	MER AC	46.7 dB
		Layer A	Layer B
MER (Layer,rms)		44.4	44.5
BER before Viterbi		0.0E-08	0.0E-07
BER before Reed Solomon		0.0E-08	0.0E-07
BER after Reed Solomon		0.0E-07	0.0E-05
Packet Errors		0	0 /s
MPEG TS Bitrate		13.730886	0.936197 0.312066 Mbit/s

Display field for status information

Receiver Settings

Measurement Parameters

Measurement parameters	Explanation
Level	<p>Power or level of the receive signal inside the channel bandwidth in the preset unit of measurement.</p> <p>This parameter is measured and displayed independently of the received signal.</p>
Crest Factor	<p>Crest factor of the demodulated baseband signal.</p> <p>This parameter is measured and displayed independently of the received signal.</p>
OFDM Demodulator	<p>Status of the OFDM demodulator.</p> <p>If the OFDM demodulator is not synchronized to the receive signal ("unlocked"), the following measurement parameters cannot be determined.</p>
ISDB-T Mode	ISDB-T mode of the received ISDB-T signal.
Guard Interval	Guard interval of the received ISDB-T signal.
Sideband Position	<p>Sideband position of the received ISDB-T signal.</p> <p>This parameter is only displayed if the OFDM demodulator is synchronized.</p>
RF Offset	<p>Carrier frequency offset in Hz of the received ISDB-T signal relative to the set receive frequency.</p> <p>This parameter is only displayed if the OFDM demodulator is synchronized.</p>
Symbol Rate Offset	<p>Relative symbol rate offset in ppm (parts per million). The offset is of equal importance for the sampling rate offset of the OFDM signal, the length of the guard interval, the bit rate of the MPEG transport stream and the bandwidth of the OFDM signal.</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
MER (total, rms)	<p>Average modulation error of all OFDM carriers including the TMCC and AC carriers (MER = modulation error ratio) . The RMS value of the error power of the demodulated I/Q components are shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>

Measurement parameters	Explanation
MER (total, peak)	<p>Peak modulation error of all OFDM carriers including the TMCC and AC carriers. The peak value and the peak value of the error power of the demodulated I/Q components are shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
MER TMCC	<p>Average modulation error of the TMCC carriers. The RMS value of the error power of the demodulated I/Q components are shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
MER AC	<p>Average modulation error of the AC carriers (auxiliary carriers). The RMS value of the error power of the demodulated I/Q components are shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
MER (Layer, rms)	<p>Average modulation error of the carriers of the corresponding layer. The RMS value of the error power of the demodulated I/Q components is shown in relation to the power of an OFDM data carrier in the logarithmic quantity (dB).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
FEC Decoder	<p>Status of the forward error correction (FEC) decoder.</p> <p>If the FEC decoder is not synchronized to the receive signal (" "), the following measurement parameters cannot be determined.</p>

Measurement parameters	Explanation
Bit Error Ratio Before Viterbi	<p>Bit error ratio of the incorrectly transmitted bits to the transmitted bits of the corresponding layer which are located upstream of the Viterbi decoder. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with the measurement time or with the number of transmitted bits.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
Bit Error Ratio before RS Decoder	<p>Bit error ratio of the incorrectly transmitted bits in relation to the transmitted bits of the corresponding layer which are located upstream of the Reed Solomon (RS) decoder. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with measurement time or with the number of transmitted bits.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
Bit Error Ratio after RS Decoder	<p>Bit error ratio of the incorrectly transmitted bits in relation to the transmitted bits of the corresponding layer which are located after the Reed Solomon (RS) decoder. The resolution of the measurement value depends on the number of transmission errors and (provided that the error rate is low) on the measurement time. The measurement value is given in powers of ten, i.e. in the case of error-free transmission, the exponent of the measurement value becomes increasingly negative with measurement time or with the number of transmitted bits.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>

Measurement parameters	Explanation
Packet Errors	Number of errored MPEG transport stream packets in the last second of the corresponding layer.  This parameter is only displayed if the FEC decoder is synchronized.
MPEG TS Bitrate	Transmission rate of the MPEG transport stream of the corresponding layer.  This parameter is only displayed if the FEC decoder is synchronized.

### Setting the RF Attenuation

1. Press the MEAS key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

ISDB-T		Meas List	<No Profile>	12/08/13	16:30
	RF	610 MHz			
	Band	---			
	Channel Table	---			
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB			
Measurement Parameter					
Power	-49.93 dBm	Crest Factor	12.93 dB		
OFDM Demodulator	locked	FEC Decoder	locked		
ISDB-T Mode	Mode 3 (8K)				
Guard Interval	1/8	MER (total,rms)	38.5 dB		
Sideband Position	normal	MER (total,peak)	16.9 dB		
RF Offset	29.8 Hz	MER TMCC	39.9 dB		
Symbol Rate Offset	0.1 ppm	MER AC	39.8 dB		
	Layer A	Layer B	Layer C		
MER (Layer,rms)	37.9	---	---	dB	
BER before Viterbi	1.6E-09	---	---		
BER before Reed Solomon	0.0E+00	---	---		
BER after Reed Solomon	Auto Low Noise	---	---		
Packet Errors	Auto Low Distortion	---	---	/s	
MPEG TS Bitrate	Manual RF Att...	---	---	Mbit/s	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info

The RF attenuation can be either preset in 5 dB steps (MAN setting) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION setting) or to high input sensitivity (AUTO LOW NOISE setting).

3. Select the required item.

### Setting the Symbol Loop

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to set SYMBOL LOOP, CHANNEL ADAPTATION, LOCK CONDITION, and FFT WINDOW POSITION.

ISDB-T		Meas List	<No Profile>	12/08/13 16:24	
		RF	610 MHz		
		Band	---		
		Channel Table	---		
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
		<b>Measurement</b>		<b>Symbol Loop</b>	
				Slow	
Power	-49.92 dBm			<b>Medium</b>	13.06 dB
OFDM Demodulator	<b>locked</b>			Fast	<b>locked</b>
ISDB-T Mode	Mode 3 (8K)			<b>Channel Adaptation</b>	
Guard Interval	1/8			Slow/Laboratory	38.5 dB
Sideband Position	normal			<b>Fast/SFN</b>	16.8 dB
RF Offset	29.9 Hz			Mobile	39.8 dB
Symbol Rate Offset	0.0 ppm			<b>Lock Condition</b>	
		<b>Layer A</b>		<b>C</b>	
MER (Layer,rms)	37.9			<b>FEC Lock Required</b>	dB
BER before Viterbi	0.1E-08			FEC Lock Not Required	
BER before Reed Solomon	0.0E-08			<b>FFT Window Position</b>	
BER after Reed Solomon	0.0E-07			Auto	
Packet Errors	0			Manual ...	/s
MPEG TS Bitrate	21.298476			<b>Mbit/s</b>	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info

3. Under SYMBOL LOOP, select SLOW, MEDIUM or FAST.

### Setting the Channel Adaptation

With the CHANNEL ADAPTION setting, the OFDM demodulator can be adapted to receive conditions.

With the MOBILE setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. The demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels.

For measurements at transmitters and in the laboratory, it is recommended to use the SLOW / LABORATORY setting because then the channel filtering is optimized for MER performance. This has especially influence to the channel border carriers of the OFDM signal. The control loops react only slowly to changes in the receive signal. Possible errors in the ISDB-T signal are thus detected.

With the FAST / SFN setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels, e.g. in single frequency networks (SFN) when the same signal is received by several transmitters. The channel filtering is optimized for reception of signals with strong echoes. The setting degrades the inherent MER performance slightly.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to set SYMBOL LOOP, CHANNEL ADAPTATION, LOCK CONDITION and FFT WINDOW POSITION.

ISDB-T		Meas List	<No Profile>	12/08/13 16:24	
	RF	610 MHz			
	Band	---			
	Channel Table	---			
	Gain Control / RF Attenuation	Auto Low Noise / 0 dB			
Measurements			Symbol Loop		
Power	-49.92 dBm		Slow	13.06 dB	
OFDM Demodulator	locked		Medium	locked	
ISDB-T Mode	Mode 3 (8K)		Fast		
Guard Interval	1/8		Channel Adaptation	38.5 dB	
Sideband Position	normal		Slow/Laboratory	16.8 dB	
RF Offset	29.9 Hz		Fast/SFN	39.8 dB	
Symbol Rate Offset	0.0 ppm		Mobile	39.8 dB	
	Layer A	Lock Condition	C		
MER (Layer.rms)	37.9	FEC Lock Required			dB
BER before Viterbi	0.1E-08	FEC Lock Not Required			
BER before Reed Solomon	0.0E-08	FFT Window Position			
BER after Reed Solomon	0.0E-07	Auto			/s
Packet Errors	0	Manual ...			Mbit/s
MPEG TS Bitrate	21.298476				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info

- Under CHANNEL ADAPTATION, select SLOW/LABPRATORY, FAST / SFN or MOBILE.

### Setting the Demodulator Synchronization Condition

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to set SYMBOL LOOP, CHANNEL ADAPTATION, LOCK CONDITION, and FFT WINDOW POSITION.

ISDB-T		Meas List	<No Profile>	12/08/13 16:24	
		RF	610 MHz		
		Band	---		
		Channel Table	---		
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
Measurements			Symbol Loop		
			Slow		
Power	-49.92 dBm		Medium	13.06 dB	
OFDM Demodulator	locked		Fast	locked	
ISDB-T Mode	Mode 3 (8K)		Channel Adaptation		
Guard Interval	1/8		Slow/Laboratory	38.5 dB	
Sideband Position	normal		Fast/SFN	16.8 dB	
RF Offset	29.9 Hz		Mobile	39.8 dB	
Symbol Rate Offset	0.0 ppm		Lock Condition	C	
MER (Layer,rms)	37.9		FEC Lock Required		dB
BER before Viterbi	0.1E-08		FEC Lock Not Required		
BER before Reed Solomon	0.0E-08		FFT Window Position		
BER after Reed Solomon	0.0E-07		Auto		/s
Packet Errors	0		Manual ...		Mbit/s
MPEG TS Bitrate	21.298476				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info

- Under LOCK CONDITION, select FEC LOCK REQUIRED or FEC LOCK NOT REQUIRED.

### Setting the FFT Window Position

If FFT WINDOW POSITION is set to AUTO, the OFDM demodulator sets the FFT window automatically according to the received signal.

If FFT WINDOW POSITION is set to MANUAL, the main echo path is fixed to the center of the guard interval. The position of the FFT window can be shifted as far as half the length of the guard interval in both directions.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to set SYMBOL LOOP, CHANNEL ADAPTATION, LOCK CONDITION, and FFT WINDOW POSITION.

ISDB-T		Meas List	<No Profile>	12/08/13 16:24	
		RF	610 MHz		
		Band	---		
		Channel Table	---		
		Gain Control / RF Attenuation	Auto Low Noise / 0 dB		
Measurements			Symbol Loop		
			Slow		
Power	-49.92 dBm		Medium	13.06 dB	
OFDM Demodulator	locked		Fast	locked	
ISDB-T Mode	Mode 3 (8K)		Channel Adaptation		
Guard Interval	1/8		Slow/Laboratory	38.5 dB	
Sideband Position	normal		Fast/SFN	16.8 dB	
RF Offset	29.9 Hz		Mobile	39.8 dB	
Symbol Rate Offset	0.0 ppm		Lock Condition	C	
MER (Layer,rms)	37.9		FEC Lock Required		dB
BER before Viterbi	0.1E-08		FEC Lock Not Required		
BER before Reed Solomon	0.0E-08		FFT Window Position		
BER after Reed Solomon	0.0E-07		Auto		/s
Packet Errors	0		Manual ...		Mbit/s
MPEG TS Bitrate	21.298476				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info

3. Under FFT WINDOW POSITION, select the desired mode.
4. To set the FFT window position manually:
  - a) Select MANUAL.
  - b) Set the FFT window position.

#### **Resetting the BER Measurement**

If a new synchronization to an ISDB-T signal takes place (change of FEC decoder lock status from "unlocked" to "locked"), the BER measurements are reset and restarted.

With the BER RESET function, the BER measurements are reset and restarted manually.

1. Press the MEAS key.
2. Tap BER RESET.

The R&S ETC resets the bit error measurement irrespective of the status of the FEC decoder and restarts it.

#### **2.4.2.5 Working with the TMCC Parameter List**

The ISDB-T transmitters transmit the TMCC parameters (transmission and multiplexing configuration control), such as system identification, partial reception, configuration of the layers, etc. The R&S ETC decodes the TMCC information and adjusts the test demodulator accordingly.

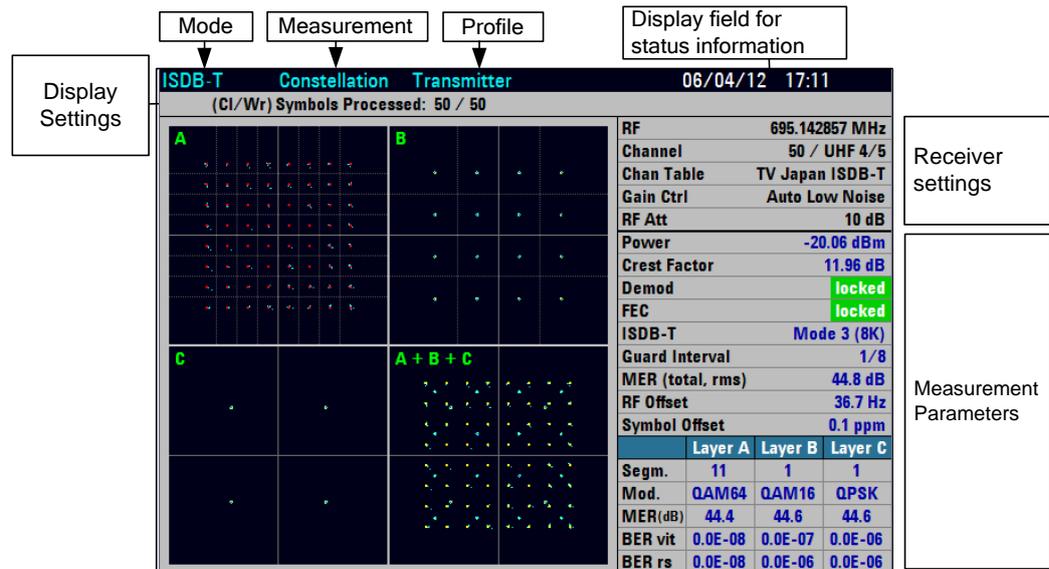
The R&S ETC displays the TMCC parameters in a list.

1. Press the MEAS key.
2. Tap TMCC INFO.

The R&S ETC lists the TMCC parameters.

3. Tap TMCC INFO EXIT to redisplay the previously set measurement.





For a description of the measurement parameters, see the chapter "[Working with the Measurement Parameter List](#)".

### Requirement for displaying the constellation



The minimum requirement for displaying the constellation is a synchronized OFDM demodulator. If the OFDM demodulator is not synchronized because, for example, the setting of the receive frequency does not match the receive signal, the measurement cannot be performed and the R&S ETC displays evenly distributed noise in the measurement diagram.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful display a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Displaying the 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. Tap PILOT CARRIERS.

### Setting the Constellation Diagram Parameters

With the CLEAR/WRITE setting, the displayed symbols are substituted by currently received symbols when the preset symbol count is reached. The number of displayed symbols is user-selectable. With the INFINITE COUNT setting, the symbols are added

until a synchronization loss exists, the trace setting changes or the measurement is closed. With FREEZE, the addition of symbols is stopped and the current display is retained until the measurement is closed. With RESTART, the constellation diagram is reset and addition of the symbols is restarted.

### Selecting the Constellation Diagram

1. Press the TRACE key.
2. Tap CLEAR/WRITE, INFINITE COUNT or FREEZE to select the required diagram.

In the CLEAR/WRITE trace setting, you can adjust the number of symbols to be displayed.

3. Tap SYMBOL COUNT.

The R&S ETC opens the entry field for the symbol count.

4. Set the required number of symbols.

### 2.4.2.7 Working with the Echo Pattern Measurement

The ECHO PATTERN measurement presents the echo profile of the receive channel. Echoes are caused by reflections on building, for example. In single-frequency networks (SFN), the receive signal with the highest level is the useful signal. The receive signals of the other SFN transmitters also appear as echoes.

The R&S ETC sets the largest receive signal as the reference signal (0 dB, 0  $\mu$ s). It sets the guard interval automatically as a function of the receive signal. The echo detection line (i.e. the level threshold starting from which echoes are taken into account for positioning the guard interval) is also automatically defined by the analyzer. If desired, this threshold is shown in the diagram as a horizontal line. The guard start and guard stop times set by the demodulator are displayed as vertical lines in the diagram. Optionally, the guard interval can be moved manually.

The time axis is displayed by the R&S ETC alternatively as a distance axis calibrated in kilometers or miles. To make estimation simple, the time display range is set in steps of 1, 2 and 5. As a result, it may occur that some subranges contain no data. These ranges are indicated by a different diagram background.

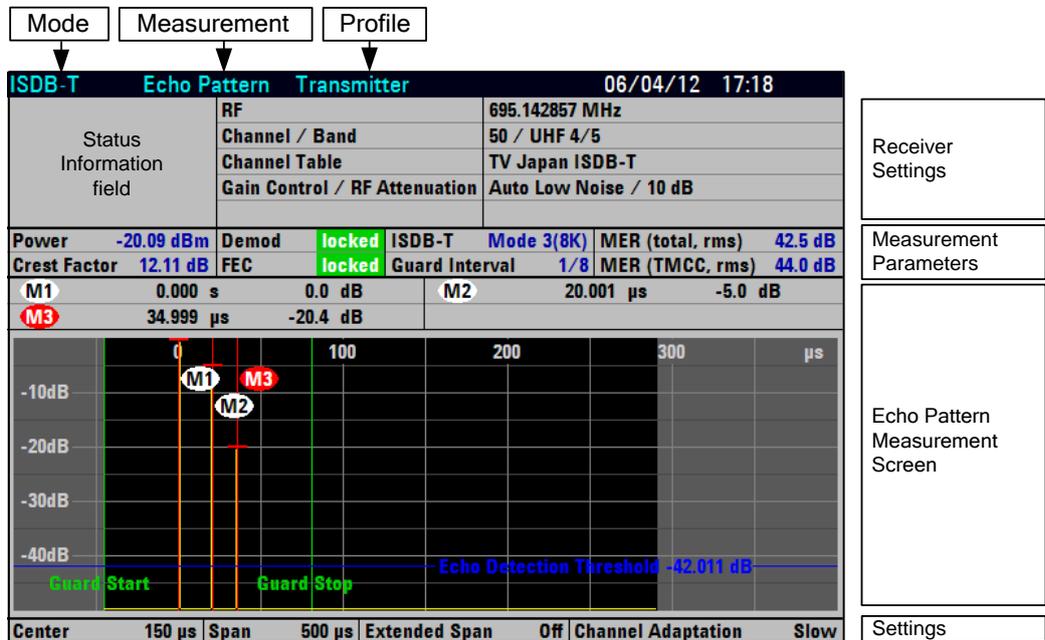
In the default setting, the value range corresponds to the third part of an OFDM symbol, since the echo profile is derived from the pilots.

In the EXTENDED SPAN setting, the time display range corresponds to the length of an OFDM symbol. The I/Q values are routed to the demapper after the channel equalizer. The ideal I/Q position is sent back to the channel equalizer. This information is used to extend the display range to the length of an OFDM symbol. If mistakes occur in the demapper, this will result in a detrimental reduction of the dynamic range and pseudo-echoes.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select ECHO PATTERN (ECHO PATTERN highlighted in red).
- The R&S ETC displays the echo pattern measurement diagram.



### Requirement for the echo measurement



The minimum requirement for displaying echoes is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the RF does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Zooming the Display Range

In the default setting, the R&S ETC determines the possible display range automatically and displays it. The R&S ETC allows zooming of the time axis.

1. Press the SPAN key.
2. Tap MANUAL SPAN.
3. Tap CENTER POSITION.

4. Set the center position.
5. Tap MANUAL SPAN.

The display range can be changed in steps of 1, 2 and 5.

6. Set the display range.

The R&S ETC zooms the echo pattern measurement diagram about the center position.

**Note:** The level display range is always 0 dB to –50 dB. It cannot be set. The receive path with the highest level is always set to 0 dB.

### Extending the Display Range

In the default setting, the value range corresponds to the third part of an OFDM symbol. In the EXTENDED SPAN settings, the time display range is extended to the length of an OFDM symbol.



Due to mistakes in the demapper, this may result in reduced dynamic range and pseudo-echoes in the EXTENDED SPAN settings.

---

1. Press the SPAN key.
2. Tap EXTENDED SPAN.
3. Set the display range.

### Selecting the Time or Distance Unit

The R&S ETC displays the x axis calibrated either to time or distance. As time axis, the unit is always  $\mu$ s. The distance axis can be calibrated in kilometers or miles.

1. Press the SPAN key.
2. Tap SPAN UNIT.
3. Select the unit.

### Displaying the Echo Detector Threshold

The R&S ETC positions the guard interval automatically. The level threshold can be shown as display line. It indicates from which level the demodulator echoes are taken into account for positioning.

1. Press the LINES key.
2. Tap VIEW ECHO DETECTION LINE.
3. Tap the menu a second time to hide the display line again.

### Using the Markers

To evaluate the trace, the R&S ETC provides up to six markers, five of which can be used either as markers or delta markers.

The markers are always bound to the trace and show the distance to the main path and, depending on the setting, the relative or absolute level at the respective points on the trace. The position of the marker is indicated by a vertical line over the entire length of the measurement diagram. The numeric values for distance and level are displayed on the screen. The units for level and distance are determined by the set units.

1. Press the MARKER key.

The R&S ETC opens the marker menu. If no marker is activated yet, the R&S ETC automatically activates MARKER 1 and sets it to the highest echo level. The distance to the main path and the level is displayed in the selected units above the measurement diagram. The value entry field for the marker frequency is open.

2. The following steps are possible:

- Set the marker position.
- Tap NEW MARKER to activate a further marker.
- Tap MARKER TYPE to select the level unit of the markers (relative or absolute).
- Tap VIEW LIST to deactivate the numeric display of the markers. Tap the menu a second time to activate the marker list again.
- Tap DELETE MARKER to deactivate the marker.



The relative level unit is always given in dB. It is referenced to the receive path with the highest level.

The absolute level unit is determined by the selection in the AMPT : UNIT menu.

The unit of the distance to the main receive path depends on the selection made in the SPAN : SPAN UNIT menu.

### Automatic Positioning of the Marker

To simplify operation, the R&S ETC provides functions for positioning the markers.

- PEAK  
This function sets the marker at the highest value of the trace. The function always affects the active marker, whose menu is highlighted in red.
- NEXT PEAK  
This function sets the marker, starting from its current position, to the next lower value of the trace.
- CENTER = MRK FREQ

In a zoomed display (MANUAL SPAN), the R&S ETC sets the position of the active marker (menu highlighted in red) in the center of the measurement diagram. This function is useful especially when an echo with a smaller display range is to be examined in greater detail. For this purpose, first set the marker in the center of the display range and then reduce the display range.

### 2.4.2.8 Working with the Echo Peak List

In addition to the graphic display, the R&S ETC displays the detected echoes, sorted by level, in the ECHO PEAK LIST.

#### Setting the Level Threshold

To selectively restrict the entries, set a threshold value in the range from  $-50$  dB to  $0$  dB. Only the echoes that exceed the threshold value are listed.

1. Press the MEAS key.
2. Tap PEAK LIST THRESHOLD.
3. Set the threshold value.

#### Displaying the Echo Peak List

1. Press the MEAS key.
2. Tap VIEW PEAK LIST.

The R&S ETC displays the echo pattern peak list. The list shows the relative level difference to the main receive path, the absolute level and the time difference to the main receive path. As an alternative to the time difference, the R&S ETC displays the distance difference in kilometers or miles. Select the unit in the SPAN : SPAN UNIT menu.



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. This reading can thus be used to adjust the modulator's residual carrier.

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.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the MER(k) menu item (MER(k) SPECTRUM highlighted in red).

The R&S ETC displays the measurement window for the MER(k) measurement.

Mode

Measurement

Profile

ISDB-T		MER (k)		Transmitter		06/04/12 17:24	
		RF		695.142857 MHz			
		Channel / Band		50 / UHF 4/5			
		Channel Table		TV Japan ISDB-T			
		Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
Power	-20.02 dBm	Demod	locked	ISDB-T	Mode 3(8K)	MER (total, rms)	44.8 dB
Crest Factor	13.04 dB	FEC	locked	Guard Interval	1/8	MER (TMCC, rms)	46.8 dB
M1	Carrier 2808	30.9 dB		M2	-0.848 MHz	44.4 dB	
M3	1.545 MHz	44.5 dB					

Receiver settings

Meas parameters

Marker values

MER(k) measurement screen

MER(k) settings

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

### Requirement for the MER(k) measurement



The minimum requirement for displaying the MER(k) measurement parameter is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the RF does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Setting the MER Measurement Range

An MER measurement range of 50 dB, 20 dB or 10 dB can be selected. The display range can be shifted by setting the MER reference. The MER reference corresponds to the uppermost grid line. The Scale Adjust function automatically sets the reference and measurement range as a function of the MER value of the receive signal. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap MER RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the MER reference and MER measurement range such that the MER values of all carriers are displayed. It sets the smallest possible measurement range.

### Setting the Detector

The MER measurement screen shows the modulation errors of all modulated OFDM carriers. 631 pixel columns are available for the display. For this reason, several OFDM carriers are grouped in a pixel column.

The selected detector determines the display of the MER value. In the RMS setting, the root-mean-square value of the MER values per pixel column are determined and displayed. In the MIN und 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.

An important parameter of OFDM transmitters is the residual carrier. The residual carrier is determined on the basis of the center carrier. Since this carrier is not modulated, no MER value can be determined for this carrier. However, the residual carrier essentially determines the MER values of the adjacent carriers. If the Min Peak detector is used, the MER value at the carrier frequency (middle pixel column) corresponds to that of the residual carrier.

To set the Min Peak detector, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select MIN PEAK.

The R&S ETC displays the minimum (worst) MER values of the OFDM carriers of each pixel column.

### Trace Modes

Traces can be displayed in different ways (modes):

- CLEAR/WRITE

The R&S ETC deletes the previous trace. This is its default setting.

- MIN HOLD

The trace displays the maximum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the maximum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals in the spectrum or the minimum value in the case of fluctuating signals can be located well with MIN HOLD.

- MAX HOLD

The trace displays the minimum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the minimum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals can be suppressed with MAX HOLD.

- VIEW

The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured MER(k) traces with the marker at a later time.

### Setting the Trace

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the MER trace.

### Using Markers

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the trace and display the marker position and the MER value in a logarithmic scale at the corresponding point of the trace. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the MER value are displayed above the measurement screen. The unit of the marker position is determined by the marker type setting.

### Setting the Marker Type

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

To set the marker position to absolute frequency specification, proceed as follows:

1. Press the MARKER key.
2. Tap MARKER TYPE.
3. Select ABSOLUTE FREQUENCY.

The R&S ETC specifies the marker position of the active marker as an absolute frequency.

### Automatic Positioning of the Marker

The R&S ETC provides marker functions that make it easier to set the marker:

- PEAK  
This function sets the marker to the minimum value of the trace. It always applies to the active marker, whose marker label is highlighted in red.
- NEXT PEAK  
This function sets the active marker, starting from its momentary position, to the next highest value of the trace.

To position the marker to the minimum MER value, proceed as follows:

1. Press the MKR-> key.
2. Tap SELECT MARKER repeatedly until the desired marker is active.
3. Tap SET TO PEAK.

The R&S ETC positions the active marker to the OFDM carrier with the worst MER value.

### 2.4.2.10 Working with the Amplitude/Phase/Group Delay Measurement

In the Amplitude/Phase/Group Delay measurement, the R&S ETC determines the magnitude, phase and group delay of the channel transfer function in respect to the corresponding frequency.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the Amplitude/Phase/GpDelay menu item (Amplitude/Phase/GpDelay highlighted in red).

ISDB-T		Meas List		<No Profile>		03/07/13 15:52	
RF Preselection	RF			610 MHz			
	Band			---			
	Channel Table			---			
	Gain Control / RF Attenuation			Auto Low Noise / 25 dB			
Measurement Parameter							
Measurement Mode	94 dBm	Crest Factor			11.75 dB		
Measurement List	locked	FEC Decoder			locked		
Constellation Diagram	le 3 (8K)						
Echo Pattern	1/8	MER (total,rms)			44.5 dB		
MER (k)	normal	MER (total,peak)			23.1 dB		
Amplitude/Phase/GrpDelay	8.9 Hz	MER TMCC			46.4 dB		
	2 ppm	MER AC			46.4 dB		
Spectrum	Layer A	Layer B			Layer C		
Spectrum Emission Mask	44.0	44.1			44.1	dB	
TV Standard	0.0E-10	0.0E-10			0.0E-09		
DVB-T/H	0.0E-10	0.0E-10			0.0E-09		
DVB-T2	0.0E-09	0.0E-08			0.0E-08		
ISDB-T	0	0			0	/s	
	13.106756	2.808591			0.832175	Mbit/s	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	TMCC Info		

The R&S ETC displays the measurement window for the Amplitude/Phase/GrpDelay measurement.

Mode

Measurement

Profile

ISDB-T		Phase		<No Profile>		03/07/13 15:56	
RF Preselection	RF			610 MHz			
	Band			---			
	Channel Table			---			
	Gain Control / RF Attenuation			Auto Low Noise / 25 dB			
Power	-18.18 dBm	Demod	locked	ISDB-T	Mode 3(8K)	MER (total, rms)	42.4 dB
Crest Factor	11.98 dB	FEC	locked	Guard Interval	1/8	MER (TMCC, rms)	44.4 dB
Amplitude(pk-pk)	15.5 dB	Phase(pk-pk)			92.7 °		

Receiver setting parameters

---

Meas parameters

---

Measurement Result Marker values

---

Amplitude/Phase/GrpDelay measurement screen

---

APGD setting parameters

---

APGD menu

### Setting the Amplitude/Phase/GrpDelay Measurement Format and Range

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the "Forma/Range" softkey.

For switching of measurement view, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select AMPLITUDE+PHASE or AMPLITUDE+GROUP DELAY.

A measurement range of 100 dB, 50dB, 20 dB or 10 dB can be selected for amplitude. A measurement range of 360°, 180°, 90°, 45°, 20° and 10° can be selected for phase. A measurement range of 50nsec, 100nsec, 200nsec, 500nsec, 1usec, 2usec, 5usec, 10usec, 20usec, 50usec and 100usec can be selected for group delay.

For adjusting of the measurement range, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select the corresponding trace AMPLITUDE..., PHASE... or GROUP DELAY... for adjustment of the individual trace range.

The Scale Adjust function automatically sets the measurement range of the measurement for the two traces that appear on the screen. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the measurement range such that the minimum and maximum values are visible on the screen.

### Setting the Detector

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the "Forma/Range" softkey.

For selection of trace detector type, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select RMS or Auto Peak for the corresponding trace for amplitude, phase or group delay.

The R&S ETC sets the desired detector type for the selected trace.

### Trace Modes

Trace can be displayed in different ways (modes):

- VIEW  
The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured amplitude/phase/group delay traces with the marker at a later time.
- CLEAR/WRITE  
The R&S ETC deletes the previous trace. This is its default setting.
- AVERAGE : XX

The trace displays the result over the average number set by user where XX indicates the average count that user has entered. On the left top corner, user will be able to see the current average number of the measurement is performing.

- **BLANK**

The selected trace will be hidden but the measurement is still on-going in the background. This is to allow user to see one trace and have a better view.

### **Setting the Trace**

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the selected trace.

### **Using Markers**

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the two traces that are selected and displayed on the screen. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the corresponding value are displayed above the measurement screen. The unit of the marker position is determined by the marker type setting and the current format display of Amplitude/Phase or Amplitude/Group Delay.

### **Setting the Marker Type**

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

To set the marker position to absolute frequency specification, proceed as follows:

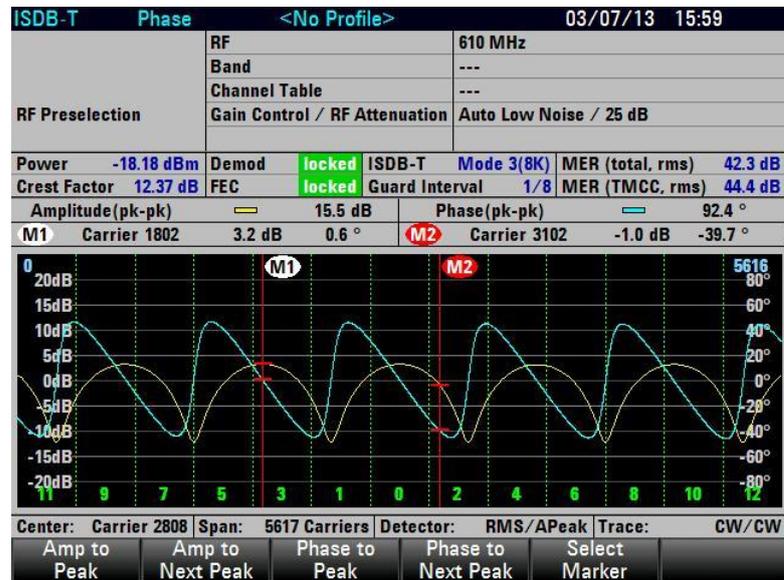
1. Press the MARKER key.
2. Tap MARKER TYPE.
3. Select the desired marker type for the trace.

The R&S ETC set the marker position of the active marker to the desired marker type.

### **Automatic Positioning of the Marker**

The R&S ETC provides marker functions that make it easier to set the marker. The AMP TO PEAK is always available for selection. PHASE TO PEAK / PHASE TO NEXT PEAK or GD TO PEAK / GD TO NEXT PEAK depends on the current format type of Amplitude/Phase or Amplitude/Group Delay that is selected for display. When moving

the selected marker to the next peak of the desired trace, the marker will also indicate the corresponding value for the other trace which in this case might not be the peak value.



- **AMP TO PEAK**  
This function sets the marker to the maximum value of the amplitude trace. It always applies to the active marker, whose marker label is highlighted in red.
- **AMP TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the amplitude trace.
- **PHASE TO PEAK**  
This function sets the marker to the maximum phase value of the phase trace. It always applies to the active marker, whose marker label is highlighted in red.
- **PHASE TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the phase trace.
- **GD TO PEAK**  
This function sets the marker to the maximum value of the group delay trace. It always applies to the active marker, whose marker label is highlighted in red.
- **GD TO NEXT PEAK**  
This function sets the active marker, starting from its momentary position, to the next highest value of the group delay trace.

To position the marker to the peak value of the phase trace, proceed as follows:

1. Press the MKR-> key.

2. Tap SELECT MARKER repeatedly until the desired marker is active.
3. Tap PHASE TO PEAK.

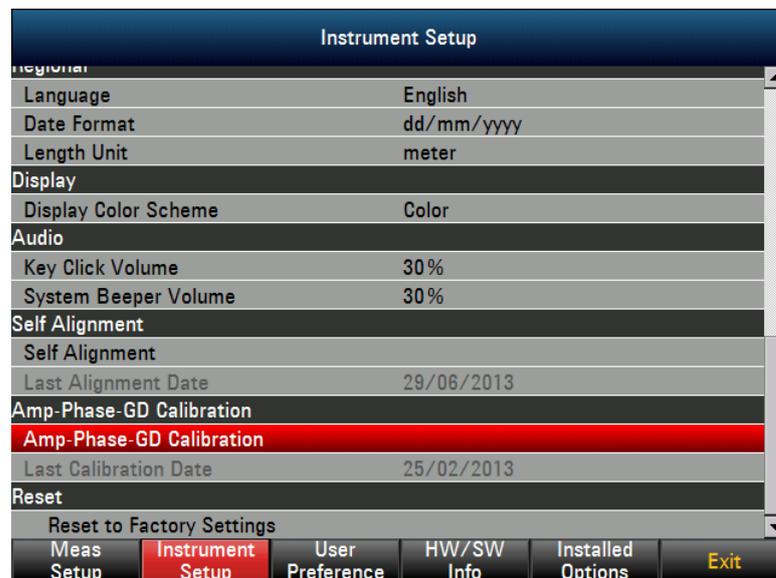
The R&S ETC positions the active marker to the OFDM carrier with the peak value for phase trace.

### Performing alignment for Amplitude / Phase / Group Delay

The R&S ETC need to perform a calibration in order for accurate measurement. The R&S ETC comes with a factory default alignment data. It is highly recommended to perform the calibration once before starting the measurement.

To perform the alignment, proceed as follows :

1. Press SETUP key.
2. Tap INSTRUMENT SETUP tab.
3. Scroll down to AMP-PHASE-GD CALIBRATION and press ENTER. Follow the instruction on screen to complete the calibration.



#### 2.4.2.11 Working with the Measurement Value Monitoring

You can preset limits for the measurement parameters. If the limit check function is activated and the limit is exceeded, the measurement parameter result is displayed in red. Additionally, you can activate an acoustic warning signal. Set the volume of the acoustic warning signal in the SETUP : Instrument Setup menu under Audio : System Beeper Volume.

The R&S ETC can store more than 100 different limit tables. You can activate them using the front panel. The maximum number of limit tables may become smaller if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

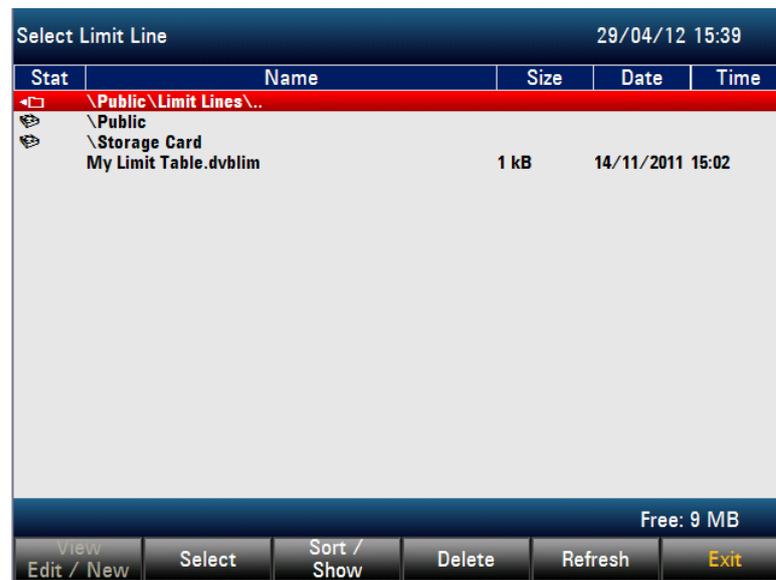
Use the supplied R&S ETC View software to create limit tables and to load them in the R&S ETC. Refer to the R&S ETC View software manual.

### Selecting the Limit Table

1. Press the LINES key.
2. Tap LIMIT TABLE.

The R&S ETC opens the dialog for selecting the limit table.

3. Select the required limit table.
4. Tap SELECT to activate it.



5. To sort the table entries by name/date/size, press the SORT/SHOW. You can also use this menu to hide entries that are incompatible with the current instrument setup.

### Activating the Measurement Value Monitoring

1. Press the LINES key.
2. Tap LIMIT CHECK.

The limit check function is activated. The color of the LIMIT CHECK menu changes to green. "Limits" is displayed in the status field of the measurement window.

3. Tap LIMIT CHECK again to deactivate the limit check function.

### Viewing Limit Settings and Table Information

1. Press the LINES key.
2. Tap LIMIT INFO.

The file name and the edited description of the currently selected limit table are displayed.

3. Tap OK to deactivate the table information.

#### Activating the Acoustic Measurement Value Monitoring

1. Press the LINES key.
2. Tap LIMIT OPTIONS.
3. Select AUDIO BEEP.

If a measurement value limit is violated and the limit check is active, an acoustic warning signal is additionally output.

If the audio beep is activated, [X] is displayed to the left of AUDIO BEEP.

**Note:** Set the volume of the warning signal under SETUP : INSTRUMENT SETUP : AUDIO : SYSTEM BEEPER VOLUME.

4. To close the menu without changing the warning signal setting, press the CANCEL key.

#### Deactivating the Acoustic Warning Signal

1. Tap LIMIT OPTIONS.
2. Press the ENTER key or tap LIMIT OPTIONS to deselect AUDIO BEEP.

### 2.4.2.12 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 ETC 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.

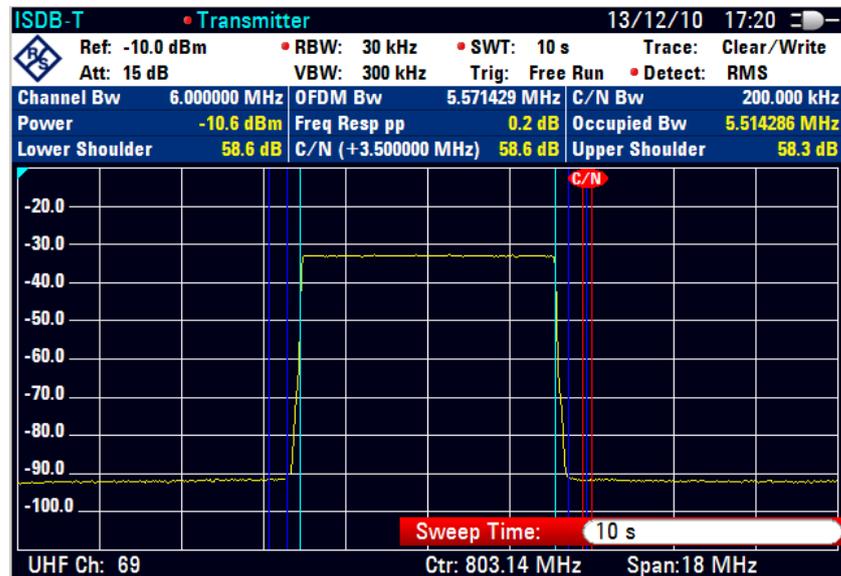
The occupied bandwidth is defined as the bandwidth that contains 99 % of the entire power of the transmitter.

In addition, the R&S ETC 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 ETC. To produce a stable and accurate frequency response measurement, set the measurement time to 10 seconds.

1. Press the SWEEP key.

2. Tap MANUAL SWP TIME.
3. Set the sweep time.



The R&S ETC 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.

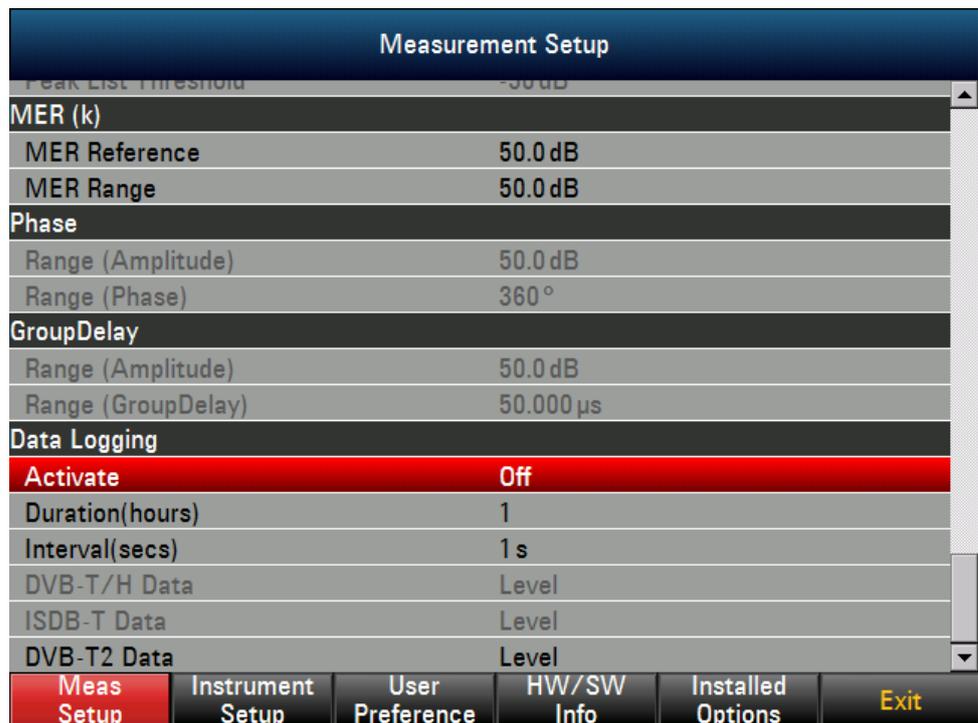
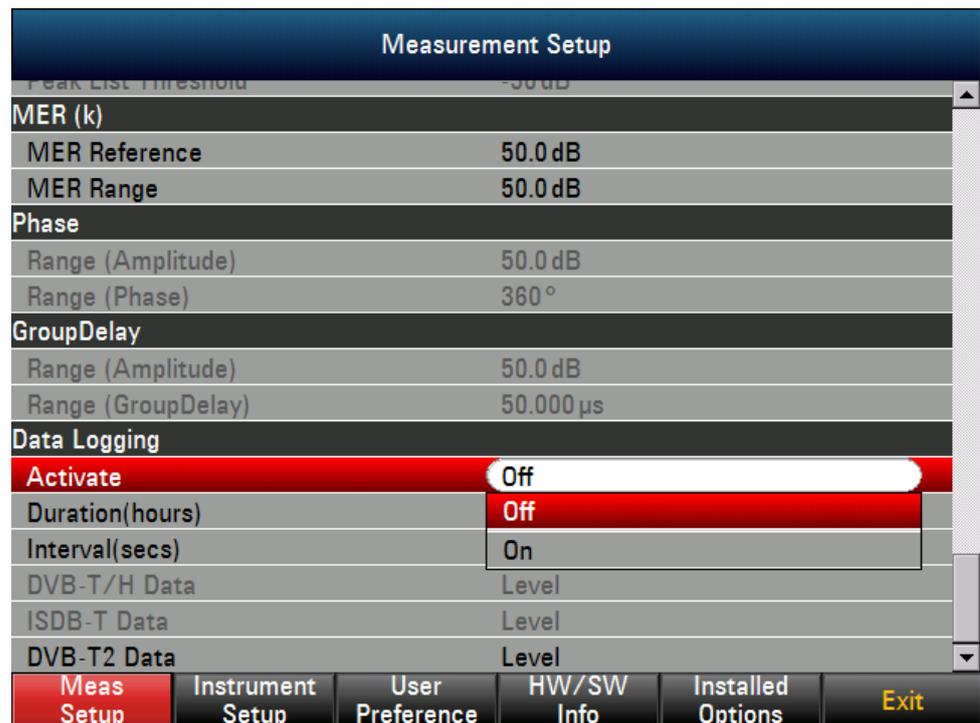
### 2.4.2.13 Working with Data Logging

Data logging on the device can be activated via the setup screen. The data that is logged (csv format) for ISDB-T are :

Level, MER(total rms), BER before Viterbi (Layer A,B,C), BER before RS (Layer A,B,C) and GPS

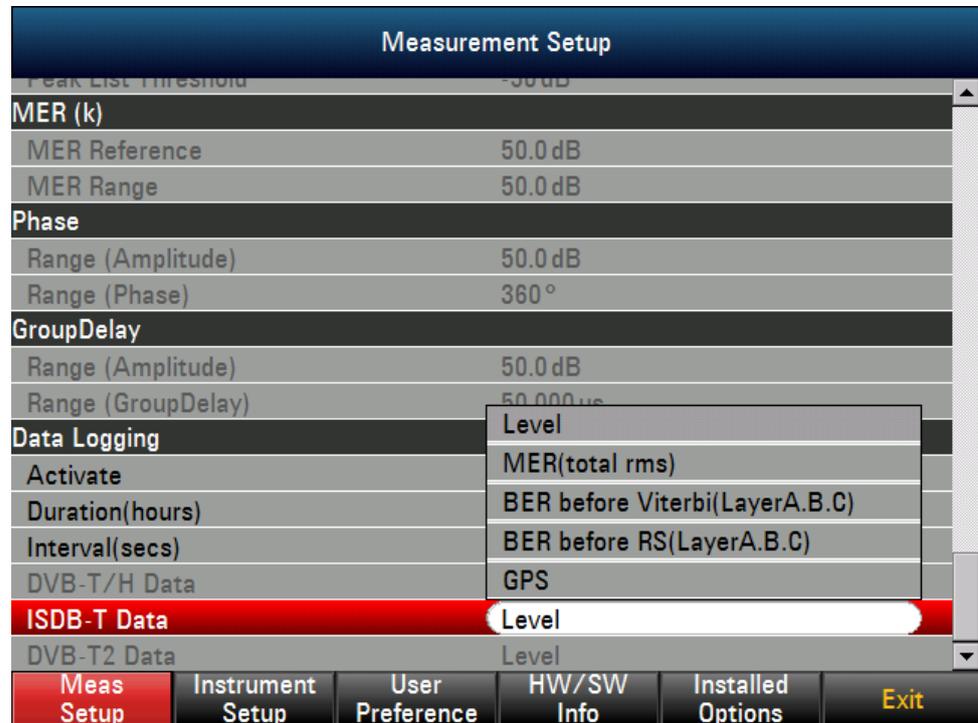
To start the data logging, select “On” under the Data logging Activate menu item in the Measurement Setup Screen (via Setup->Meas Setup). The duration and time interval to log data can be set in this screen too. The data logging will be saved to USB, internal SD card or the internal memory with the highest priority of USB storage. The csv file will be in the format of “DeviceSerialNumber\_Date\_Time”.csv.

In the event that the file is saved in the SD card or internal memory, ETC view can be used to extract or copy out the saved file.



During logging, different measurement screen can be selected except the Spectrum and Spectrum Emission Mask. Switching over to this measurement will cause the logging to be stopped. In order to switch to other instrument mode like Spectrum or Network Analyzer, data logging has to be stopped first if it is started.

When the data logging has completed, the top right corner will show the complete icon.



Data Logging icon	Explanation
	This icon indicates that data logging has completed.
	This icon indicates that data logging encountered some errors.
	This icon indicates that data logging is in progress.
	This icon indicates that data logging is stopped by user.

### 2.4.3 DVB-T2 Analysis

The R&S ETC offers the following TV receiver measurement modes:

- Measurement List, chapter [2.4.3.5](#)
- PLP Signaling Info Parameters, chapter [2.4.3.6](#)
- Constellation Diagram, chapter [2.4.3.7](#)
- Echo Pattern, chapter [2.4.3.8](#)

- Echo Pattern Peak List, chapter [2.4.3.9](#)
- MER(k), chapter [2.4.3.10](#)
- Amplitude/Phase/Group Delay, chapter [2.4.3.11](#)
- Data Logging, chapter [2.4.3.16](#)

You can configure the test demodulator for specific measurement tasks as follows.

With the CHANNEL ADAPTATION setting, you can adapt the OFDM demodulator to the receive conditions. With the MOBILE setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. With this setting, the demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels. For measurements at transmitters and in the lab, it is recommended to use the SLOW / LABORATORY setting because with this setting the control loops react only slowly to changes in the receive signal. Possible errors in the DVB-T2 signal are thus detected. With the FAST / SFN setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels which may occur in single frequency networks (SFN) when the same signal is received by several transmitters.

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

The bit error measurements are automatically reset and restarted when the demodulator is resynchronized. With BER RESET, the bit error measurements can be reset and restarted manually.

The accuracy of the carrier frequency drift and symbol rate corresponds to the accuracy of the internal reference. The R&S ETC provides the possibility of feeding in an external 10 MHz reference frequency signal. The accuracy of frequency measurement then corresponds to the accuracy of this reference.

The R&S ETC supports the R&S HA-Z240 GPS receiver. If the GPS receiver is connected, the R&S ETC shows the geographical data on the measurement screen. In addition, the 1 ppm signal is used to increase the frequency measurement accuracy.

To simplify operation, the R&S ETC provides the possibility of organizing the measurement settings in a measurement profile. The selected measurement profile contains the measurement settings which the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile defines the settings for the test demodulator, the bandwidths, the detector and the displayed dimensional unit. The supplied R&S ETC View software contains predefined measurement profiles. R&S ETC View software can also be used to create customer-specific measurement profiles and to load them in the R&S ETC. The measurement profiles stored in the R&S ETC when shipped can be deleted if necessary.

Limits can be preset for the measurement parameters. If the limit check function is activated, the measurement parameter result is displayed in red if the limit is exceeded. An acoustic warning signal can additionally be activated. The limits are defined using the supplied R&S ETC View software.

The MEASUREMENT LIST measurement presents a clear overview of the measurement parameters together with the most important settings.

The CONSTELLATION DIAGRAM measurement shows the I/Q values in a Cartesian coordinate system together with the most important measurement parameters and instrument settings. To permit simple qualitative evaluation of the signal quality, the R&S ETC also indicates the decision thresholds, the levels of which are adapted automatically to the modulation mode.

The PLP Signaling Info screen presents the PLP Signaling Info information covering the L1-Pre Signaling, PLP Parameters and Auxiliary L1-Post Information.

The ECHO PATTERN measurement presents the echo profile of the receive channel. Extensive marker functions make it easier to detect echoes. Besides the graphic display, the R&S ETC lists the detected echoes, sorted by level, in the ECHO PEAK LIST.

The MER(k) measurement shows the modulation error ratios versus the modulated OFDM carriers (k). Extensive marker functions facilitate operation and make it easier to detect disturbances.

During the MEASUREMENT LIST, CONSTELLATION DIAGRAM, MER(k) and ECHO PATTERN measurements, the R&S ETC makes the asynchronous transport stream TS-ASI of the received DVB-T2 signal available at the BNC connector TS OUT.

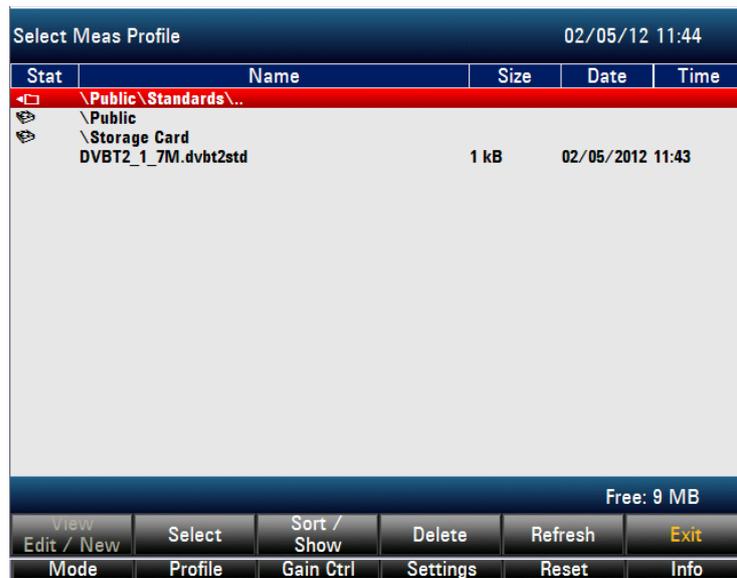
### 2.4.3.1 Selecting a Measurement Profile

To simplify operation, the R&S ETC provides measurement profiles. The measurement profile contains the setting parameters that the R&S ETC uses to perform the measurement. In the TV ANALYZER mode, the measurement profile contains the settings for all measurements available in the selected TV standard.

You can use the supplied R&S ETC View software to create additional customer-specific measurement profiles, to load them in the R&S ETC and to delete the measurement profiles. How to create measurement profiles and to load these profiles in the R&S ETC is described in the R&S ETC View software manual.

1. Press the MEAS key.
2. Tap MEAS PROFILE.

The R&S ETC opens the browser and shows the measurement profile definition files (DVBT2STD file extension) available for the selected DVB-T2 standard.



### 2.4.3.2 Setting the Frequency

The frequency is set on the R&S ETC using the **FREQ** key. It can be set by entering the carrier frequency or by entering a channel. If a channel is entered, a channel frequency table must be loaded in the R&S ETC using the supplied R&S ETC View software. How to create the channel tables is described in the R&S ETC View software manual.

#### Setting the Receive Frequency

1. Press the **FREQ** key.

The R&S ETC opens the frequency menu.

- If the frequency was last set by entering the carrier frequency, the entry field for the frequency value is already activated and the frequency that has just been set is displayed in the entry field. You can enter a new frequency immediately.
- If the frequency was last set by entering a channel, the entry field for the channel value is already activated, allowing immediate entry of the channel. To enter the carrier frequency, press the **RF**.

2. Tap **RF**.

**Note:** Only necessary if the frequency was last set by entering the channel.

3. Set the required frequency.

The R&S ETC sets the entered frequency as the new receive frequency. The entry field remains active to allow further entries to be made.

DVB-T2		Meas List	<No Profile>	03/05/12	05:41
	RF	498 MHz			
	Band	---			
	Channel Table	---			
	Gain Control / RF Attenuation	Auto Low Noise / 10 dB			
	Channel Bw	8 MHz			
Measurement Parameter		Result			
Power		-19.83 dBm			
Crest Factor		12.65 dB			
Demodulator		locked			
Sideband Position		normal			
Frame Parameter		16Kext	1/8	PP3	
Carrier Frequency Offset		24.1 Hz			
Symbol Rate Offset		0.0 ppm			
Modulation Error Ratio (L1)		rms: 43.6 dB	peak: 31.9 dB		
FEC Decoder		locked (PLP ID: 1)			
Modulation Error Ratio (PLP)		rms: 44.3 dB	peak: 24.9 dB		
Error Vector Magnitude (PLP)		rms: 0.38 %	peak: 3.48 %		
LDPC Iterations		10			
BER before LDPC / BCH		RF: 498 MHz			
BBFRAME / TS Packet Error Ratio		BBFRAME: 0.0E-05	TSPER: 0.0E-06		
RF	RF StepSize	Freq Offset	Channel	Channel Table	

### Working with a Frequency Offset

For measurements on frequency converters, it is often useful to reference the results to the frequency prior to conversion. The R&S ETC provides a frequency offset for this purpose. It offsets the center frequency mathematically to higher or lower frequencies so that the R&S ETC displays the input frequency of the DUT.

The possible range for the positive frequency offset is 1 Hz to 100 GHz in 1 Hz steps. The permitted negative frequency offset depends on the frequency setting. The frequency at the RF input of the R&S ETC must be positive.

1. Press the FREQ key.
2. Tap FREQ OFFSET.

The R&S ETC opens the entry field for the frequency offset.

DVB-T2		Meas List	<No Profile>	03/05/12	05:39
	RF	498 MHz			
	Band	---			
	Channel Table	---			
	Gain Control / RF Attenuation	Auto Low Noise / 10 dB			
	Channel Bw	8 MHz			
Measurement Parameter		Result			
Power		-19.90 dBm			
Crest Factor		12.49 dB			
Demodulator		locked			
Sideband Position		normal			
Frame Parameter		16Kext	1/8	PP3	
Carrier Frequency Offset		10.6 Hz			
Symbol Rate Offset		0.0 ppm			
Modulation Error Ratio (L1)		rms: 44.0 dB	peak: 33.6 dB		
FEC Decoder		locked (PLP ID: 1)			
Modulation Error Ratio (PLP)		rms: 44.3 dB	peak: 24.7 dB		
Error Vector Magnitude (PLP)		rms: 0.37 %	peak: 3.56 %		
LDPC Iterations		10			
BER before LDPC / BCH		Offset: 0 Hz			
BBFRAME / TS Packet Error Ratio		BBFRAME: 0.0E-04	TSPER: 0.0E-05		
RF	RF StepSize	Freq Offset	Channel	Channel Table	

- Set the required frequency offset.

The R&S ETC adds the frequency offset to the set center frequency. A red dot next to the receive frequency indicates that a frequency offset has been set.

- To cancel the frequency offset again, enter an offset of 0 Hz.

### Setting the Receive Frequency Step Size

The frequency step size is freely selectable. It enables the analysis of DVB-T2 signals with regular frequency spacing (e.g. channel spacing).

- Tap RF STEPSIZE.

The entry field containing the value for the current step size opens.

Measurement Parameter		Result	
Power		-19.86 dBm	
Crest Factor		12.49 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter	16Kext	1/8	PP3
Carrier Frequency Offset		18.1 Hz	
Symbol Rate Offset		0.0 ppm	
Modulation Error Ratio (L1)	rms: 44.0 dB	peak: 33.4 dB	
FEC Decoder		locked (PLP ID: 1)	
Modulation Error Ratio (PLP)	rms: 44.4 dB	peak: 25.4 dB	
Error Vector Magnitude (PLP)	rms: 0.37 %	peak: 3.30 %	
LDPC Iterations		10	
BER before LDPC / BCH	RF Step: 1 MHz		
BBFRAME / TS Packet Error Ratio	BBFRAME: 0.0E-04	TSPER: 0.0E-06	
RF	RF StepSize	Freq Offset	Channel Table

- Set the step size.

### Working with Channel Tables

Almost all transmission systems divide the frequency range that they have been assigned into channels, whereby the channels are each assigned one frequency. To simplify operation, the R&S ETC therefore provides the possibility of defining channel assignments based on terms familiar to users.

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. The R&S ETC can store more than 100 different channel tables which can be activated as required from the front panel. The maximum number of channel tables may be lower if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

How to create channel tables and to transmit the channel table to the R&S ETC is described in the R&S ETC View software manual.

### Selecting the Channel Frequency Table

- Press the FREQ key.

2. Tap CHANNEL TABLE.

The R&S ETC opens the browser for selecting the channel table.

Select Channel Table					17/04/12 21:18	
Stat	Name	Size	Date	Time		
	TV Australia.chntab	1 kB	14/11/2011	15:02	▲	
	TV Brazil.chntab	1 kB	14/11/2011	15:02		
	TV China.chntab	1 kB	14/11/2011	15:02		
	TV DK_OIRT.chntab	1 kB	14/11/2011	15:02		
	TV Europe.chntab	1 kB	14/11/2011	15:02		
	TV France.chntab	1 kB	14/11/2011	15:02		
	TV French Overs.chntab	1 kB	14/11/2011	15:02		
	TV Ireland.chntab	1 kB	14/11/2011	15:02		
	TV Italy.chntab	1 kB	14/11/2011	15:02		
	TV Japan ISDB-T.chntab	1 kB	14/11/2011	15:02		
	TV Japan.chntab	1 kB	14/11/2011	15:02		
	TV Morocco.chntab	1 kB	14/11/2011	15:02		
	TV South Africa.chntab	1 kB	14/11/2011	15:02		
	TV UK negative offset.chntab	1 kB	14/11/2011	15:02		
	TV UK positive offset.chntab	1 kB	14/11/2011	15:02		
	TV UK.chntab	1 kB	14/11/2011	15:02		
	TV USA Air.chntab	1 kB	14/11/2011	15:02		
	TV USA CATV.chntab	1 kB	14/11/2011	15:02		
	TV USA HRC.chntab	1 kB	14/11/2011	15:02		
	TV USA IRC.chntab	1 kB	14/11/2011	15:02	▼	

Free: 9 MB

View Edit / New    Select    Sort / Show    Delete    Refresh    Exit

3. To sort the table entries by name/date/size, press the SORT/SHOW. You can also hide entries that are incompatible with the current instrument setup.
4. Select the required channel table.
5. Tap SELECT to activate it.

The R&S ETC opens the channel entry field.

### Setting the Channel

1. Press the FREQ key.
2. Tap CHANNEL.

The R&S ETC opens the channel entry field.

DVB-T2		Meas List	<No Profile>	03/05/12	05:43
RF				498 MHz	
Channel / Band				24 / UHF 4/5	
Channel Table				TV Europe	
Gain Control / RF Attenuation				Auto Low Noise / 10 dB	
Channel Bw				8 MHz	
Measurement Parameter			Result		
Power			-19.79 dBm		
Crest Factor			12.49 dB		
Demodulator			locked		
Sideband Position			normal		
Frame Parameter			16Kext	1/8	PP3
Carrier Frequency Offset			32.6 Hz		
Symbol Rate Offset			0.1 ppm		
Modulation Error Ratio (L1)			rms: 44.0 dB	peak: 33.6 dB	
FEC Decoder			locked (PLP ID: 1)		
Modulation Error Ratio (PLP)			rms: 44.3 dB	peak: 25.7 dB	
Error Vector Magnitude (PLP)			rms: 0.37 %	peak: 3.21 %	
LDPC Iterations			10		
BER before LDPC / BCH			Channel: 24		
BBFRAME / TS Packet Error Ratio			BBFRAME: 0.0E-05	TSPER: 0.0E-06	
RF	RF StepSize	Freq Offset	Channel	Channel Table	

- Set the required channel number.

The R&S ETC sets the receive frequency of the entered channel.

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

Channel tables are defined using the supplied R&S ETC View software and loaded in the R&S ETC. Assignment of channel numbers to frequencies is as follows:

- The first channel is assigned a channel number and a frequency.
- All subsequent channels have ascending numbers.
- The frequency spacing between the channels is fixed. It can also be negative, i.e. as the channel number increases, the center frequency of the R&S ETC decreases.
- In the case of transmission systems with gaps in the frequency range (e.g. television), a channel table can be composed of several ranges.

How to create channel tables and to load these tables in the R&S ETC is described in the R&S ETC View software manual.

### 2.4.3.3 Setting the Amplitude Parameters

At the RF input, the R&S ETC has an RF attenuator which, in the AUTO LOW NOISE and AUTO LOW DISTORTION settings, is controlled automatically in 5 dB steps depending on the receive level.

- AUTO LOW DISTORTION

The R&S ETC sets a 5 dB higher attenuation (related to AUTO LOW NOISE setting). As a result, the load on the input mixer is 5 dB lower for the given reference level. In the case of an input spectrum with high signal density, intrinsic interference products of the input mixer are reduced. However, the receiver noise factor of the R&S ETC increases owing to the higher attenuation upstream of the

input mixer. Due to the headroom of more than 5 dB, this setting is also recommended for mobile reception.

- **AUTO LOW NOISE**

The R&S ETC sets a 5 dB lower attenuation (related to AUTO LOW DISTORTION setting). This increases the sensitivity of the R&S ETC, i.e. the receiver noise factor drops owing to the lower attenuation upstream of the input mixer. This setting is also recommended for measurements at the transmitter as here large headrooms are not necessary.

In the DVB-T2 demodulation mode, the R&S ETC provides a routine to determine the optimum attenuator setting. This routine adjusts the attenuator so that the demodulated signal produces the smallest possible modulation error. On completion of the routine, the attenuator setting assumes the "manual control" state.

As an alternative to automatic control, the RF input attenuator can be manually preset in 5 dB steps. The current RF attenuation setting is shown in the status display of the measurement window.

By default, the measured receive level is displayed in dBm. However, it is also possible to select the units dBmV, dB $\mu$ V, watt and volt.

A reference offset (REF OFFSET) can be defined for the measured receive level. The reference offset adds a settable value to the reference level. This is useful if, for example, an attenuator or an amplifier is used upstream of the RF input. The R&S ETC includes this attenuation or gain in the level display, making manual conversion unnecessary. Attenuation upstream of the RF input must be entered as a positive value and gain as a negative value.

As an option, the R&S ETC features internal RF preselection for the suppression of unwanted receive 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. To improve sensitivity, signals are passed through a low-noise amplifier after preselection. This 15 dB amplifier improves sensitivity by approx. 10 dB.

For measurements on 75  $\Omega$  systems, the R&S ETC provides the possibility of switching over to 75  $\Omega$ . Here, however, it does not switch the RF input to 75  $\Omega$ , but instead simply switches to a 75  $\Omega$  matching pad that is located at the RF input. The 50/75  $\Omega$  matching pads R&S RAZ, R&S RAM and R&S FSH-Z38 are available for impedance matching to 75  $\Omega$  (see the recommended accessories). If configured accordingly, the R&S ETC automatically takes the conversion factor of the matching pad into consideration.

Other matching pads can be implemented by using a transducer factor. How to generate transducer factors is described in the R&S ETC View software manual.

### **Setting the RF Attenuation**

1. Press the AMPT key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

DVB-T2		Meas List		<No Profile>		03/05/12 05:48	
RF				498 MHz			
Channel / Band				24 / UHF 4/5			
Channel Table				TV Europe			
Gain Control / RF Attenuation				Auto Low Noise / 10 dB			
Channel Bw				8 MHz			
Measurement Parameter				Result			
Power				-19.69 dBm			
Crest Factor				12.08 dB			
Demodulator				locked			
Sideband Position				normal			
Frame Parameter		16Kext		1/8		PP3	
Carrier Frequency Offset				48.2 Hz			
Symbol Rate Offset				0.1 ppm			
Modulation Error Ratio (L1)		rms: 43.3 dB		peak: 33.4 dB			
FEC Decoder				locked (PLP ID: 1)			
Modulation Error Ratio (PLP)		rms: 44.2 dB		peak: 25.6 dB			
Error Vector Magnitude (PLP)		rms: 0.38 %		peak: 3.24 %			
LDPC Iterations				1.0			
BER before LDPC / BCH		LDPC: 0.0E-10		BCH: 0.0E-10			
BBFRAME / TS Packet Error		BBFRAME: 0.0E-05		TSPER: 0.0E-07			
RF Att / Gain Ctrl		Unit		Ref Offset		RF Imp / Preselection	
						Transducer	

The RF attenuation can be either preset in 5 dB steps (MANUAL RF ATT) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION) or to high input sensitivity (AUTO LOW NOISE).

3. Select the required item.

### Setting the Display Unit for Level

1. Press the AMPT key.
2. Tap UNIT.

The R&S ETC opens a submenu to select the various dimensional units for the receive level.

DVB-T2		Meas List		<No Profile>		03/05/12 05:47	
RF				498 MHz			
Channel / Band				24 / UHF 4/5			
Channel Table				TV Europe			
Gain Control / RF Attenuation				Auto Low Noise / 10 dB			
Channel Bw				8 MHz			
Measurement Parameter				Result			
Power				-19.70 dBm			
Crest Factor				12.64 dB			
Demodulator				locked			
Sideband Position				normal			
Frame Parameter		dBm		16Kext		1/8 PP3	
Carrier Frequency Offset				46.2 Hz			
Symbol Rate Offset				0.1 ppm			
Modulation Error Ratio (L1)		V		rms: 44.1 dB		peak: 33.6 dB	
FEC Decoder				locked (PLP ID: 1)			
Modulation Error Ratio (PLP)		W		rms: 44.3 dB		peak: 25.4 dB	
Error Vector Magnitude (PLP)		dBµV/m		rms: 0.37 %		peak: 3.30 %	
LDPC Iterations		dBµA/m		1.0			
BER before LDPC / BCH		V/m		LDPC: 0.0E-10		BCH: 0.0E-10	
BBFRAME / TS Packet Error		W/m²		RAME: 0.0E-05		TSPER: 0.0E-07	
RF Att / Gain Ctrl		Unit		Ref Offset		RF Imp / Preselection	
						Transducer	

3. Select the required unit.

**Note:** The R&S ETC sets the unit selected for receive level. The units dB $\mu$ V/m, dB $\mu$ A/m, V/m and W/m<sup>2</sup> are only available if a transducer with corresponding unit is activated.

### Setting the Reference Offset

1. Press the AMPT key.
2. Tap REF OFFSET.
3. Set a reference offset.

The reference offset is always entered in dB, even if the reference level is set to a different unit.

**Note:** A light blue asterisk appears at the top left of the measurement window to indicate that a reference offset that is not equal to 0 dB has been entered.

### Activating the RF Preselection

Only available with the R&S ETC-K1 option.

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select RF PRESELECTION and RF IMPEDANCE.

Measurement Parameter		Result	
Power		-49.83 dBm	
Crest Factor		12.21 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter	32Kext	RF Impedance	
Carrier Frequency Offset		50 $\Omega$	
Symbol Rate Offset		75 $\Omega$ RAM (5.7 dB loss)	
Modulation Error Ratio (L1)	rms: 36.9 d	75 $\Omega$ FSH-Z38 (5.7 dB loss)	
FEC Decoder		75 $\Omega$ RAZ (1.8 dB loss)	
Modulation Error Ratio (PLP)	rms: 36.7 d	75 $\Omega$ Transf. (0 dB loss)	
Error Vector Magnitude (PLP)	rms: 0.90 %	Loss of Transformer...	
LDPC Iterations		RF Preselection	
BER before LDPC / BCH	2.1E-05	[ ] RF Preselection	
BBFRAME / TSPER / ESR5	0.0E-05		
RF Att / Gain Ctrl	Unit	Ref Offset	RF Imp / Preselection
			Transducer

3. Select RF PRESELECTION.

**Note:** If RF preselection is already activated, RF PRESELECTION is highlighted in green and an [X] is shown between the square brackets to the left of the entry. If RF preselection is activated, PRESELECTION is displayed in the status area of the measurement window.

4. To deactivate the RF preselection, deselect the respective item.

### Setting the Input Impedance

1. Press the AMPT key.
2. Tap RF IMP/PRESELECTION.

The R&S ETC opens a submenu to select 50  $\Omega$  and 75  $\Omega$  as the input impedance.

Measurement Parameter		Result
Power		-49.83 dBm
Crest Factor		12.21 dB
Demodulator		locked
Sideband Position		normal
Frame Parameter	32Kext	RF Impedance
Carrier Frequency Offset		50 $\Omega$
Symbol Rate Offset		75 $\Omega$ RAM (5.7 dB loss)
Modulation Error Ratio (L1)	rms: 36.9 d	75 $\Omega$ FSH-Z38 (5.7 dB loss)
FEC Decoder		75 $\Omega$ RAZ (1.8 dB loss)
Modulation Error Ratio (PLP)	rms: 36.7 d	75 $\Omega$ Transf. (0 dB loss)
Error Vector Magnitude (PLP)	rms: 0.90 %	Loss of Transformer...
LDPC Iterations		
BER before LDPC / BCH	2.1E-05	RF Preselection
BBFRAME / TSPER / ESR5	0.0E-05	[ ] RF Preselection
RF Att / Gain Ctrl	Unit	Ref Offset
		RF Imp / Preselection
		Transducer

3. Select the required input impedance.

**Note:** If the input is set to 75  $\Omega$ , it is essential to connect the appropriate matching pad upstream of the RF input. The level displayed by the R&S ETC will otherwise be incorrect.

Note: For 75  $\Omega$  Transf. (xx dB loss), user can connect a transformer and indicate the transformer loss via the "Loss of Transformer..." menu. An entry box will appear to allow user-defined loss to be entered.

### Selecting the Transducer Factor

In many cases, the R&S ETC is not connected directly to the output of the DUT. Instead the measurement signal is fed to the R&S ETC via cables, amplifiers or antenna, or a combination of these items.

The R&S ETC can include the frequency responses of up to two upstream accessory units in the measurement result. For this purpose, "transducer factors" are defined and loaded in the R&S ETC using the R&S ETC View software. Each transducer factor consists of a list of frequency/level pairs which describe the frequency response of the test accessory unit. In the case of antennas, the dimensional unit for the measured electrical or magnetic field strength is also included.

Two entries (primary/secondary transducer) can be activated from the list of transducer factors loaded in the R&S ETC so that, for example, a combination consisting of cable+antenna or cable+amplifier can be taken into consideration. It is important to note that only one of the two selected transducers can define a dimensional unit other than dB.

How to use transducer factors is described in the chapter "Measuring with Transducer Factors".

How to create transducer tables and to load them in the R&S ETC is described in the R&S ETC View software manual.

#### 2.4.3.4 Setting the Channel Bandwidth

The DVB-T2 demodulator of the R&S ETC processes OFDM signals with signal bandwidths of 1.7 MHz, 5 MHz, 6 MHz, 7 MHz and 8 MHz. To allow the demodulator to synchronize, it must be informed of the OFDM signal bandwidth of the receive signal. The OFDM signal bandwidth OFDM BW corresponds to the current bandwidth of the OFDM signal, i.e. it is the frequency spacing between the first and last OFDM carrier. It is calculated internally and automatically based on the selected channel bandwidth.

DVB-T2		Meas List		<No Profile>		03/05/12 05:54	
RF				498 MHz			
Channel / Band				24 / UHF 4/5			
Channel Table				TV Europe			
Gain Control / RF Attenuation				Auto Low Noise / 10 dB			
Channel Bw				8 MHz			
Measurement Parameter				Result			
Power				-19.60 dBm			
Crest Factor				12.20 dB			
Demodulator				locked			
Sideband Position				normal			
Frame Parameter		16Kext		1/8		PP3	
Carrier Frequency Offset				62.6 Hz			
Symbol Rate Offset				0.1 ppm			
Modulation Error Ratio (L1)				rms: 44.0 dB		peak: 32.9 dB	
FEC Decoder				locked (PLP ID: 1)			
Modulation Error Ratio (PLP)				rms: 44.1 dB		peak: 26.0 dB	
Error Vector Magnitude (PLP)				rms: 0.38 %		peak: 3.08 %	
LDPC Iterations				1.0			
BER before LDPC / BCH				LDPC: 0.0E-10		BCH: 0.0E-10	
BBFRAME / TS Packet Error Ratio				BBFRAME: 0.0E-05		TSPER: 0.0E-07	
Ch Bw		Ch Bw		Ch Bw		Ch Bw	
1.7 MHz		5 MHz		6 MHz		7 MHz	
						8 MHz	

#### 2.4.3.5 Working with the Measurement Parameter List

In the MEASUREMENT LIST measurement, the R&S ETC functions as the test demodulator. The measurement parameter list provides an overview of the most important instrument settings, the receive signal status and the quality of the received DVB-T2 signal. The sequence in which the measurement parameters are shown corresponds to the sequence of synchronization steps in the demodulator. The first measurement parameter in the list are the receive level and the crest factor measured in the receive channel. These parameters are always measured, irrespective of whether synchronization of the demodulator takes place. In the DEMODULATOR line, the R&S ETC indicates whether the test demodulator is synchronized to the received signal. The SIDEBAND POSITION and CARRIER FREQUENCY OFFSET measurement parameters, the Signaling information and the modulation error are only determined and displayed if the test demodulator is synchronized to the receive signal. A synchronized PLP decoder is necessary for measurement of the bit error ratios.

1. Press the MEAS key.

2. Tap MEAS MODE.  
The R&S ETC opens the menu containing the measurement functions of the DVB-T/H Analyzer mode.
3. Select MEASUREMENT LIST (MEASUREMENT LIST highlighted in red).  
The R&S ETC displays the measurement parameter list of the DVB-T2 test receiver.

Mode
Measurement
Profile

	<b>DVB-T2</b>	<b>Meas List</b>	<b>&lt;No Profile&gt;</b>	26/02/12 14:39
Display field for status information	RF	600 MHz		
	Band	---		
	Channel Table	---		
	Gain Control / RF Attenuation	Auto Low Noise / 10 dB		
	Channel Bw	8 MHz		
DVB-T2 receiver setting parameters				
	<b>Measurement Parameter</b>	<b>Result</b>		
	Power	-20.19 dBm		
	Crest Factor	12.69 dB		
	Demodulator	locked		
	Sideband Position	normal		
	Frame Parameter	16K	1/32	PP7
	Carrier Frequency Offset	164.0 Hz		
	Symbol Rate Offset	0.3 ppm		
	Modulation Error Ratio (L1)	rms: 43.6 dB	peak: 25.5 dB	
	FEC Decoder	locked (PLP ID: 3)		
	Modulation Error Ratio (PLP)	rms: 43.3 dB	peak: 10.8 dB	
	Error Vector Magnitude (PLP)	rms: 47.56 %	peak: 15.07 %	
	LDPC Iterations	2.3		
	BER before LDPC / BCH	LDPC: 7.5E-05	BCH: 0.0E-10	
	BBFRAME / TS Packet Error Ratio	BBFRAME: 0.0E-05	TSPER: 0.0E-07	
	Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings
			MER Range	Signalling Info
Measurement parameters				

Measurement parameters	Explanation
Level	Power or level of the receive signal inside the channel bandwidth in the preset unit of measurement.  This parameter is measured and displayed independently of the received signal.
Crest Factor	Crest factor of the demodulated baseband signal.  This parameter is measured and displayed independently of the received signal.
Demodulator	Status of the test demodulator is displayed.  If the demodulator is not synchronized to the receive signal ("unlocked"), the following measurement parameters cannot be determined.
Sideband Position	Sideband position of the received DVB-T/2 signal.  This parameter is only displayed if the demodulator is synchronized.

Measurement parameters	Explanation
Frame Parameter	<p>"FFT" and "Guard Interval" parameters and the modulation mode. All Signaling parameters are displayed in the Signaling Info measurement window; see the chapter "<a href="#">Working with the PLP Signaling Info Parameter List</a>".</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Carrier Frequency Offset	<p>Absolute carrier frequency offset of the received DVB-T2 signal relative to the set receive frequency.</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Symbol Rate Offset	<p>Relative symbol rate offset. It is given in ppm (parts per million). The offset is of equal importance for the sampling rate offset of the OFDM signal, the length of the guard interval and the bit rate of the MPEG transport stream.</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
Modulation Error Ratio (L1, rms and peak)	$-10 \log_{10} \frac{\frac{1}{N} \sum_{\nu=0}^{N-1}  meas(\nu) - ref(\nu) ^2}{E\{ ref(\nu) ^2\}} \quad dB$ <p>Root mean square of modulation error ratio. The value covers the modulation errors of all I/Q cells of L1-pre signaling. Each T2 frame carries 1840 I/Q cells (modulation: BPSK) for this signaling type. The MER(L1) value analyzes these I/Q cells of 12 consecutive T2 frames. The I/Q cells of L1 signaling are referenced to the signal power of L1 signaling I/Q cells which is identical to the average signal power of data I/Q cells.</p>
FEC Decoder	<p>Status of the forward error correction (FEC) decoder is displayed.</p> <p>If the FEC decoder is not synchronized to the receive signal ("<b>unlocked</b>"), the following measurement parameters cannot be determined.</p>
Modulation Error Ratio (PLP, rms and peak)	<p>Root mean square of modulation error ratio of the currently decoded physical layer pipe (PLP). This value covers the modulation errors of all I/Q data cells of one PLP.</p>

Measurement parameters	Explanation
Error Vector Magnitude (PLP, rms and peak)	<p>Average modulation error of all OFDM data carriers (EVM = error vector magnitude). The RMS value and the peak value of the error power of the demodulated IQ components are shown in relation to the peak power of an OFDM data carrier in the linear quantity (%).</p> <p>This parameter is only displayed if the demodulator is synchronized.</p>
LDPC Iterations	<p>Average number of iterations applied by the LDPC decoder.</p>
Bit Error Ratio Before LDPC	<p>Bit error ratio before LDPC decoder in the forward error correction of the currently selected PLP. The R&amp;S ETL compares all bits of each FECFRAME before the LDPC decoder with the corresponding bits after LDPC decoding. An acquisition counter in percent is appended to the BER value. Furthermore, the number of bits representing a complete acquisition (100%) is displayed.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
Bit Error Ratio Before BCH	<p>Bit error ratio before BCH decoder in the forward error correction of the currently decoded PLP. The R&amp;S ETC compares all bits of each baseband frame (BBFRAME) before BCH decoding with the corresponding bits after BCH decoding. An acquisition counter in percent is appended to the BER value. Furthermore, the number of bits representing a complete acquisition (100%) is displayed.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>
BBFRAME (Baseband frame)	<p>Bit error ratio of baseband frame.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>

Measurement parameters	Explanation
TS Packet error ratio	<p>Ratio between erroneous MPEG transport stream packets and transmitted packets. This value is displayed only if the payload type of the decoded PLP is a transport stream (TS) and the baseband frame is transmitted in normal mode (NM). An acquisition counter in percent is appended to the error ratio value. Furthermore, the number of transport stream packets representing a complete acquisition (100%) is displayed.</p> <p>This parameter is only displayed if the FEC decoder is synchronized.</p>

### Setting the RF Attenuation

1. Press the MEAS key.
2. Tap RF ATT/GAIN CTRL.

The R&S ETC opens a submenu for selecting attenuator control.

Measurement Parameter	Result
Power	-19.90 dBm
Crest Factor	12.41 dB
Demodulator	locked
Sideband Position	normal
Frame Parameter	16Kext 1/8 PP3
Carrier Frequency Offset	79.0 Hz
Symbol Rate Offset	0.2 ppm
Modulation Error Ratio (L1)	rms: 42.2 dB peak: 28.6 dB
FEC Decoder	locked (PLP ID: 1)
Modulation Error Ratio (PLP)	rms: 42.8 dB peak: 26.6 dB
Error Vector Magnitude (PLP)	rms: 0.45 % peak: 2.86 %
LDPC Iterations	Auto Low Noise 1.0
BER before LDPC / BCH	Auto Low Distortion 1.1E-08 BCH: 0.0E-09
BBFRAME / TS Packet Error	Manual RF Att... 1.0E-05 TSPER: 0.0E-06

The RF attenuation can be either preset in 5 dB steps (MAN setting) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION setting) or to high input sensitivity (AUTO LOW NOISE setting).

3. Select the required item.

### Selecting the Sideband Position

With the Sideband Position setting, it is possible to select whether the received signal is in normal spectrum position or inverted.

1. Press the MEAS key.

2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

DVB-T2		Meas List	<No Profile>	09/10/13	10:49	LOG
	RF			530 MHz		
	Channel / Band			28 / UHF 4/5		
	Channel Table			TV Europe		
	Gain Control / RF Attenuation			Auto Low Noise / 10 dB		
	Channel Bw			8 MHz		
Measurement Parameter		Result				
Power		-20.65 dBm				
Crest Factor		12.70 dB				
Demodulator		locked				
Sideband Position		normal				
Frame Parameter		32K	1/128	PP7		
Carrier Frequency Offset		- Sideband Position				
Symbol Rate Offset		Normal				
Modulation Error Ratio (L1)		rr	Inverse	24.5	dB	
FEC Decoder		+ Decoded PLP ID				
Modulation Error Ratio (PLP)		rr	+ DVB-T2 Profile	7.1	dB	
Error Vector Magnitude (PLP)		rr	+ Symbol Loop	27.06	%	
LDPC Iterations		+ Channel Adaptation				
BER before LDPC / BCH		0.0E-08				
BBFRAME / TSPER / ESR5		+ FFT Window Position				
Meas Mode		Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

3. Under SIDEBAND POSITION, select NORMAL or INVERSE.

### Setting the Decoded PLP ID

The test demodulator decoded the selected PLP ID either AUTOMATICALLY or MANUALLY.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

DVB-T2		Meas List	<No Profile>	09/10/13	10:50
RF		530 MHz			
Channel / Band		28 / UHF 4/5			
Channel Table		TV Europe			
Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
Channel Bw		8 MHz			
Measurement Parameter			Result		
Power			-20.65 dBm		
Crest Factor			12.88 dB		
Demodulator			locked		
Sideband Position			normal		
Frame Parameter			32K	1/128	PP7
Carrier Frequency Offset			+ Sideband Position		
Symbol Rate Offset			- Decoded PLP ID		
Modulation Error Ratio (L1)			Auto	24.1 dB	
FEC Decoder			Manual ...		
Modulation Error Ratio (PLP)			+ DVB-T2 Profile		
Error Vector Magnitude (PLP)			+ Symbol Loop		
LDPC Iterations			+ Channel Adaptation		
BER before LDPC / BCH			+ FFT Window Position		
BBFRAME / TSPER / ESR5			0.0E-09		
BBFRAME / TSPER / ESR5			0%		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

- Under DECODED PLP ID, select AUTO or MANUAL.
- For MANUAL selection, an entry for PLP ID will appear for entering of the PLP ID to decode.

DVB-T2		Meas List	DVB-T2_1_7M	02/05/12	18:56
RF		498 MHz			
Channel / Band		24 / UHF 4/5			
Channel Table		TV Europe			
Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
Channel Bw		1.7 MHz			
Measurement Parameter			Result		
Power			-19.91 dBm		
Crest Factor			11.75 dB		
Demodulator			locked		
Sideband Position			normal		
Frame Parameter			16Kext	1/8	PP3
Carrier Frequency Offset			79.1 Hz		
Symbol Rate Offset			0.2 ppm		
Modulation Error Ratio (L1)			rms: 41.1 dB	peak: 29.1 dB	
FEC Decoder			locked (PLP ID: 1)		
Modulation Error Ratio (PLP)			rms: 42.5 dB	peak: 24.5 dB	
Error Vector Magnitude (PLP)			rms: 0.46 %	peak: 3.65 %	
LDPC Iterations			10		
BER before LDPC / BCH			PLP ID: 1		
BBFRAME / TS Packet Error Ratio			BBFRAME: 0.0E-02	TSPER: ---	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

### Setting the DVB-T2 Profile

The test demodulator allows the selection of DVB-T2 profile to be demodulated. T2-lite has been introduced to ease the implementation of mobile TV services. It uses a subset of signal parameter combinations possible in T2-base profile and defines new code rates.

The provided modes are :

T2-base: Only a T2-base or T2-base lite signal (part) is demodulated and analyzed.

T2-lite: Only a T2-lite signal (part) is demodulated and analyzed.

In case of a multi profile signal (a T2-lite signal is transmitted during the future extension frames (FEF) of the T2-base signal and vice versa), only the selected signal part is demodulated and analyzed.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

Measurement Parameter		Result	
Power		-20.66 dBm	
Crest Factor		13.27 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter		32K	1/128 PP7
Carrier Frequency Offset		+ Sideband Position	
Symbol Rate Offset		+ Decoded PLP ID	
Modulation Error Ratio (L1)		- DVB-T2 Profile 25.0 dB	
FEC Decoder		T2-Base	
Modulation Error Ratio (PLP)		T2-Lite 6.3 dB	
Error Vector Magnitude (PLP)		29.86 %	
LDPC Iterations		+ Symbol Loop	
BER before LDPC / BCH		+ Channel Adaptation 0.0E-09	
BBFRAME / TSPER / ESR5		+ FFT Window Position 0%	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings BER Reset Signalling Info

3. Under DVB-T2 PROFILE, select T2-BASE or T2-LITE.

### Setting the Symbol Loop

The test demodulator adapts to the sampling frequency of the received OFDM signal. With the SYMBOL LOOP setting, the control bandwidth of this signal is adjusted. With the SYMBOL LOOP : FAST setting, fluctuations in the sampling rate are compensated. This setting is not recommended for measurements at the transmitter as possible errors may be compensated and therefore not detected. The SLOW setting is recommended for measurements at the transmitter.

1. Press the MEAS key.
2. Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

DVB-T2		Meas List	<No Profile>	09/10/13	10:50
	RF			530 MHz	
	Channel / Band			28 / UHF 4/5	
	Channel Table			TV Europe	
	Gain Control / RF Attenuation			Auto Low Noise / 10 dB	
	Channel Bw			8 MHz	
Measurement Parameter		Result			
Power		-20.65 dBm			
Crest Factor		13.05 dB			
Demodulator		locked			
Sideband Position		normal			
Frame Parameter		+ Sideband Position		PP7	
Carrier Frequency Offset		+ Decoded PLP ID			
Symbol Rate Offset		+ DVB-T2 Profile			
Modulation Error Ratio (L1)		- Symbol Loop		24.6 dB	
FEC Decoder		Slow			
Modulation Error Ratio (PLP)		Medium		6.3 dB	
Error Vector Magnitude (PLP)		Fast		29.83 %	
LDPC Iterations		+ Channel Adaptation		0.0E-09	
BER before LDPC / BCH		+ FFT Window Position		0%	
BBFRAME / TSPER / ESR5					
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

- Under SYMBOL LOOP, select SLOW, MEDIUM or FAST.

### Setting the Channel Adaptation

With the CHANNEL ADAPTATION setting, the OFDM demodulator can be adapted to receive conditions.

With the FAST setting, the demodulator adapts itself quickly to changes in the receive signal, i.e. level fluctuations, fading effects and Doppler effects are quickly corrected. With this setting, the demodulator therefore yields the most stable demodulation results for mobile reception. This setting is not recommended for measurements at the transmitter as the rapid and sensitive control operations are not optimized to static channels.

For measurements at transmitters and in the lab, it is recommended to use the SLOW setting because in this setting the channel filtering is optimized for MER performance which has especially influence to the channel border carriers of the OFDM signal. The control loops react only slowly to changes in the receive signal. Possible errors in the DVB-T2 signal are thus detected.

With the MEDIUM setting, changes in the receive signal are corrected at a moderate rate. This setting is suitable for the reception of moderately time-variable channels which may occur in single frequency networks (SFN) when the same signal is received by several transmitters. The channel filtering is optimized for reception of signals with strong echoes. The setting degrades the inherent MER performance slightly.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

DVB-T2		Meas List	<No Profile>	09/10/13	10:50
RF		530 MHz			
Channel / Band		28 / UHF 4/5			
Channel Table		TV Europe			
Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
Channel Bw		8 MHz			
Measurement Parameter			Result		
Power			-20.66 dBm		
Crest Factor			12.59 dB		
Demodulator			locked		
Sideband Position			normal		
Frame Parameter			+ Sideband Position PP7		
Carrier Frequency Offset			+ Decoded PLP ID		
Symbol Rate Offset			+ DVB-T2 Profile		
Modulation Error Ratio (L1)			+ Symbol Loop 25.7 dB		
FEC Decoder			- Channel Adaptation		
Modulation Error Ratio (PLP)			Slow/Laboratory 6.3 dB		
Error Vector Magnitude (PLP)			Fast/SFN 29.83 %		
LDPC Iterations			Mobile		
BER before LDPC / BCH			0.0E-09		
BBFRAME / TSPER / ESR5			+ FFT Window Position 0%		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

- Under CHANNEL ADAPTATION, select SLOW/LABORATORY, FAST/SFN or MOBILE.

### Setting the FFT Window Position

With FFT WINDOW POSITON setting, the FFT window can be AUTO or MANUAL. This allows the manual shifting of the FFT window for demodulation. If the FFT WINODW POSITIONING is set to MANUAL, the main echo path is fixed to the center of the guard interval.

- Press the MEAS key.
- Tap DEMOD SETTINGS.

The R&S ETC opens a submenu to select SIDEBAND POSITION, DECODED PLP ID, DVB-T2 PROFILE, SYMBOL LOOP, CHANNEL ADAPTATION and FFT WINDOW POSITION.

DVB-T2		Meas List	<No Profile>	09/10/13	10:50
RF		530 MHz			
Channel / Band		28 / UHF 4/5			
Channel Table		TV Europe			
Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
Channel Bw		8 MHz			
Measurement Parameter			Result		
Power			-20.66 dBm		
Crest Factor			13.28 dB		
Demodulator			locked		
Sideband Position			normal		
Frame Parameter			32K 1/128 PP7		
Carrier Frequency Offset			+ Sideband Position		
Symbol Rate Offset			+ Decoded PLP ID		
Modulation Error Ratio (L1)			+ DVB-T2 Profile 25.9 dB		
FEC Decoder			+ Symbol Loop		
Modulation Error Ratio (PLP)			+ Channel Adaptation 6.5 dB		
Error Vector Magnitude (PLP)			- FFT Window Position 29.05 %		
LDPC Iterations			Auto		
BER before LDPC / BCH			0.0E-09		
BBFRAME / TSPER / ESR5			Manual ... 0%		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	BER Reset	Signalling Info

- Under FFT WINDOW POSITION, select AUTO or MANUAL.

### Resetting the BER Measurement

If a new synchronization to a DVB-T/H signal takes place (change of FEC decoder lock status from "unlocked" to "locked"), the BER measurements are reset and restarted.

With the BER RESET function, the BER measurements are reset and restarted manually.

- Press the MEAS key.
- Tap BER RESET.

The R&S ETC resets the bit error measurement irrespective of the status of the FEC decoder and restarts it.

DVB-T2 Meas List • DVBT2_1_7M		02/05/12 18:53	
RF	498 MHz		
Channel / Band	24 / UHF 4/5		
Channel Table	TV Europe		
Gain Control / RF Attenuation	Auto Low Noise / 10 dB		
Channel Bw	1.7 MHz		
Measurement Parameter		Result	
Power	-19.92 dBm		
Crest Factor	11.90 dB		
Demodulator	locked		
Sideband Position	normal		
Frame Parameter	16Kext	1/8	PP3
Carrier Frequency Offset	78.8 Hz		
Symbol Rate Offset	0.2 ppm		
Modulation Error Ratio (L1)	rms: 40.2 dB	peak: 25.6 dB	
FEC Decoder	locked (PLP ID: )		
Modulation Error Ratio (PLP)	rms: 41.5 dB	peak: 25.9 dB	
Error Vector Magnitude (PLP)	rms: 0.52 %	peak: 3.12 %	
LDPC Iterations	1.0		
BER before LDPC / BCH	LDPC: 1.0E-08	BCH: 0.0E-09	
BBFRAME / TS Packet Error Ratio	BBFRAME: 0.0E-05	TSPER: 0.0E-06	
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings
			BER Reset
			Signalling Info

### 2.4.3.6 Working with the PLP Signaling Info Parameter List

The DVB-T2 transmitters transmit the PLP Signaling Information. The R&S ETC decodes the selected PLP ID information and adjusts the test demodulator accordingly. The L1-Pre Signaling, PLP parameters and Auxiliary L1-post signaling information is available for selection.

- Press the MEAS key.
- Tap SIGNALING INFO.

The R&S ETC lists the Signaling Information parameters.

DVB-T2		SIG Info		• DVB-T2 1 7M		02/05/12 18:57	
		RF			498 MHz		
		Channel / Band			24 / UHF 4/5		
		Channel Table			TV Europe		
		Gain Control / RF Attenuation			Auto Low Noise / 10 dB		
		Channel Bw			1.7 MHz		
Power	-19.91 dBm	Demod	locked	PLP(ID: 1)	locked	MER (PLP, rms)	42.0 dB
L1-Pre Signalling							
T2 Version	1.2.1	L1-post Constellation			BPSK		
Transmission System	SISO	L1-post Code Rate			1/2		
Guard Interval	1/8	L1-post FEC Type			Short		
Pilot Pattern	PP3	L1-post Extension			Off		
Bandwidth Extension	0n	L1-post Size			1780		
Data Symbols / Frame	13	L1-post Info Size			445		
Frames / Superframe	3	L1 Repetition			0n		
PAPR	L1-ACE & TR	Stream Type			TS only		
System ID (hex)	0x278E	Tx ID Availability (hex)			0x00		
Cell ID (hex)	0x00F8	Regeneration Flag			0		
Network ID (hex)	0xFFFF	Frequencies			1		
S1 / S2 (binary)	000 / 1000	RF Index			0		
CRC 32 (hex)	0x1B8B315E	Reserved (hex)			0x00		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	Sig Info Settings	Sig Info Exit		

- Under SIG INFO SETTINGS, select L1-PRE SIGNALING, PLP PARAMETER or AUXILIARY L1-POST INFO.

DVB-T2		SIG Info		• DVB-T2 1 7M		02/05/12 18:57	
		RF			498 MHz		
		Channel / Band			24 / UHF 4/5		
		Channel Table			TV Europe		
		Gain Control / RF Attenuation			Auto Low Noise / 10 dB		
		Channel Bw			1.7 MHz		
Power	-19.91 dBm	Demod	locked	PLP(ID: 1)	locked	MER (PLP, rms)	41.5 dB
L1-Pre Signalling							
T2 Version	1.2.1	L1-post Constellation			BPSK		
Transmission System	SISO	L1-post Code Rate			1/2		
Guard Interval	1/8	L1-post FEC Type			Short		
Pilot Pattern	PP3	L1-post Extension			Off		
Bandwidth Extension	0n	L1-post Size			1780		
Data Symbols / Frame	13	L1-post Info Size			445		
Frames / Superframe	3	L1 Repetition			0n		
PAPR	L1-ACE & TR	Stream Type			TS only		
System ID (hex)	0x278E	Tx ID Availability (hex)			0x00		
Cell ID (hex)	0x00F8	Regeneration Flag			0		
Network ID (hex)	0xFFFF	Frequencies			1		
S1 / S2 (binary)	000 / 1000	RF Index			0		
CRC 32 (hex)	0x1B8B315E	Reserved (hex)			0x00		
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	Sig Info Settings	Sig Info Exit		



most important instrument settings are displayed above the measurement parameters. The measurement parameters are described in the chapter "[Working with the Measurement Parameter List](#)".

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

Measurement Parameter		Result	
Measurement Mode		-49.90 dBm	
Measurement List		12.48 dB	
Constellation Diagram		locked	
Echo Pattern		normal	
MER (k)		32Kext	1/128 PP7
Amplitude/Phase/GpDelay		56.5 Hz	
Spectrum		0.1 ppm	
Spectrum Emission Mask		rms: 36.9 dB	peak: 22.8 dB
TV Standard		locked (PLP ID: )	
DVB-T/H		rms: 36.9 dB	peak: 11.6 dB
DVB-T2		rms: 0.88 %	peak: 16.09 %
ISDB-T		2.3	
		---	0.0E-08
		0.0E-03	n/a(HEM) 0%

3. Select CONSTELLATION DIAGRAM (CONSTELLATION DIAGRAM highlighted in red).

The R&S ETC shows the constellation diagram of the DVB-T2 test receiver.

The screenshot shows the 'Constellation' mode of the TV Analyzer. The main display area shows a grid of constellation points. To the right, a list of parameters is shown, including RF (600 MHz), Power (-20.18 dBm), Crest Factor (12.37 dB), Demod (locked), Frame Param (16K, 1/32, PP7), Carrier Offset (163.6 Hz), Symbol Offset (0.3 ppm), MER(L1,rms) (43.9 dB), PLP (ID: 3) (locked), Constellation (QAM256), Rotation (0n), MER(PLP,rms) (43.4 dB), BER before LDPC (6.7E-05), BER before BCH (0.0E-10), and BBRAME Error Ratio (0.0E-05). Callouts point to various UI elements: 'Mode' (DVB-T2), 'Measurement' (Constellation), 'Profile' (<No Profile>), 'Display field for status information' (26/02/12 14:40), 'Display settings' (left side), 'DVB-T2 receiver setting parameters' (right side), and 'Measurement parameters' (bottom right).

For a description of the measurement parameters, see the chapter "[Working with the Measurement Parameter List](#)".

### Requirement for displaying the constellation



The minimum requirement for displaying the constellation is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays evenly distributed noise in the measurement diagram.

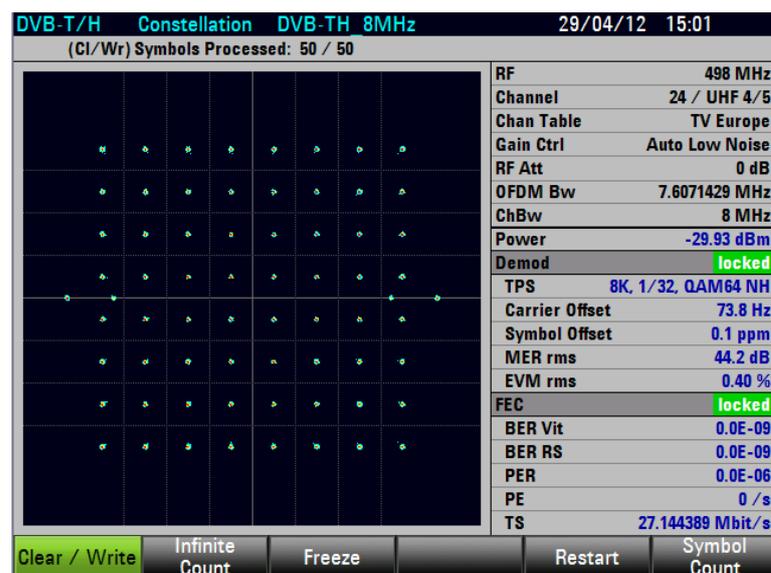
If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful display a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

### Setting the Constellation Diagram Parameters

With the CLEAR/WRITE setting, the displayed symbols are substituted by currently received symbols when the preset symbol count is reached. The number of displayed symbols is user-selectable. With the INFINITE COUNT setting, the symbols are added until a synchronization loss exists, the trace setting changes or the measurement is closed. With FREEZE, the addition of symbols is stopped and the current display is retained until the measurement is closed. With RESTART, the constellation diagram is reset and addition of the symbols is restarted.

### Selecting the Constellation Diagram

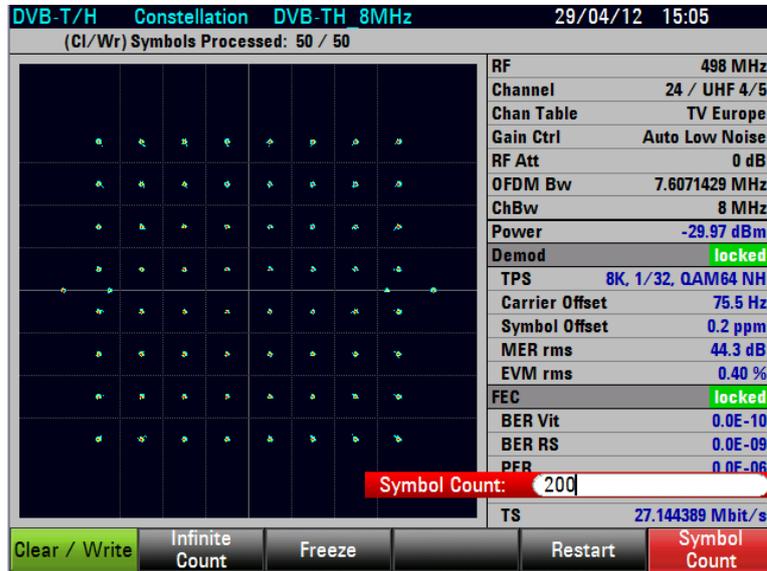
1. Press the TRACE key.
2. Tap CLEAR/WRITE, INFINITE COUNT or FREEZE to select the required diagram.



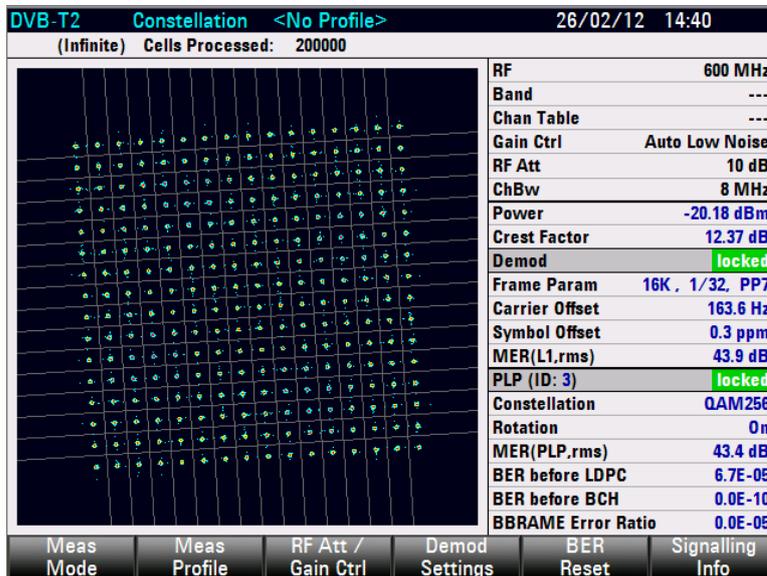
In the CLEAR/WRITE trace setting, you can adjust the number of cells to be displayed.

3. Tap CELL COUNT.

The R&S ETC opens the entry field for the cell count.



4. Set the required number of cell count.



### 2.4.3.8 Working with the Echo Pattern Measurement

The ECHO PATTERN measurement presents the echo profile of the receive channel. Echoes are caused by reflections on building, for example. In single-frequency networks (SFN), the receive signal with the highest level is the useful signal. The receive signals of the other SFN transmitters also appear as echoes.

The R&S ETC sets the largest receive signal as the reference signal (0 dB, 0 μs). It sets the guard interval automatically as a function of the receive signal. The echo detection line (i.e. the level threshold starting from which echoes are taken into account for positioning the guard interval) is also automatically defined by the analyzer. If desired, this threshold is shown in the diagram as a horizontal line. The guard start and guard stop times set by the demodulator are displayed as vertical lines in the diagram.

The time axis is displayed by the R&S ETC alternatively as a distance axis calibrated in kilometers or miles. To make estimation simple, the time display range is set in steps of 1, 2 and 5. As a result, it may occur that some subranges contain no data. These ranges are indicated by a different diagram background.

In the default setting, the value range corresponds to the third part of an OFDM symbol, since the echo profile is derived from the scattered pilots.

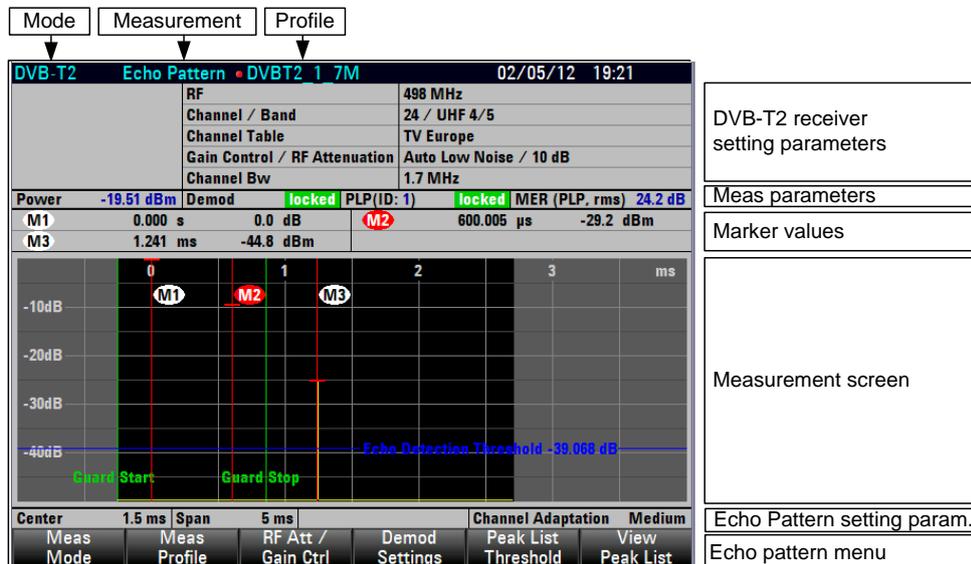
In the EXTENDED SPAN setting, the time display range corresponds to the length of an OFDM symbol. The I/Q values are routed to the demapper after the channel equalizer. The ideal I/Q position is sent back to the channel equalizer. This information is used to extend the display range to the length of an OFDM symbol. If mistakes occur in the demapper, this will result in a detrimental reduction of the dynamic range and pseudo-echoes.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select ECHO PATTERN (ECHO PATTERN highlighted in red).

The R&S ETC displays the echo pattern measurement diagram.



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### Requirement for the echo measurement



The minimum requirement for displaying echoes is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

---

### Zooming the Display Range

In the default setting, the R&S ETC determines the possible display range automatically and displays it. The R&S ETC allows zooming of the time axis.

1. Press the SPAN key.
2. Tap MANUAL SPAN.
3. Tap CENTER POSITION.
4. Set the center position.
5. Tap MANUAL SPAN.

The display range can be changed in steps of 1, 2 and 5.

6. Set the display range.

The R&S ETC zooms the echo pattern measurement diagram about the center position.

**Note:** The level display range is always 0 dB to –50 dB. It cannot be set. The receive path with the highest level is always set to 0 dB.

### Extending the Display Range

In the default setting, the value range corresponds to the third part of an OFDM symbol. In the EXTENDED SPAN settings, the time display range is extended to the length of an OFDM symbol.



Due to mistakes in the demapper, this may result in reduced dynamic range and pseudo-echoes in the EXTENDED SPAN settings

---

1. Press the SPAN key.

2. Tap EXTENDED SPAN.
3. Set the display range.

### Selecting the Time or Distance Unit

The R&S ETC displays the x axis calibrated either to time or distance. As time axis, the unit is always  $\mu$ s. The distance axis can be calibrated in kilometers or miles.

1. Press the SPAN key.
2. Tap SPAN UNIT.
3. Select the unit.

### Displaying the Echo Detector Threshold

The R&S ETC positions the guard interval automatically. The level threshold can be shown as display line. It indicates from which level the demodulator echoes are taken into account for positioning.

1. Press the LINES key.
2. Tap VIEW ECHO DETECTION LINE.
3. Tap the menu a second time to hide the display line again.

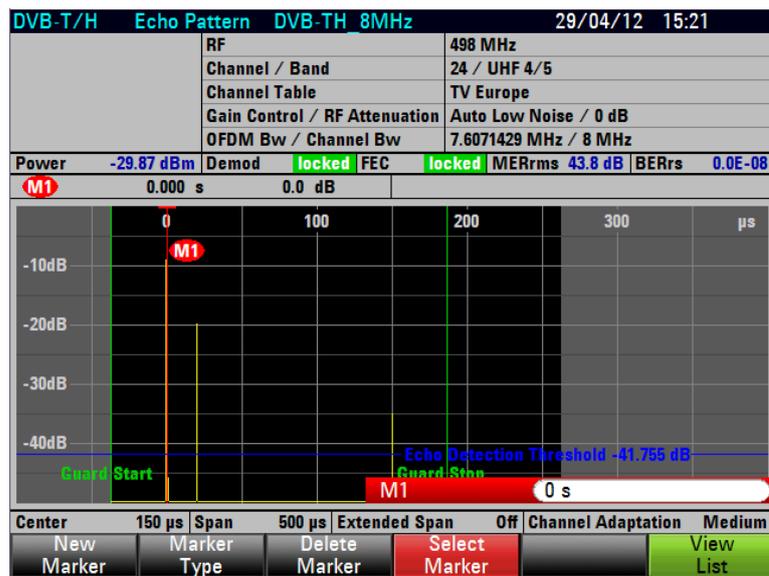
### Using the Markers

To evaluate the trace, the R&S ETC provides up to six markers, five of which can be used either as markers or delta markers.

The markers are always bound to the trace and show the distance to the main path and, depending on the setting, the relative or absolute level at the respective points on the trace. The position of the marker is indicated by a vertical line over the entire length of the measurement diagram. The numeric values for distance and level are displayed on the screen. The units for level and distance are determined by the set units.

1. Press the MARKER key.

The R&S ETC opens the marker menu. If no marker is activated yet, the R&S ETC automatically activates MARKER 1 and sets it to the highest echo level. The distance to the main path and the level is displayed in the selected units above the measurement diagram. The value entry field for the marker frequency is open.



2. The following steps are possible:
  - Set the marker position.
  - Tap NEW MARKER to activate a further marker.
  - Tap MARKER TYPE to select the level unit of the markers (relative or absolute).
  - Tap VIEW LIST to deactivate the numeric display of the markers. Tap the menu a second time to activate the marker list again.
  - Tap DELETE MARKER to deactivate the marker.



The relative level unit is always given in dB. It is referenced to the receive path with the highest level.

The absolute level unit is determined by the selection in the AMPT : UNIT menu.

The unit of the distance to the main receive path depends on the selection made in the SPAN : SPAN UNIT menu.

### Automatic Positioning of the Marker

To simplify operation, the R&S ETC provides functions for positioning the markers.

- PEAK
 

This function sets the marker at the highest value of the trace. The function always affects the active marker, whose menu is highlighted in red.
- NEXT PEAK
 

This function sets the marker, starting from its current position, to the next lower value of the trace.
- CENTER = MRK FREQ

In a zoomed display (MANUAL SPAN), the R&S ETC sets the position of the active marker (menu highlighted in red) in the center of the measurement diagram. This function is useful especially when an echo with a smaller display range is to be examined in greater detail. For this purpose, first set the marker in the center of the display range and then reduce the display range.

### 2.4.3.9 Working with the Echo Peak List

In addition to the graphic display, the R&S ETC displays the detected echoes in the ECHO PEAK LIST, sorted by level.

#### Setting the Level Threshold

To selectively restrict the entries, set a threshold value in the range from  $-50$  dB to  $0$  dB. Only the echoes that exceed the threshold value are listed.

1. Press the MEAS key.
2. Tap PEAK LIST THRESHOLD.
3. Set the threshold value.

#### Displaying the Echo Peak List

1. Press the MEAS key.
2. Tap VIEW PEAK LIST.

The R&S ETC displays the echo pattern peak list. The list shows the relative level difference to the main receive path, the absolute level and the time difference to the main receive path.

As an alternative to the time difference, the R&S ETC displays the distance difference in kilometers or miles. Select the unit in the SPAN : SPAN UNIT menu; see chapter "[Selecting the Time or Distance Unit](#)".

Mode
Measurement
Profile

DVB-T2		Peak List		• DVBT2 1 7M		02/05/12 19:24	
		RF		498 MHz			
		Channel / Band		24 / UHF 4/5			
		Channel Table		TV Europe			
		Gain Control / RF Attenuation		Auto Low Noise / 10 dB			
		Channel Bw		1.7 MHz			
Power		-19.50 dBm		Demod		locked	
				PLP(ID: 1)		locked	
				MER (PLP, rms)		24.2 dB	
Echo		Relative Level		Absolute Level		Time	
1		0.0 dB		-19.6 dBm		0.000 s	
2		-9.3 dB		-28.9 dBm		600.007 μs	
3		-25.1 dB		-44.7 dBm		1.241 ms	
Threshold		-50.0 dB		-69.6 dBm			
Meas Mode		Meas Profile		RF Att / Gain Ctrl		Demod Settings	
						Freeze Peak List	
						Peak List Exit	

Important setting parameters

Meas parameters

Echo pattern peak list

Threshold

Peak list menu

In the ECHO PEAK LIST, the R&S ETC displays the echoes, sorted by level, that exceed the set threshold value.

### Freezing the Echo Peak List

- ▶ Tap FREEZE PEAK LIST.  
The R&S ETC freezes the echo peak list.

### Freezing the Echo Peak List via TRACE menu

Freezing of PEAK LIST can also be performed under the TRACE menu.

- ▶ Press TRACE key.
- ▶ Tap FREEZE PEAK LIST.  
The R&S ETC freezes the echo peak list and the trace.

### Returning to the Echo Profile Display

- ▶ Tap PEAK LIST EXIT.  
The R&S ETC displays the echo profile.

## 2.4.3.10 Working with the MER(k) Measurement

In the MER(k) measurement, the R&S ETC shows the modulation error ratios of the modulated OFDM carriers (k). In the measurement screen, the modulated OFDM carriers are evenly distributed among the 631 pixel columns. The display of the OFDM carriers always corresponds to the frequency. The selected 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. This reading can thus be used to adjust the modulator's residual carrier.

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.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the MER(k) menu item (MER(k) SPECTRUM highlighted in red).

The R&S ETC displays the measurement window for the MER(k) measurement.

Mode

Measurement

Profile

DVB-T2 receiver setting parameters	
Meas parameters	
Marker values	
MER(k) measurement screen	
MER(k) setting parameters	
MER(k) menu	

---

### Requirement for the MER(k) measurement



The minimum requirement for displaying the MER(k) measurement parameter is a synchronized demodulator. If the demodulator is not synchronized because, for example, the setting of the receive frequency or the OFDM bandwidth (channel bandwidth) does not match the receive signal, the measurement cannot be performed and the R&S ETC displays no measured values.

If FEC LOCKED REQUIRED is selected with the demodulator settings, then for a successful measurement a synchronized FEC decoder is additionally required. For demodulator settings, see chapter "[Setting the Demodulator Synchronization Condition](#)".

---

### Setting the MER Measurement Range

An MER measurement range of 50 dB, 20 dB or 10 dB can be selected. The display range can be shifted by setting the MER reference. The MER reference corresponds to the uppermost grid line. The Scale Adjust function automatically sets the reference and measurement range as a function of the MER value of the receive signal. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap MER RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the MER reference and MER measurement range such that the MER values of all carriers are displayed. It sets the smallest possible measurement range.

### Setting the Detector

The MER measurement screen shows the modulation errors of all modulated OFDM carriers. 631 pixel columns are available for the display. For this reason, several OFDM carriers are grouped in a pixel column.

The selected detector determines the display of the MER value. In the RMS setting, the root-mean-square value of the MER values per pixel column are determined and displayed. In the MIN und 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.

An important parameter of DVB-T2 transmitters is the residual carrier. The residual carrier is determined on the basis of the center carrier. Since this carrier is not modulated, no MER value can be determined for this carrier. However, the residual carrier essentially determines the MER values of the adjacent carriers. If the Min Peak detector is used, the MER value at the carrier frequency (middle pixel column) corresponds to that of the residual carrier.

To set the Min Peak detector, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select MIN PEAK.

The R&S ETC displays the minimum (worst) MER values of the OFDM carriers of each pixel column.

### Trace Modes

Traces can be displayed in different ways (modes):

- CLEAR/WRITE

The R&S ETC deletes the previous trace. This is its default setting.

- MIN HOLD

The trace displays the maximum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the maximum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals in the spectrum or the minimum value in the case of fluctuating signals can be located well with MIN HOLD.

- MAX HOLD

The trace displays the minimum value from the currently measured trace and from all previous traces. The R&S ETC does not interrupt the formation of the minimum value until a different setting is selected and the pixels of a trace therefore no longer match each other. Intermittent signals can be suppressed with MAX HOLD.

- VIEW

The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured MER(k) traces with the marker at a later time.

### Setting the Trace

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the MER trace.

### Using Markers

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the trace and display the marker position and the MER value in a logarithmic scale at the corresponding point of the trace. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the MER value are

displayed above the measurement screen. The unit of the marker position is determined by the marker type setting.

### Setting the Marker Type

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

To set the marker position to absolute frequency specification, proceed as follows:

1. Press the MARKER key.
2. Tap MARKER TYPE.
3. Select ABSOLUTE FREQUENCY.

The R&S ETC specifies the marker position of the active marker as an absolute frequency.

### Automatic Positioning of the Marker

The R&S ETC provides marker functions that make it easier to set the marker:

- PEAK  
This function sets the marker to the minimum value of the trace. It always applies to the active marker, whose marker label is highlighted in red.
- NEXT PEAK  
This function sets the active marker, starting from its momentary position, to the next highest value of the trace.

To position the marker to the minimum MER value, proceed as follows:

1. Press the MKR-> key.
2. Tap SELECT MARKER repeatedly until the desired marker is active.
3. Tap SET TO PEAK.

The R&S ETC positions the active marker to the OFDM carrier with the worst MER value.

### 2.4.3.11 Working with the Amplitude/Phase/Group Delay Measurement

In the Amplitude/Phase/Group Delay measurement, the R&S ETC determines the magnitude, phase and group delay of the channel transfer function in respect to the corresponding frequency.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

- Select the Amplitude/Phase/GpDelay menu item (Amplitude/Phase/GpDelay highlighted in red).

DVB-T2		Meas List		<No Profile>		12/08/13 11:40	
RF				610 MHz			
Band				---			
Channel Table				---			
Gain Control / RF Attenuation				Auto Low Noise / 0 dB			
Channel Bw				8 MHz			
Measurement Parameter				Result			
Measurement Mode				-49.90 dBm			
Measurement List				12.48 dB			
Constellation Diagram				locked			
Echo Pattern				normal			
MER (k)				32Kext		1/128 PP7	
Amplitude/Phase/GpDelay				56.5 Hz			
				0.1 ppm			
Spectrum				rms: 36.9 dB		peak: 22.8 dB	
Spectrum Emission Mask				locked (PLP ID: 1)			
TV Standard				rms: 36.9 dB		peak: 11.6 dB	
DVB-T/H				rms: 0.88 %		peak: 16.09 %	
DVB-T2				2.3			
ISDB-T				---		0.0E-08	
Meas Mode		Meas Profile		RF Att / Gain Ctrl		Demod Settings	
						BER Reset	
						Signalling Info	

The R&S ETC displays the measurement window for the Amplitude/Phase/GpDelay measurement.

Mode    Measurement    Profile

↓           ↓           ↓

DVB-T2		Phase		<No Profile>		03/07/13 16:12	
RF				610 MHz			
Band				---			
Channel Table				---			
Gain Control / RF Attenuation				Auto Low Noise / 15 dB			
Channel Bw				8 MHz			
Power	-18.27 dBm	Demod	locked	PLP(ID: 0)	locked	MER (PLP, rms)	42.8 dB
Amplitude(pk-pk)	15.4 dB	Phase(pk-pk)	96.7 °				
M1	Carrier 13920	3.1 dB	0.7 °	M2	Carrier 9067	-3.6 dB	46.7 °
Center: Carrier 13920   Span: 27841 Carriers   Detector: RMS/APeak   Trace: CW/CW							
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	Format/Range	Signalling Info		

Receiver setting parameters

---

Meas parameters

---

Measurement Result Marker values

---

Amplitude/Phase/GpDelay measurement screen

---

APGD setting parameters

---

APGD menu

### Setting the Amplitude/Phase/GpDelay Measurement Format and Range

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the “Forma/Range’ softkey.

For switching of measurement view, proceed as follows:

- Press the MEAS key.

2. Tap FORMAT / RANGE.
3. Select AMPLITUDE+PHASE or AMPLITUDE+GROUP DELAY.

A measurement range of 100 dB, 50dB, 20 dB or 10 dB can be selected for amplitude. A measurement range of 360°, 180°, 90°, 45°, 20° and 10° can be selected for phase. A measurement range of 50nsec, 100nsec, 200nsec, 500nsec, 1usec, 2usec, 5usec, 10usec, 20usec, 50usec and 100usec can be selected for group delay.

For adjusting of the measurement range, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select the corresponding trace AMPLITUDE..., PHASE... or GROUP DELAY... for adjustment of the individual trace range.

The Scale Adjust function automatically sets the measurement range of the measurement for the two traces that appear on the screen. The measurement accuracy does not depend on the measurement range setting.

For the automatic measurement range setting, proceed as follows:

1. Press the MEAS key.
2. Tap FORMAT / RANGE.
3. Select SCALE ADJUST.

The R&S ETC sets the measurement range such that the minimum and maximum values are visible on the screen.

### Setting the Detector

The Amplitude/Phase or Amplitude/GrpDelay measurement view can be activated via the "Forma/Range" softkey.

For selection of trace detector type, proceed as follows:

1. Press the TRACE key.
2. Tap DETECTOR.
3. Select RMS or Auto Peak for the corresponding trace for amplitude, phase or group delay.

The R&S ETC sets the desired detector type for the selected trace.

### Trace Modes

Trace can be displayed in different ways (modes):

- VIEW  
The R&S ETC freezes the currently displayed trace. The measurement is interrupted. This makes it possible, for example, to evaluate measured amplitude/phase/group delay traces with the marker at a later time.
- CLEAR/WRITE

The R&S ETC deletes the previous trace. This is its default setting.

- **AVERAGE : XX**

The trace displays the result over the average number set by user where XX indicates the average count that user has entered. On the left top corner, user will be able to see the current average number of the measurement is performing.

- **BLANK**

The selected trace will be hidden but the measurement is still on-going in the background. This is to allow user to see one trace and have a better view.

### **Setting the Trace**

1. Press the TRACE key.
2. Tap TRACE MODE.
3. Select the required trace function.

The R&S ETC sets the desired mode for displaying the selected trace.

### **Using Markers**

The R&S ETC provides up to six markers for evaluating the trace.

The markers are always bound to the two traces that are selected and displayed on the screen. The marker position is indicated by a vertical line extending from the top to the bottom of the measurement diagram. The numeric values for the position and the corresponding value are displayed above the measurement screen. The unit of the marker position is determined by the marker type setting and the current format display of Amplitude/Phase or Amplitude/Group Delay.

### **Setting the Marker Type**

The R&S ETC specifies the marker position as a carrier number, as a relative frequency deviation from the carrier frequency or as an absolute frequency, which is especially helpful for analyzing disturbance frequencies.

The marker type can be individually set for each of the six markers.

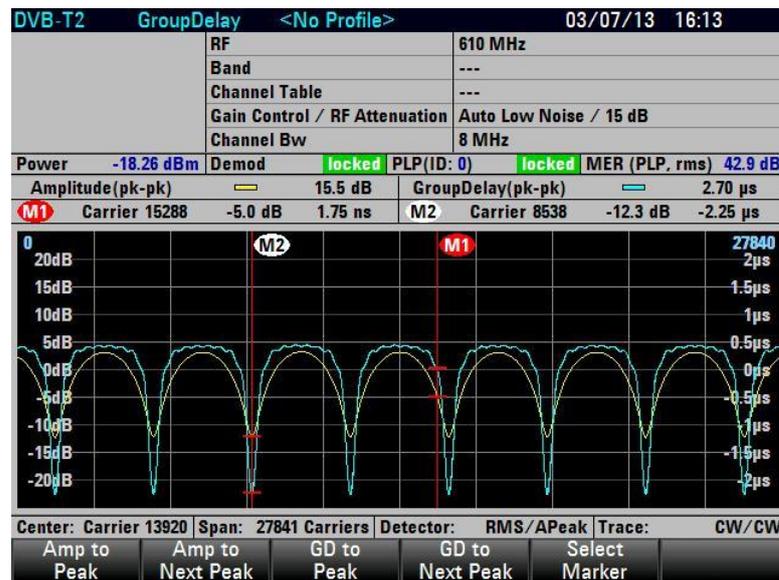
To set the marker position to absolute frequency specification, proceed as follows:

4. Press the MARKER key.
5. Tap MARKER TYPE.
6. Select the desired marker type for the trace.

The R&S ETC set the marker position of the active marker to the desired marker type.

### Automatic Positioning of the Marker

The R&S ETC provides marker functions that make it easier to set the marker. The AMP TO PEAK is always available for selection. PHASE TO PEAK / PHASE TO NEXT PEAK or GD TO PEAK / GD TO NEXT PEAK depends on the current format type of Amplitude/Phase or Amplitude/Group Delay that is selected for display. When moving the selected marker to the next peak of the desired trace, the marker will also indicate the corresponding value for the other trace which in this case might not be the peak value.



- AMP TO PEAK**  
 This function sets the marker to the maximum value of the amplitude trace. It always applies to the active marker, whose marker label is highlighted in red.
- AMP TO NEXT PEAK**  
 This function sets the active marker, starting from its momentary position, to the next highest value of the amplitude trace.
- PHASE TO PEAK**  
 This function sets the marker to the maximum phase value of the phase trace. It always applies to the active marker, whose marker label is highlighted in red.
- PHASE TO NEXT PEAK**  
 This function sets the active marker, starting from its momentary position, to the next highest value of the phase trace.
- GD TO PEAK**  
 This function sets the marker to the maximum value of the group delay trace. It always applies to the active marker, whose marker label is highlighted in red.

- GD TO NEXT PEAK

This function sets the active marker, starting from its momentary position, to the next highest value of the group delay trace.

To position the marker to the peak value of the group delay trace, proceed as follows:

1. Press the MKR-> key.
2. Tap SELECT MARKER repeatedly until the desired marker is active.
3. Tap GD TO PEAK.

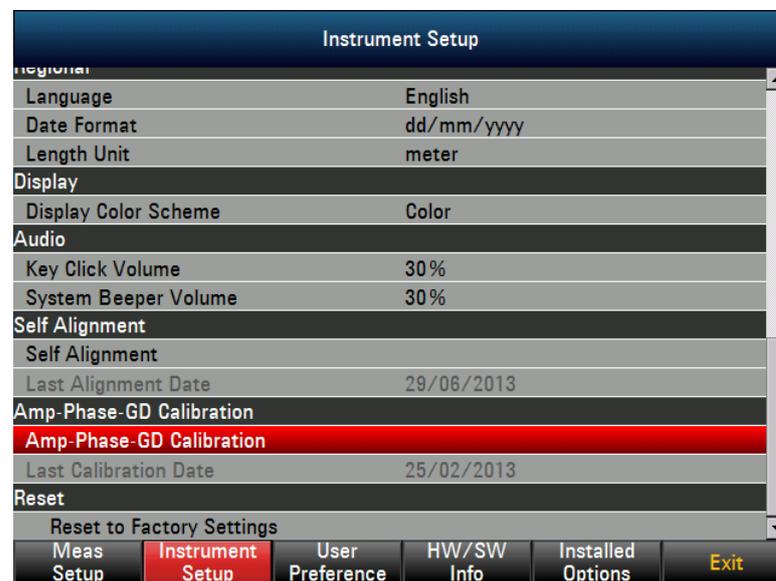
The R&S ETC positions the active marker to the OFDM carrier with the peak value for group delay trace.

### Performing alignment for Amplitude / Phase / Group Delay

The R&S ETC need to perform a calibration in order for accurate measurement. The R&S ETC comes with a factory default alignment data. It is highly recommended to perform the calibration once before starting the measurement.

To perform the alignment, proceed as follows :

1. Press SETUP key.
2. Tap INSTRUMENT SETUP tab.
3. Scroll down to AMP-PHASE-GD CALIBRATION and press ENTER. Follow the instruction on screen to complete the calibration.



#### 2.4.3.12 Working with the Measurement Value Monitoring

You can preset limits for the measurement parameters. If the limit check function is activated and the limit is exceeded, the measurement parameter result is displayed in red. Additionally, you can activate an acoustic warning signal. Set the volume of the

acoustic warning signal in the SETUP : Instrument Setup menu under Audio : System Beeper Volume.

The R&S ETC can store more than 100 different limit tables. You can activate them using the front panel. The maximum number of limit tables may become smaller if transducer factors, cable models, limit lines or data sets are also stored (see also the chapter "Saving and Loading Instrument Settings").

Use the supplied R&S ETC View software to create limit tables and to load them in the R&S ETC. Refer to the R&S ETC View software manual.

### Selecting the Limit Table

1. Press the LINES key.
2. Tap LIMIT TABLE.

The R&S ETC opens the list of limit tables that have been loaded using R&S ETC View software.

Measurement Parameter		Result	
Power		-19.46 dBm	
Crest Factor		12.34 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter	16Kext	1/8	PP3
Carrier Frequency Offset		78.1 Hz	
Symbol Rate Offset		0.2 ppm	
Modulation Error Ratio (L1)	rms: 43.9 dB	peak: 33.4 dB	
FEC Decoder		locked (PLP ID: 1)	
Modulation Error Ratio (PLP)	rms: 44.2 dB	peak: 25.0 dB	
Error Vector Magnitude (PLP)	rms: 0.38 %	peak: 3.47 %	
LDPC Iterations		1.0	
BER before LDPC / BCH	LDPC: 0.0E-10	BCH: 0.0E-10	
BBFRAME / TS Packet Error Ratio	BBFRAME: 0.0E-05	TSPER: 0.0E-07	
	Limit Check	Limit Info	Limit Options
			Limit Table

3. Select the required limit table.
4. Tap SELECT to activate it.



- To sort the table entries by name/date/size, press the SORT/SHOW. You can also use this menu to hide entries that are incompatible with the current instrument setup.

### Activating the Measurement Value Monitoring

- Press the LINES key.
- Tap LIMIT CHECK.

The limit check function is activated. The color of the LIMIT CHECK menu changes to green. "Limits" is displayed in the status field of the measurement window.

Measurement Parameter		Result	
Limits		locked (PLP ID: 1)	
Power		-19.47 dBm	
Crest Factor		12.62 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter	16Kext	1/8	PP3
Carrier Frequency Offset		78.0 Hz	
Symbol Rate Offset		0.2 ppm	
Modulation Error Ratio (L1)	rms: 44.1 dB	peak: 31.6 dB	
FEC Decoder		locked (PLP ID: 1)	
Modulation Error Ratio (PLP)	rms: 44.3 dB	peak: 24.9 dB	
Error Vector Magnitude (PLP)	rms: 0.38 %	peak: 3.51 %	
LDPC Iterations		1.0	
BER before LDPC / BCH	LDPC: 0.0E-10	BCH: 0.0E-10	
BBFRAME / TS Packet Error Ratio	BBFRAME: 0.0E-05	TSPER: 0.0E-07	
	Limit Check	Limit Info	Limit Options
			Limit Table

- Tap LIMIT CHECK again to deactivate the limit check function.

### Viewing the Limit Settings and the Table Information

1. Press the LINES key.
2. Tap LIMIT INFO.

The file name and the edited description of the currently selected limit table are displayed.

DVB-T2		Meas List	DVBT2_1_7M	02/05/12	19:58
Limits	RF	498 MHz			
	Channel / Band	24 / UHF 4/5			
	Channel Table	TV Europe			
	Gain Control / RF Attenuation	Auto Low Noise / 10 dB			
	Channel Bw	8 MHz			
Measurement Parameter		Result			
Power		<b>-19.48 dBm</b>			
Crest Factor		12.99 dB			
Demodulator		locked			
Sideband Position		normal			
Frame Parameter		16Kext	1/8	PP3	
Carrier Frequency Offset		77.9 Hz			
Symbol Rate Offset		0.2 ppm			
Limit Table Info					
Name: My Limit Table					
Description: example					
Status: Valid					
OK					

3. Tap OK to deactivate the table information.

### Activating the Acoustic Measurement Value Monitoring

1. Press the LINES key.
2. Tap LIMIT OPTIONS.
3. Select AUDIO BEEP.

If a measurement value limit is violated and the limit check is active, an acoustic warning signal is additionally output.

DVB-T2 Meas List • DVBT2_1_7M		02/05/12 19:51	
Limits		RF	498 MHz
		Channel / Band	24 / UHF 4/5
		Channel Table	TV Europe
		Gain Control / RF Attenuation	Auto Low Noise / 10 dB
		Channel Bw	8 MHz
Measurement Parameter		Result	
Power		-19.48 dBm	
Crest Factor		12.31 dB	
Demodulator		locked	
Sideband Position		normal	
Frame Parameter		16Kext	1/8 PP3
Carrier Frequency Offset		78.0 Hz	
Symbol Rate Offset		0.2 ppm	
Modulation Error Ratio (L1)		rms: 43.8 dB	peak: 32.4 dB
FEC Decoder		locked (PLP ID: 1)	
Modulation Error Ratio (PLP)		rms: 44.3 dB	peak: 25.0 dB
Error Vector Magnitude (PLP)		rms: 0.37 %	peak: 3.47 %
LDPC Iterations		1.0	
BER before LDPC / BCH		LDPC: 0.0E-10	BCH: 0.0E-10
BBFRAME / TS Packet Error Ratio		BBFRAME: 0.0E-05	[ ] Audio BEEP 0E-07
Limit Check		Limit Info	Limit Options
			Limit Table

If the audio beep is activated, [X] is displayed to the left of AUDIO BEEP.

**Note:** Set the volume of the warning signal under SETUP : INSTRUMENT SETUP : AUDIO : SYSTEM BEEPER VOLUME.

- To close the menu without changing the warning signal setting, press the CANCEL key.

#### Deactivating the Acoustic Warning Signal

- Tap LIMIT OPTIONS.
- Press the ENTER key or tap LIMIT OPTIONS to deselect AUDIO BEEP.

#### 2.4.3.13 Measuring the Shoulder Attenuation

When performing a DVB-T2 SPECTRUM measurement, the R&S ETC 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 ETC 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 ETC provides the channel power in the DVB-T2 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-T2 signal is **not** available in the DVB-T2 SPECTRUM measurement.

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

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.

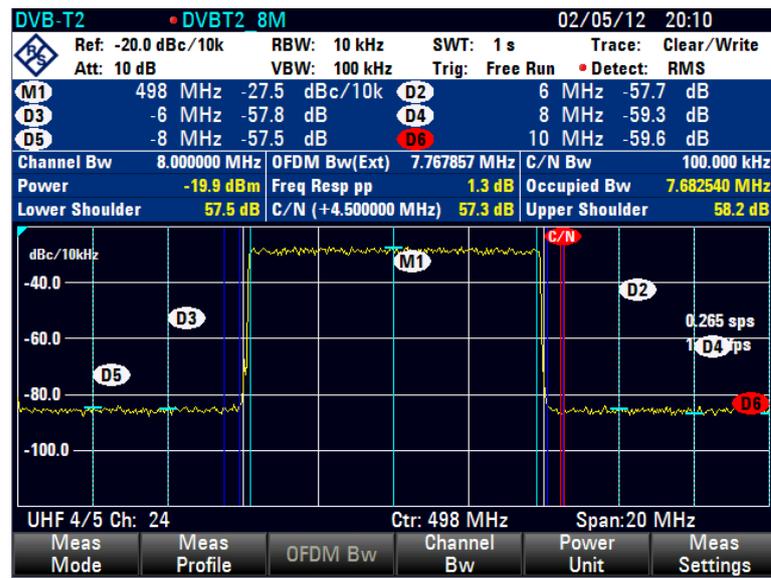
1. Tap MEAS MODE.
2. Select DVB-T2 SPECTRUM.

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 ETC presents the measurement results above the measurement screen.



3. In addition, you can set up to 6 markers.



#### 2.4.3.14 Measuring the In-Channel Frequency Response

When performing a DVB-T2 SPECTRUM measurement, the R&S ETC measures the shoulder attenuations, the channel power and the peak-to-peak in-channel amplitude frequency response.

In addition, the DVB-T2 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. Tap MANUAL SWT TIME.
3. Set the sweep time.



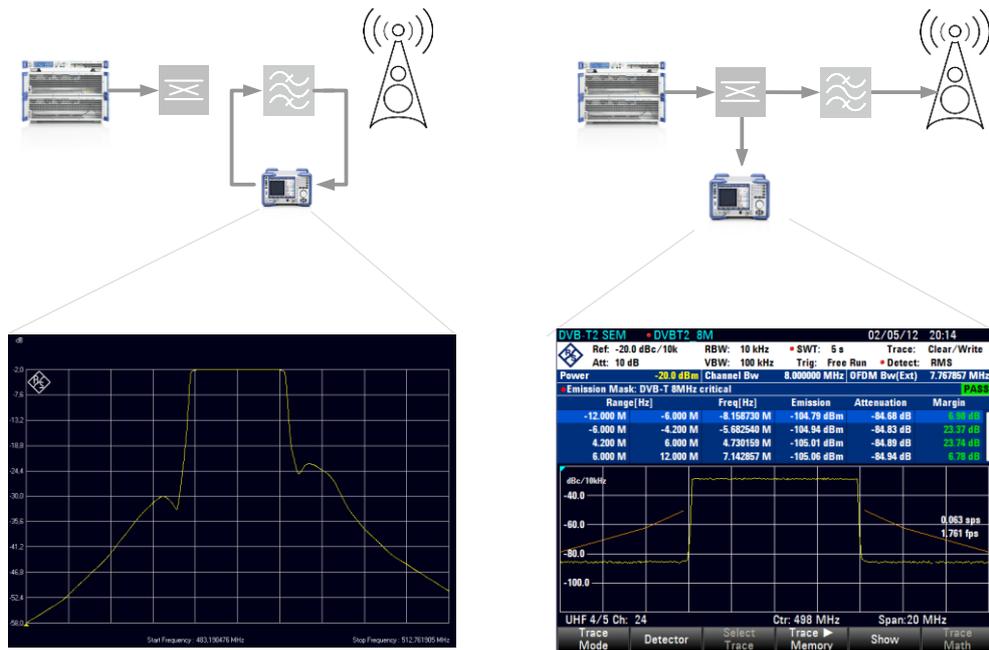
The R&S ETC provides the channel power in the DVB-T2 Spectrum measurement. For the channel power measurement, the RMS trace detector is used to get correct measurement results, independent from the trace detector setting.

The TS ASI transport stream of the incoming DVB-T2 signal is **not** available in the DVB-T2 SPECTRUM measurement.

### 2.4.3.15 Applying Output Filter Characteristic for Determining 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 ETC 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 ETC with tracking generator (model .04 or .08). For detailed information refer to chapter "Measuring with Transducer Factors".



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 ETC.

### Enabling a Transducer Data Set

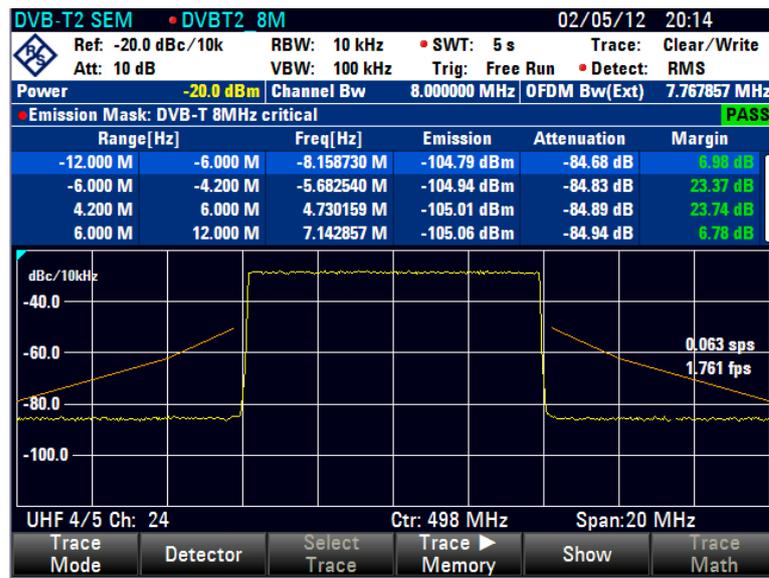
1. Press the AMPT key.
2. Tap TRANSDUCER.
3. Select SELECT SECONDARY TRANSDUCER.

The R&S ETC opens the browser.

4. Select the "MeasTransducer" dataset of the transmitter output filter.

### Setting a Proper Amplitude Scaling

1. Press the AMPT key.
2. Tap RANGE/REF POS.
3. Select SCALE ADJUST.



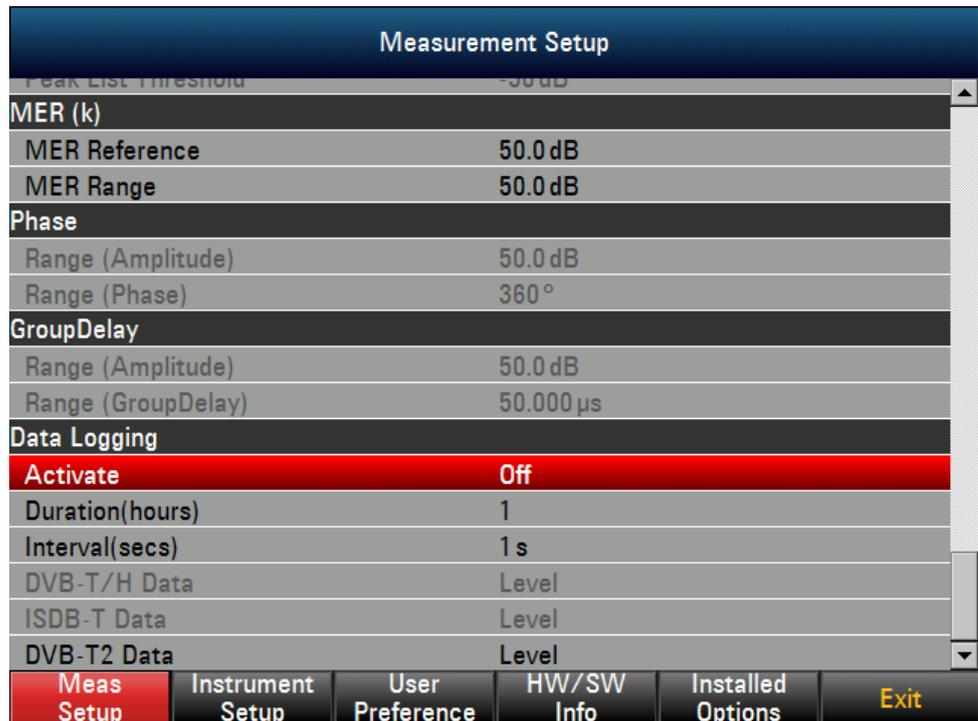
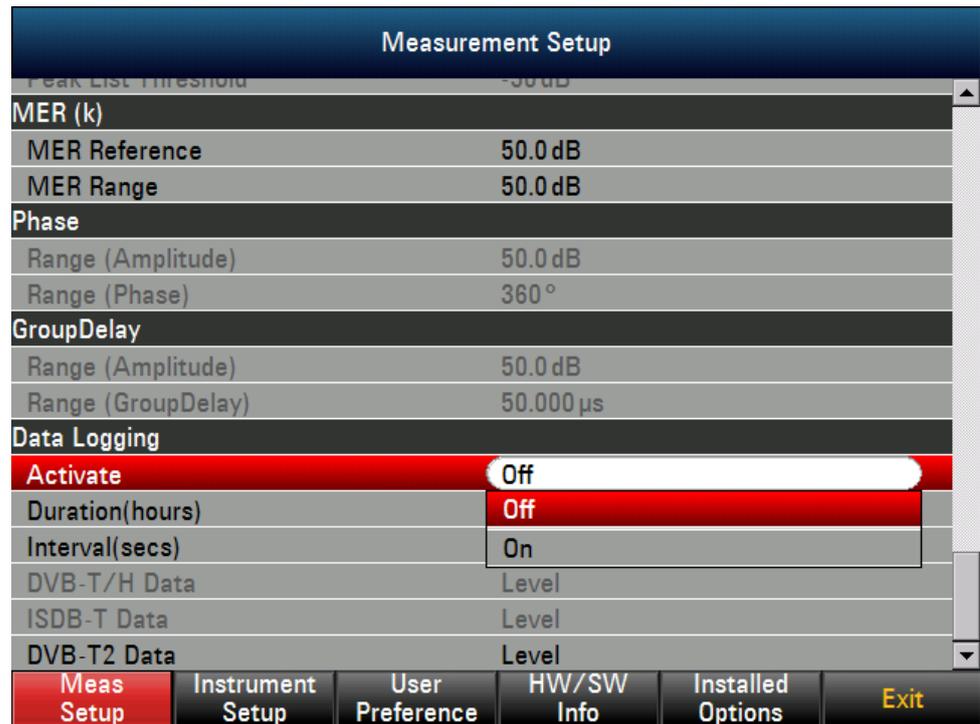
### 2.4.3.16 Working with Data Logging

Data logging on the device can be activated via the setup screen. The data that is logged (csv format) for DVB-T2 are :

Level, MER PLP(rms), BER before LDPC, BER before BCH, ESR5 and GPS

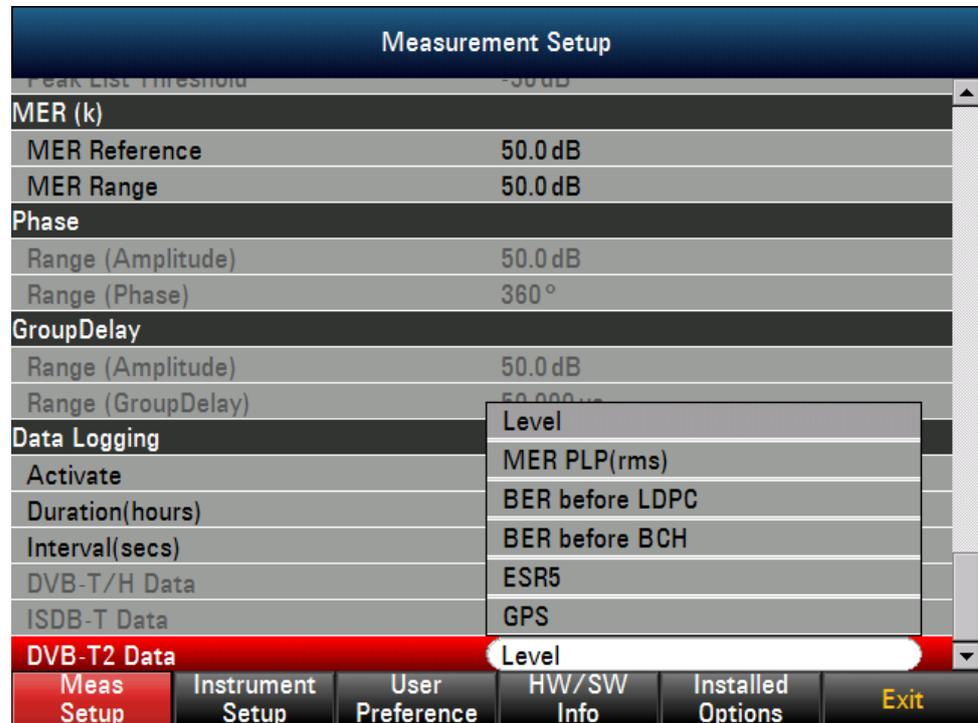
To start the data logging, select "On" under the Data logging Activate menu item in the Measurement Setup Screen (via Setup->Meas Setup). The duration and time interval to log data can be set in this screen too. The data logging will be saved to USB, internal SD card or the internal memory with the highest priority of USB storage. The csv file will be in the format of "DeviceSerialNumber\_Date\_Time".csv.

In the event that the file is saved in the SD card or internal memory, ETC view can be used to extract or copy out the saved file.



During logging, different measurement screen can be selected except the Spectrum and Spectrum Emission Mask. Switching over to this measurement will cause the logging to be stopped. In order to switch to other instrument mode like Spectrum or Network Analyzer, data logging has to be stopped first if it is started.

When the data logging has completed, the top right corner will show the complete icon.



Data Logging icon	Explanation
	This icon indicates that data logging has completed.
	This icon indicates that data logging encountered some errors.
	This icon indicates that data logging is in progress.
	This icon indicates that data logging is stopped by user.

## 2.4.4 MPEG Decoder Measurement

The R&S ETC offers MPEG decoder measurement mode(R&S ETC-B280 option required with at least one digital TV option ETC-K140, ETC-K160 or ETC-K240.).

### 2.4.4.1 Working with MPEG Decoder Measurement

In the MPEG decoder measurement, the R&S ETC decodes the auto/manual selected program and displays the corresponding decoded video / audio information.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the MPEG Decoder menu item (highlighted in red).

DVB-T/H		Meas List		<No Profile>		04/06/14		03:51		LOG	
		RF		610 MHz							
		Band		---							
		Channel Table		---							
		Gain Control / RF Attenuation		Auto Low Noise / 0 dB							
		OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz							
Measurement Parameter				Result							
Measurement Mode											
Measurement List								-67.60 dBm			
Constellation Diagram								12.02 dB			
Echo Pattern								locked			
MER (k)								normal			
Amplitude/Phase/GpDelay				ling				8K 1/8 QAM64 NH			
MPEG Decoder								-243.4 Hz			
Spectrum								-0.4 ppm			
Spectrum Emission Mask								rms 19.3 dB peak 3.7 dB			
TV Standard								rms 7.06 % peak 52.23 %			
DVB-T/H				mon				locked			
DVB-T2								2.0E-02 5.2E-05			
ISDB-T								0.0E-07			
								0 /s			
								22.117638 Mbit/s			
Meas Mode		Meas Profile		RF Att / Gain Ctrl		Demod Settings		BER Reset		TPS Info	

DVB-T/H	MPEG Dec	<No Profile>	16/12/14	16:24	LOG
RF		610 MHz			
Band		---			
Channel Table		---			
Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Power	-41.10 dBm	Demod	locked	FEC	locked
MERrms		32.3 dB		BERrs	
0.0E-09					
Network Info		MediaCorp DTV (NID:0x3211)			
Services Number: 4		Decoded Service			
Service: 8 (SD)*		Service ID	0x2	Service Name	8 (SD)
VPID: 0x22*		VPID	0x22	APID	0x62
APID: 0x62*		Video Format	MPEG2	Audio Format	MPEG1
APID: 0x64		Video Size	720 x 576	Audio Language	chi
Service: 5 (SD)		Video Frame	25.000 fps	Audio Sampling	48000 Hz
VPID: 0x85		Video datarate	2758800	Audio datarate	144000
APID: 0xc4					
APID: 0xc5					
Service: CNA (SD)					
VPID: 0x23					
APID: 0xc7					
APID: 0xc9					
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	MPEG Settings	Live Video

The R&S ETC displays the MPEG parameters for the Transport stream.

#### 2.4.4.2 Selecting a Program for Decoding

The program to be decoded is selected by choosing a program or a video. Selection of service or video PID will trigger a change in the decoded program. Selection/Changing of audio is possible only when the audio PID is under the same service selected for decoding.

You can select a program/video/audio by using up/down key or the rotary followed by pressing "Enter" key to confirm the selection. The decoded video and audio are indicated with (\*) sign in the list.

DVB-T/H	MPEG Dec	<No Profile>	16/12/14	16:24	LOG
RF	610 MHz				
Band	---				
Channel Table	---				
Gain Control / RF Attenuation	Auto Low Noise / 0 dB				
OFDM Bw / Channel Bw	7.6071429 MHz / 8 MHz				
Power	-41.10 dBm	Demod	locked	FEC	locked
		MERrms	32.3 dB	BERrs	0.0E-09
<b>Network Info</b>		<b>MediaCorp DTV (NID:0x3211)</b>			
Services Number: 4		Decoded Service			
Service: 8 (SD)*	▲	Service ID	0x2	Service Name	8 (SD)
VPID: 0x22*		VPID	0x22	APID	0x62
APID: 0x62*		Video Format	MPEG2	Audio Format	MPEG1
APID: 0x64		Video Size	720 x 576	Audio Language	chi
Service: 5 (SD)		Video Frame	25.000 fps	Audio Sampling	48000 Hz
VPID: 0x85		Video datarate	2758800	Audio datarate	144000
APID: 0xc4					
APID: 0xc5					
Service: CNA (SD)					
VPID: 0x23					
APID: 0xc7					
APID: 0xc9	▼				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	MPEG Settings	Live Video

Default automatic setting:

As soon as a new transport stream is applied at a signal input, the decoder will automatically always be set to the first program with at least one video ES that is displayed in the TS list. If the TS does not contain a program with video ES, the first program with audio ES will be set.

Rules apply for default automatic setting:

After the same TS has been disconnected and reconnected.

After the instrument is switched on.

After a loss of RF signal.

Manual setting:

The decoded video or audio elementary stream always comes from the same program. If you select a video or audio elementary stream from another program in the list, both video and audio decoding will be switched to the corresponding program.

Rules apply for manual setting:

- Decode Service:

First video ES and first audio ES of program will be set

- Decode Video PID:

The selected video ES will be set. The first audio ES in the program of the video ES will be set.

- Decode Audio PID:

The selected audio ES will be set. If the selected audio PID is not under the current selected decoding service, the audio will not be changed.

### 2.4.4.3 Decoded Service/Program View

The decoded service/program view displays information about the current decoded program including information about the decoded video and audio elementary streams.

The decoded service/program view contains the following elements:

**Network** information field

Name of the network provider and NID

**Service ID** field

Decoded service ID

**Service Name** field

Name of the decoded service provider

**VPID**

PID of the selected video

**Video Format**

Video decoder format of selected video

**Video Size**

Video size (frame width and height in pixels) of selected video

**Video Frame**

Frame rate and aspect ratio of selected video

**Video Data Rate**

Data rate of selected video

**APID**

PID of selected audio

**Audio Format**

Audio decoder format of selected audio

**Audio Language**

Language of selected audio

**Audio Sampling**

Maximum sampling rate of selected audio

**Audio Data rate**

Data rate of selected audio

**Video frame pane**

Display the decoded video frame. The resolution is scaled to the size of the display.

**2.4.4.4 PID display format**

To switch between Hexadecimal and decimal display of PID for Network, service, video and audio PID, proceed as follows:

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select the Mpeg Decoder menu item to go to MPEG decoder view.
4. Tap MPEG setting and select the format to be displayed.

DVB-T/H		MPEG Dec		<No Profile>		07/06/16 16:48	
RF		610 MHz		Band		---	
Channel Table		---		Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		Power		-46.89 dBm	
Demod		locked		FEC		locked	
MERrms		21.8 dB		BERrs		5.7E-04	
Network Info		MediaCorp DTV (NID:12817)					
Services Number: 4		Decoded Service					
Service: 5 (HD)		Service ID: 2		Service Name: 8 (SD)		APID: 98	
VPID: 33		VPID: 34		PID Format: MPEG1		chi	
APID: 97		Video Format: MPEG2		Audio: Decimal		44000	
Service: 8 (SD)*		Video Size: 720 x 576		Audio: Hex		000 Hz	
VPID: 34*		Video Frame: 25.000 fps		Audio: Audio		44000	
APID: 98*		Video datarate: 2836400		Volume...		Services	
APID: 100				Refresh		MPEG Hardware	
Service: CNA (SD)				HW Restart			
VPID: 35							
APID: 199							
APID: 201							
Service: 5 (SD)							
Meas Mode		Meas Profile		RF Att / Gain Ctrl		Demod Settings	
						MPEG Settings	
						Live Video	

**2.4.4.5 Live Video View**

To switch to live video view, proceed as follows:

1. Press the MEAS key.
2. Tap Live Video.

DVB-T/H		MPEG Dec		<No Profile>		16/12/14 17:49	
RF		Band		610 MHz		---	
Channel Table		Gain Control / RF Attenuation		Auto Low Noise / 0 dB		---	
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		Power		-40.52 dBm	
Demod		locked		FEC		locked	
MERrms		35.4 dB		BERrs		0.0E-10	
Network Info		MediaCorp DTV (NID:12817)					
Services Number: 4		Decoded Service					
Service: 8 (SD)		Service ID	3	Service Name	CNA (SD)		
VPID: 34		VPID	35	APID	199		
APID: 98		Video Format	MPEG2	Audio Format	MPEG1		
APID: 100		Video Size	720 x 576	Audio Language	eng		
Service: 5 (SD)		Video Frame	25.000 fps	Audio Sampling	48000 Hz		
VPID: 133		Video datarate	2870400	Audio datarate	144000		
APID: 196							
APID: 197							
Service: CNA (SD)*							
VPID: 35*							
APID: 199*							
APID: 201							
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	MPEG Settings	Live Video		

It displays a full screen live video of decoded program.

Press "Cancel"/"Back" key to return back to the Decoded Program/Service view.

#### 2.4.4.6 Audio Volume setting

The volume of the audio can be configured from 0% to 100%. In the event that no audio is heard, it could be that the audio codec is not supported or the speaker on the device is faulty.

### **CAUTION**

When using earphone, always make sure the the volume is not set too loud to prevent damage to the ear.

To set the audio volume, proceed as follows:

1. Press the MEAS key.
2. Tap MPEG Settings.
3. Scroll to the "Volume..." menu item and press enter.
4. Enter the desired volume (0% to 100%) and press enter.
5. Alternatively, turn the rotary knob for volume control.

DVB-T/H		MPEG Dec		<No Profile>		16/12/14 17:51	
RF		610 MHz		Band		---	
Channel Table		---		Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		Power		-40.79 dBm	
Demod		locked		FEC		locked	
MERrms		35.2 dB		BERrs		0.0E-10	
Network Info		MediaCorp DTV (NID:12817)					
Services Number: 4		Decoded Service					
Service: 8 (SD)		Service ID	3	Service Name	CNA (SD)		
VPID: 34		VPID	35	APID	199		
APID: 98		Video Format	MPEG2	Audio Format	MPEG1		
APID: 100		Video Size	720 x 576	Audio Language	eng		
Service: 5 (SD)		Video Frame	25.000 fps	Audio Sampling	48000 Hz		
VPID: 133		Video datarate	2930400	Audio datarate	144000		
APID: 196		<div style="text-align: right;"> <b>Volume:</b> <span style="border: 1px solid black; border-radius: 10px; padding: 2px 10px;">93 %</span> </div>					
APID: 197							
Service: CNA (SD)*							
VPID: 35*							
APID: 199*							
APID: 201							
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	MPEG Settings	Live Video		

- Once the volume is set, the device will play audio based on the volume entered.

#### 2.4.4.7 Service Refresh

To activate the manual service refresh for MPEG decoder to detect new TS services, proceed as follows:

- Press the MEAS key.
- Tap MPEG settings

DVB-T/H		MPEG Dec		<No Profile>		07/06/16 16:48	
RF		610 MHz		Band		---	
Channel Table		---		Gain Control / RF Attenuation		Auto Low Noise / 0 dB	
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz		Power		-46.57 dBm	
Demod		locked		FEC		locked	
MERrms		22.2 dB		BERrs		5.2E-04	
Network Info		MediaCorp DTV (NID:12817)					
Services Number: 4		Decoded Service					
Service: 5 (HD)		Service ID		2		Service Name	
VPID: 33		VPID		34		APID	
APID: 97		Video Format		MPEG2		APID Format	
Service: 8 (SD)*		Video Size		720 x 576		Decimal	
VPID: 34*		Video Frame		25.000 fps		Hex	
APID: 98*		Video datarate		2837200		Audio	
APID: 100						Volume...	
Service: CNA (SD)						Services	
VPID: 35						Refresh	
APID: 199						MPEG Hardware	
APID: 201						HW Restart	
Service: 5 (SD)							
Meas Mode		Meas Profile		RF Att / Gain Ctrl		Demod Settings	
						MPEG Settings	
						Live Video	

3. Scroll to Refresh and pressed enter to trigger a new SI data readout.

### 2.4.4.8 MPEG decoder hardware reset

In the event that the MPEG decoder is not working properly, user can restart the MPEG hardware. To restart the MPEG decoder hardware, proceed as follows:

1. Press the MEAS key.
2. Tap MPEG settings.
3. Scroll to "HW Restart" and pressed enter to trigger the hardware restart.

DVB-T/H	MPEG Dec	<No Profile>	07/06/16 16:48		
RF		610 MHz			
Band		---			
Channel Table		---			
Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Power	-46.76 dBm	Demod	locked	FEC	locked
		MERrms	21.9 dB	BERrs	6.1E-04
Network Info		MediaCorp DTV (NID:12817)			
Services Number: 4		Decoded Service			
Service: 5 (HD)	▲	Service ID	2	Service Name	8 (SD)
VPID: 33		VPID	34	APID	98
APID: 97		Video Format	MPEG2	Au	PID Format
Service: 8 (SD)*		Video Size	720 x 576	Au	Decimal
VPID: 34*		Video Frame	25.000 fps	Au	Hex
APID: 98*		Video datarate	2933600	Au	Audio
APID: 100		Volume...			
Service: CNA (SD)		Services			
VPID: 35		Refresh			
APID: 199		MPEG Hardware			
APID: 201		HW Restart			
Service: 5 (SD)	▼				
Meas Mode	Meas Profile	RF Att / Gain Ctrl	Demod Settings	MPEG Settings	Live Video

4. A warning message will appear. Press "Yes" to continue to restart the MPEG hardware or "No" to skip.

DVB-T/H	MPEG Dec	<No Profile>	07/06/16 16:52		
RF		610 MHz			
Band		---			
Channel Table		---			
Gain Control / RF Attenuation		Auto Low Noise / 0 dB			
OFDM Bw / Channel Bw		7.6071429 MHz / 8 MHz			
Power	-46.38 dBm	Demod	locked	FEC	locked
		MERrms	20.9 dB	BERrs	9.2E-04
Network Info		MediaCorp DTV (NID:12817)			
Services Number: 4		Decoded Service			
Service: 5 (HD)	▲	Service ID	2	Service Name	8 (SD)
VPID: 33		VPID	34	APID	98
APID: 97		Video Format	MPEG2	Au	PID Format
Service: 8 (SD)*		Video Size	720 x 576	Au	Decimal
VPID: 34*		Video Frame	25.000 fps	Au	Hex
<b>! Warning !</b>					
<b>Restart MPEG Hardware?</b>					
<b>It will take 30seconds or more to restart MPEG hardware.</b>					
<b>Press YES to continue, press NO to cancel</b>					
YES				NO	



You can use the supplied R&S ETC View software to create additional customer-specific measurement profiles, to load them in the R&S ETC and to delete the measurement profiles supplied with the R&S ETC. How to create measurement profiles is described in the R&S ETC View software manual.

1. Press the MEAS key.
2. Tap MEAS PROFILE.

The R&S ETC opens the browser and shows the measurement profile definition files which can be used in the selected TV standard.

Stat	Name	Size	Date	Time
<	Public \Standards\..			
📁	Public			
📁	Storage Card			
	DVB-TH 5MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 5MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 5MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 6MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 6MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 6MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 7MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 7MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 7MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 8MHz mobile.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 8MHz Transmitter.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH 8MHz weak signals.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH_5MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH_6MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH_7MHz.dvbstd	1 kB	14/11/2011	15:02
	DVB-TH_8MHz.dvbstd	1 kB	14/11/2011	15:02
	mm.dvbstd	1 kB	09/02/2011	17:29

Free: 9 MB

View Edit / New Select Sort / Show Delete Refresh Exit

3. Select the required measurement profile.

The R&S ETC sets the resolution bandwidth, the video bandwidth, the frequency span, the detector, the OFDM signal bandwidth, and the signal level unit according to the measurement profile.

## 2.5.2 Working with the TV Spectrum Measurement

The TV SPECTRUM measurement shows the frequency spectrum of the input signal. The R&S ETC uses the spectrum data to calculate the power, the shoulder attenuation, the carrier to noise ratio, the occupied bandwidth, and the amplitude frequency response of the received signal.

The R&S ETC measures the power with a resolution bandwidth that is smaller in comparison to the OFDM signal bandwidth. It integrates the measurement values on the trace to give the OFDM signal power. The small resolution bandwidth acts like a narrow channel filter and so prevents emissions outside the OFDM signal bandwidth from affecting the result.

The frequency response measurement value is the difference between the most positive and most negative value of the measurement points within the OFDM signal bandwidth. To suppress power peaks, the R&S ETC uses the power of the adjacent measurement points when calculating the power of the individual measurement points.

The shoulder attenuation is the ratio of the maximum power measurement value within the OFDM signal bandwidth to the power of spurious emissions above and below the OFDM signal. Power measurement of the spurious emissions takes place in the frequency ranges 300 kHz to 700 kHz below the first OFDM carrier (Lower Shoulder) and above the last OFDM carrier (Upper Shoulder). The R&S ETC performs the measurement in compliance to the recommendation given in ETSI TR 101290. According to this measurement recommendation, a resolution bandwidth of maximum 30 kHz must be selected. The OFDM signal bandwidth is indicated by light blue frequency lines in the measurement window. The frequency ranges, in which the power of the spurious emissions is determined, are indicated by dark blue frequency lines. In the black-and-white display, the OFDM signal frequency limits are represented by light gray lines and the frequency limits of the spurious emission measurement ranges are represented by dark gray lines.

The carrier to noise measurement value is the power ratio of the OFDM signal power to the noise power. The noise power frequency range is defined by the frequency offset to the set RF and the set noise bandwidth. The frequency range, in which the noise power is determined, is indicated by dark blue frequency lines.

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

You can activate up to six markers to record other measurement values. How to use markers is described in the chapter "Spectrum Analyzer Measurements".

For the DVB-T/H standard, the R&S ETC provides presets for the channel spacings of 5 MHz, 6 MHz, 7 MHz and 8 MHz in compliance to the recommendation to ETSI TR 101290.

For the ISDB-T standard, the channel bandwidth is fixed to 6 MHz.

For the DVB-T2 standard, the R&S ETC provides presets for the channel spacings of 1.7 MHz, 5 MHz, 6 MHz, 7 MHz and 8 MHz in compliance to the recommendation to ETSI TR 101290.



In the TV ANALYZER – SPECTRUM measurement, the serial transport stream TS-ASI is **not** provided at the BNC output TS OUT

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### Starting the Measurement

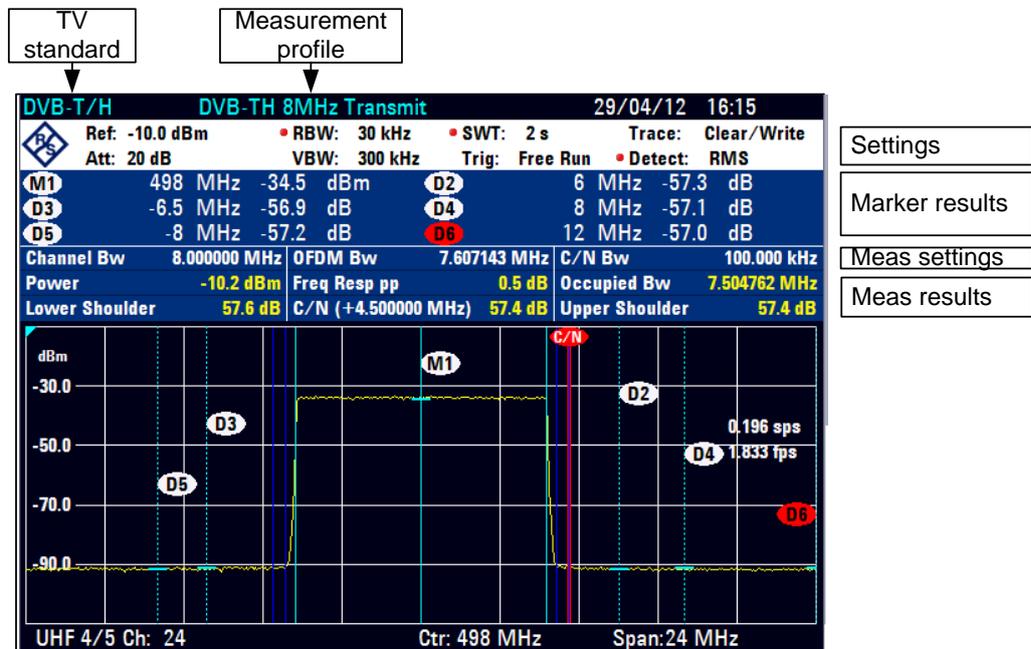
1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer.

3. Select SPECTRUM (SPECTRUM highlighted in red).

The R&S ETC displays the measurement window for the TV SPECTRUM measurement. The frequency spectrum of the input signal is displayed symmetrically to the set RF.

**TV Spectrum Measurement Parameters**



- **OFDM Bw**

Set OFDM signal bandwidth or, for the CHANNEL BW setting, the calculated OFDM signal bandwidth. In the measurement screen, the OFDM bandwidth is signed by light blue frequency lines.

For the ISDB-T standard, the OFDM bandwidth is fix set to 5.571 MHz.

For the DVB-T2 standard, the OFDM bandwidth is fixed to the bandwidth extension value.

- **Channel Bw**

Set channel bandwidth or, for the OFDM BW setting, the calculated channel bandwidth.

For the ISDB-T standard, the channel bandwidth is fix set to 6 MHz.

- **Power**

RMS power of the receive signal within the OFDM signal bandwidth. The RMS detector is used to determine the correct measurement value independent from the set trace detector.

- **Freq Resp pp**

Peak-to-peak value of the amplitude frequency response within the OFDM signal bandwidth. To suppress power peaks, the R&S ETC uses the powers of the

adjacent measurement points when calculating the power of the individual measurement points

- **Lower Shoulder**

Lower shoulder attenuation. This is the power ratio of the maximum power measurement value within the OFDM signal bandwidth to the spurious emissions in the frequency range 300 kHz to 700 kHz below the first OFDM carrier. The R&S ETC performs the measurement method in compliance to the ETSI TR 101290 recommendation. The R&S ETC uses the set detector to determine the measurement value.

- **Upper Shoulder**

Upper shoulder attenuation. This is the power ratio of the maximum power measurement value within the OFDM signal bandwidth to the spurious emissions in the frequency range 300 kHz to 700 kHz above the last OFDM carrier. These ranges are indicated by dark blue frequency lines. The R&S ETC performs the measurement method in compliance to the ETSI TR 101290 recommendation. The R&S ETC uses the set detector to determine the measurement value.

- **Occupied Bw**

Bandwidth that contains 99% of the entire power of the transmitter. The R&S ETC performs the RMS detector for determination of the power.

- **Carrier to Noise Ratio**

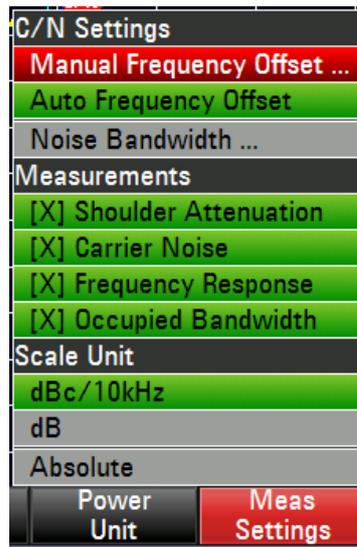
Ratio between channel power and noise power. The frequency range for measuring the noise power can be set. This range is indicated by red frequency lines. For carrier to noise determination, the noise power is referenced to the channel bandwidth. This means that the carrier to noise ratio result is independent from the set noise bandwidth in case of white noise.

### **Setting the Carrier to Noise Ratio Measurement**

For carrier to noise ratio calculation, the noise power is referenced to the OFDM bandwidth. Set the frequency range for measuring the noise power. The R&S ETC offers an automatic and manual setting of the frequency offset. In the automatic setting, the center frequency of the noise power measurement range is set to 500 kHz above the upper channel border. In the manual setting, you can set the frequency offset within the entire frequency span with a resolution of 1 Hz. In addition, set the noise channel bandwidth. In order to get carrier to noise measurement results, the noise channel must be within the frequency span.

1. Press the MEAS key.
2. Tap MEAS SETTINGS.

The R&S ETC opens the menu containing the C/N settings and measurement configuration.



3. Select NOISE BANDWIDTH.  
The R&S ETC opens the entry field for the noise bandwidth.
4. Set the noise bandwidth.
5. Tap MEAS SETTINGS.  
The R&S ETC opens the menu containing the C/N settings and measurement configuration.
6. Select MANUAL FREQUENCY OFFSET.  
The R&S ETC opens the entry field for the frequency offset.
7. Set the frequency offset.  
The R&S ETC displays red frequency lines to indicate the frequency range that is used for the noise power measurement.

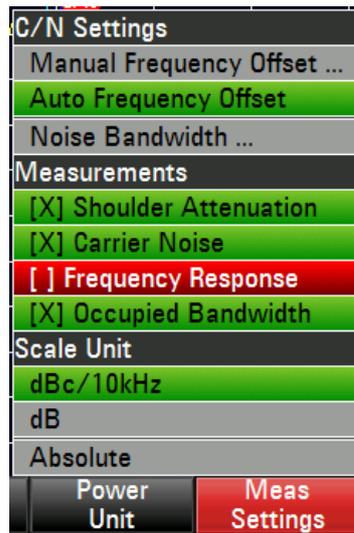
### Configuring the Measurement Screen

Apart from the signal power, the TV Spectrum measurement provides several measurement parameters:

- Shoulder attenuations according to ETSI TR 101290
- Carrier-to-noise power ratio
- Amplitude frequency response
- Occupied bandwidth

To improve the clarity of the measurement screen, the R&S ETC offers the possibility to switch off undesired measurement parameters.

1. Press the MEAS key.
2. Tap MEAS SETTINGS.  
The R&S ETC opens the menu containing the C/N settings and measurement configuration.



3. Select the corresponding measurement parameter item.

The R&S ETC removes or adds the measurement parameter from the measurement screen.

A cross in front of the measurement parameter indicates that the measurement parameter is deactivated.

### 2.5.3 Working with 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 ETC checks the signal against a spectral mask to detect whether the signal is in compliance to a specific standard or not.

Besides the pass/fail information, the spectrum emission mask list provides detailed measurement results regarding the emissions with respect to the frequency segment that is defined in the emission mask definition file.

The emission mask limits can be defined as absolute power limit or as relative power with respect to the transmission power or as a combination of absolute and relative power limit.

Both the R&S ETC and the R&S ETC View software supply the most common emission masks. Furthermore, the R&S ETC View software allows you to modify existing masks, generate new masks and copy them to the R&S ETC. To learn how to define TV spectrum emission masks, refer to the ETC View software manual.



In the TV ANALYZER – SPECTRUM EMISSION MASK measurement, the serial transport stream TS-ASI is **not** provided at the BNC output TS OUT

### Starting the Measurement

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC opens the menu containing the measurement functions of the TV Analyzer mode.

3. Select SPECTRUM EMISSION MASK.

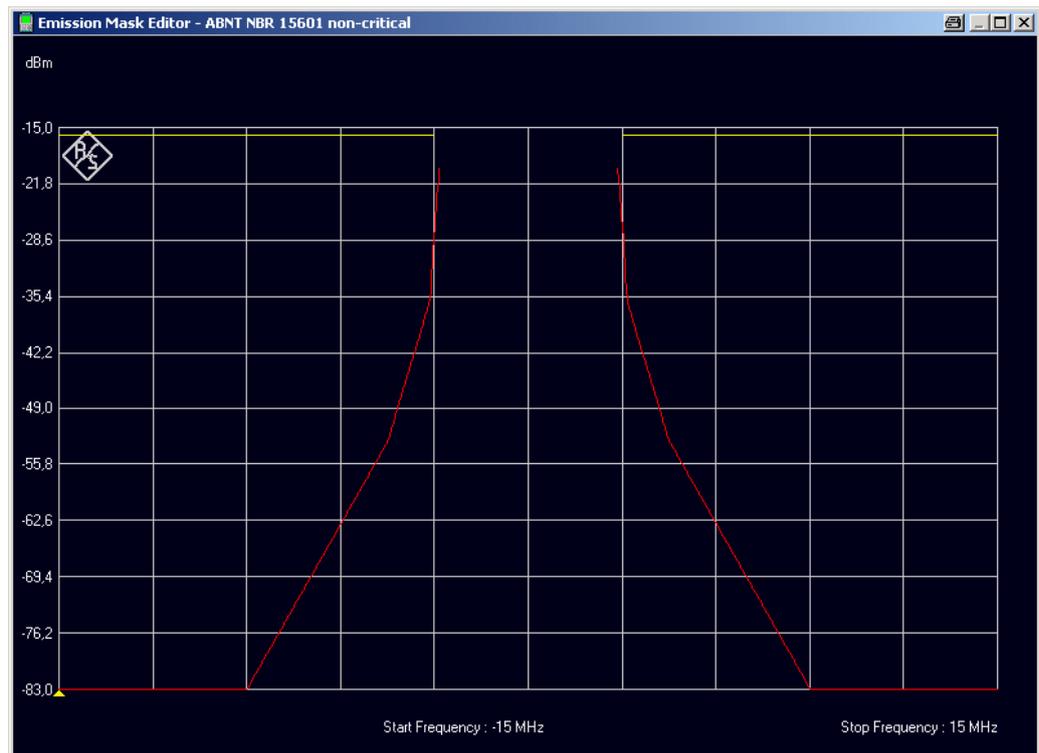
The R&S ETC displays the measurement window for the TV Spectrum Emission Mask measurement. The frequency spectrum of the input signal is displayed symmetrically to the set RF.

### Selecting a Spectrum Emission Mask

Several predefined standards are already installed on the R&S ETC to use for TV Spectrum Emission Mask measurements. However, you can define your own spectral masks with the R&S ETC View software to perform measurements in frequency ranges other than the predefined. To learn how to define spectrum emission masks, refer to the R&S ETC View software manual.

Spectrum Emission Mask		Range 1 - 5	Range 6 - 10	Range 11 - 15	Range 16 - 20
Range number		6	7	8	9
Range Start [Hz]		-2790000	2860000	3000000	3150000
Range Stop [Hz]		2790000	3000000	3150000	4500000
Limit check mode		Ref (Channel)	Rel	Abs and Rel	Abs and Rel
Limit Start Abs [dBm]		0,0	0,0	-16,0	-16,0
Limit Stop Abs [dBm]		0,0	0,0	-16,0	-16,0
Limit Start Rel [dB]		0,0	-20,0	-27,0	-36,0
Limit Stop Rel [dB]		0,0	-27,0	-36,0	-83,0

- Click "View" to show the entered emission mask as a graphic in order to check the entries.



Relative limits are displayed in red, absolute limits are displayed in yellow.

### Loading a Predefined Emission Mask

1. Press the MEAS key.
2. Tap MEAS SETTINGS.

The R&S ETC opens the menu containing the emission mask settings as well as the scale unit selection.

3. Under EMISSION MASK, select SELECT...

The R&S ETC opens the file browser and shows the spectrum emission mask definition files (TVSEM file extension) that you can use in the TV SEM measurement mode.

4. Select the required spectrum emission mask.

The R&S ETC displays the file name of the selected spectrum emission mask. In the measurement screen, the spectrum emission mask line is displayed in orange.

If the frequency span is set to AUTO, the R&S ETC sets the frequency span according to the frequency range that is defined in the spectrum emission mask definition file.

If a red dot is displayed in front of the TV SEM definition file name, the set frequency span is lower than the frequency range that is defined in the TV SEM definition file. For emission mask test result, only the set frequency span is taken into account.

### 2.5.3.1 Measurement Screen for the TV Spectrum Emission Mask Measurement



- |                                     |                                   |
|-------------------------------------|-----------------------------------|
| 1 = TV =standard                    | 8 = Emission mask list            |
| 2 = TV =measurement mode            | 9 = Emission mask list scroll bar |
| 3 = Measurement profile             | 10 = Emission mask limit line     |
| 4 = Spectrum analyzer settings      | 11 = Trace                        |
| 5 = Marker area                     | 12 = Absolute marker              |
| 6 = Transmission channel parameters | 13 = Delta marker                 |
| 7 = Emission mask result            |                                   |

#### Title Bar (1), (2), (3)

The title bar shows the TV standard, SEM for TV Spectrum Emission Mask measurement, the selected measurement profile, the date and time, and the battery status.

#### Spectrum Analyzer Parameter Settings (4)

Below the title bar, the reference power respectively reference level setting of the measurement screen, the RF input attenuator setting, the resolution and video bandwidth setting, the sweep time and trigger setting, the trace mode, and the trace detector setting are shown.

### Marker Area (5)

The spectrum analyzer settings are followed by the marker area. You can set up to 6 markers. The marker unit depends on the set scale unit that are set under MEAS : MEAS SETTINGS. The size of the marker area depends on the count of the selected markers and on the marker list view setting.

### Transmission Channel Parameters (6)

The transmission parameter line shows the following:

- Power  
Transmission power within the set OFDM bandwidth.
- OFDM Bw  
OFDM bandwidth (OFDM BW) is the real signal bandwidth of the transmission signal. If the channel bandwidth is set, the OFDM bandwidth is calculated, formulas see chapter 2.5.4 and 2.5.6.  
  
For the ISDB-T standard, the OFDM bandwidth is fix set to 5.571 MHz.  
  
For the DVB-T2 standard, the OFDM bandwidth is fix set to the corresponding bandwidth extension when applicable.
- Channel Bw  
Channel bandwidth (CHANNEL BW) corresponds to the transmission channel. Normally the transmission channel corresponds to the channel spacing. If the OFDM bandwidth is set, the channel bandwidth is calculated, formulas see chapter 2.5.4 and 2.5.6.  
  
For the ISDB-T standard, the channel bandwidth is fix set to 6 MHz.

### Spectrum Emission Mask Result (7)

The spectrum emission mask result line shows the following:

- File name of the selected TV SEM definition file.
- PASS/FAIL information regarding the TV SEM measurement.  
If the emission mask is violated in one or more frequency segments, the emission mask test result failed. In order to get the "pass" result, the emission power in all frequency segments must be lower than the emission mask.

### Spectrum Emission Mask List (8)

The spectrum emission mask list provides detailed emission measurement results regarding each frequency segment that is defined in the TV SEM definition file. If the list contains more than 4 entries, you can scroll through the list to see the other results. Note that scrolling works only if there is no active input field.

For removing respectively inserting the spectrum emission mask list from the measurement screen use the "View Mask List" function under MEAS : MEAS SETTINGS : VIEW MASK LIST.

- Range [Hz]

The first number is the start frequency, the second number the stop frequency of the frequency segment. The character following the number indicates the unit (k = kHz, M = MHz, G = GHz).

- Freq [Hz]

Frequency at which the signal has the highest emission within the frequency segment. The character following the number indicates the unit (k = kHz, M = MHz, G = GHz).

- Emission

Highest emission power within the frequency segment. The measurement value is presented in the unit that is selected under AMPT : UNIT.

- Attenuation

Power ratio in dB of the transmission power to the highest emission power within the frequency segment.

- Margin

Lowest distance in dB of the emission power to the emission mask within the frequency segment. A negative sign means that the emission power is higher than the emission mask limit. In addition, the numbers are displayed in red. If the emission power is lower than the emission mask limit, the margin result is displayed in green.

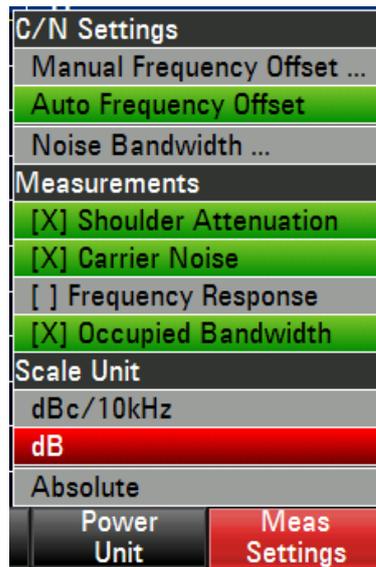
## 2.5.4 Setting the Amplitude Scale Unit

Besides the absolute amplitude scaling, you can set a relative amplitude scaling. If the scale unit is set to ABSOLUTE, the scaling is according to the selection under AMPT : UNIT. If the scale unit is to dB or dBc/10kHz, the scaling is referenced to the signal power.

If the scale unit dBc/10 kHz is selected, the R&S ETC 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 ETC calculates the signal power, the trace data and all TV SEM measurement parameters at the end of the sweep.

1. Press the MEAS key.
2. Tap MEAS SETTINGS key.



3. Under SCALE UNIT, select the desired scaling.

### 2.5.5 Setting the Channel Bandwidth

In most transmission systems, the OFDM signal bandwidth is described by the channel spacing.

In the ISDB-T standard, the channel bandwidth is fix set to 6 MHz and cannot be changed. The relationship between channel bandwidth and OFDM signal bandwidth is as follows:

$$OFDM\_Bw = Channel\_Bw - \frac{3}{7} MHz = \left(6 - \frac{3}{7}\right) MHz = 5.5714286 MHz$$

In the DVB-T/H standard, you can directly set the OFDM signal bandwidth for the channel spacings (CHANNEL BW) of 5 MHz, 6 MHz, 7 MHz and 8 MHz. The R&S ETC calculates the OFDM signal bandwidth "OFDM BW" from the selected channel bandwidth (CHANNEL BW):

$$OFDM\_Bw = \frac{213}{224} \cdot Channel\_Bw$$

1. Press the MEAS key.
2. Tap Channel BW.

The R&S ETC opens the submenu for setting the channel bandwidth.



3. Select the required item.

The R&S ETC calculates the OFDM signal bandwidth, uses it to calculate the measurement parameters and plots the corresponding frequency lines in the measurement window.

### 2.5.6 Setting the OFDM Signal Bandwidth

The OFDM signal bandwidth "OFDM BW" corresponds to the current bandwidth of the OFDM signal, i.e. it is the frequency spacing between the first and last OFDM carrier.

In the ISDB-T standard, the OFDM bandwidth is fix set as follows:

$$OFDM\_Bw = Channel\_Bw - \frac{3}{7} MHz = \left(6 - \frac{3}{7}\right) MHz = 5.5714286 MHz$$

In the DVB-T/H standard, you can enter the OFDM signal bandwidth within the range 1 MHz up to 8 MHz with a resolution of 0.1 Hz.

1. Press the MEAS key.
2. Tap OFDM BW.



The R&S ETC opens the entry field for the OFDM signal bandwidth. It displays the currently set OFDM signal bandwidth.

3. Set the required OFDM signal bandwidth.

## 2.5.7 Setting the Frequency

Set the frequency by using the **FREQ** key and entering the carrier frequency or entering a channel. If a channel is entered, a channel frequency table must be loaded from the supplied R&S ETC View software. How to create the channel tables is described in the R&S ETC View software manual.

The frequency is entered as described in the chapter "[Setting the Frequency](#)".

## 2.5.8 Changing the Frequency Span

The predefined profiles stored in the R&S ETC also define the frequency span. The defined frequency span provides the best accuracy of the measurement results. However, signals outside the measurement channel are not detected. To provide an overview of the spectrum outside the measurement channel, you can increase the frequency span up to 10 times of the channel bandwidth when the channel power is measured.

In the TV SEM measurement, if the frequency span is set to **AUTO**, the frequency span is set according to the frequency range of the mask definition. You can reduce the span setting, but for emission mask test result, only the set frequency span is taken into account. As an indication, a red dot is displayed in front of the TV SEM definition file name.

4. Press the **SPAN** key.

The color of the **AUTO SPAN** menu changes to green to indicate that the optimal frequency span for the channel power measurement is set.

5. Select MANUAL SPAN to enter a different frequency span immediately.
6. Set a new frequency span.

The largest permissible frequency span for the channel power measurement is 10 times of the channel bandwidth. With larger frequency spans, the result of the channel power measurement would be increasingly inaccurate because the channel to be measured does not contain enough trace points.

7. Tap AUTO SPAN to set the optimum frequency span again.
8. To return to the menu for channel power measurement, press the MEAS key.

### 2.5.9 Setting the Amplitude Parameters

The reference level is the level represented by the uppermost grid line in the measurement diagram. In the TV SPECTRUM measurement, the attenuator setting is not linked to the reference level in both the AUTO LOW NOISE and AUTO LOW DISTORTION settings. As a result, the reference level setting can be used to move the trace in the vertical direction without the attenuator setting being influenced.

The R&S ETC has an RF detector to allow automatic control of the attenuator. In the AUTO LOW NOISE and AUTO LOW DISTORTION settings, the RF attenuator is adjusted automatically in 5 dB steps depending on the receive level.

In the AUTO LOW DISTORTION setting, the R&S ETC sets a 5 dB higher attenuation (related to the AUTO LOW NOISE setting). As a result, the load on the input mixer is 5 dB lower for the given reference level. For an input spectrum with high signal density, intrinsic interference products of the input mixer are reduced. However, the receiver noise factor of the R&S ETC increases due to the higher attenuation upstream of the input mixer. Because of the headroom of more than 5 dB, this setting is also recommended for mobile reception.

In the AUTO LOW NOISE setting, the R&S ETC sets a 5 dB lower attenuation (related to the AUTO LOW DISTORTION setting). This increases the sensitivity of the R&S ETC, i.e. the receiver noise factor drops due to the lower attenuation upstream of the input mixer. This setting is also recommended for measurements at the transmitter as here large headrooms are not necessary.

Alternatively, you can manually preset the RF attenuation in 5 dB steps.

The current RF attenuation setting is shown in the status display of the measurement window.

By default, the measured receive level is displayed in dBm. However, you can also select the units dBmV, dB $\mu$ V, watt and volt.

You can define a reference offset (REF OFFSET) for the measured receive level. The reference offset adds a settable value to the reference level. This is useful if, for example, an attenuator or an amplifier is used upstream of the RF input. The R&S ETC includes this attenuation or gain in the level display, making manual conversion unnecessary. Enter the attenuation upstream of the RF input as a positive value and gain as a negative value.

The measurement range (RANGE) determines the resolution of the level axis in the measurement diagram. By default, the scale on the level axis is in dB. The measurement range is 100 dB or 10 dB per division (10 dB/DIV). The R&S ETC also provides the level ranges of 50 dB (5 dB/DIV), 20 dB (2 dB/DIV), 10 dB (1 dB/DIV) and 1 dB (0.1 dB/DIV) to enhance resolution along the level axis. However, increasing resolution does not increase the accuracy of, for example, the marker level readout, but only makes it easier to read values off the trace. With the LIN 0-100 % setting, the R&S ETC also provides a linear level scale. The level is then given as a percentage (0 % to 100 %) of the reference value.

As an option, the R&S ETC features an internal RF preselection for the suppression of unwanted receive signals. In contrast to no preselection, the level of the useful RF signal can be set higher, thus leading to a higher dynamic range. The RF preselection is located behind the RF attenuator and in front of the input mixer. To improve sensitivity, signals are passed through a low-noise amplifier after preselection. This 15 dB amplifier improves sensitivity by approx. 10 dB.

For measurements on 75  $\Omega$  systems, the R&S ETC provides the possibility to switch to 75  $\Omega$ . This, however, does not switch the RF input to 75  $\Omega$ , but instead simply switches to a 75  $\Omega$  matching pad that is located at the RF input. The 50/75  $\Omega$  matching pads R&S RAZ, R&S RAM and R&S FSH-Z38 are available for impedance matching to 75  $\Omega$  (see the recommended accessories). If configured accordingly, the R&S ETC automatically takes the conversion factor of the matching pad into consideration.

Other matching pads can be implemented by using a transducer factor. How to generate transducer factors is described in the R&S ETC View software manual.

### Setting the Reference Level

1. Press the AMPT key.

The R&S ETC immediately activates the entry of the reference level. The color of the REF LEVEL menu changes to red.



2. Set a reference level.

### Setting the RF Attenuation

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

The R&S ETC opens a submenu to select the RF attenuator control, RF preselection and the input impedance. The currently selected settings are highlighted in green.

The RF attenuation can be either preset in 5 dB steps (MAN setting) or set automatically to low sensitivity to interference signals (AUTO LOW DISTORTION" setting) or to high receive sensitivity (AUTO LOW NOISE setting).

**Note:** If the MAN setting is selected, a red dot appears to the left of the readout field for RF attenuation ("Att").

3. Select the required item.

### Activating the RF Preselection

Only available with the R&S ETC-K1 option.

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

The R&S ETC opens a submenu to select the RF attenuator control, RF preselection and the input impedance.

3. Select PRESELECTION ON.

If RF preselection is activated, "(PS)" is displayed in the status area of the measurement window behind "Att: xx dB".

4. To deactivate the RF preselection, select the respective item.

### Setting the Input Impedance

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

The R&S ETC opens a submenu to select the RF attenuator control, RF preselection and the input impedance. The currently selected settings are highlighted in green.

3. Select the required input impedance.

**Note:** If the input is set to 75  $\Omega$ , it is essential to connect the appropriate matching pad upstream of the RF input. The level displayed by the R&S ETC will otherwise be incorrect.

**Note:** For 75  $\Omega$  Transf. (xx dB loss), user can connect a transformer and indicate the transformer loss via the "Loss of Transformer..." menu. An entry box will appear to allow user-defined loss to be entered.

### 2.5.10 Sweep Settings

With frequency spans  $> 0$ , the sweep time is the time that a spectrum analyzer takes to sweep through the set frequency range in order to measure its spectrum. Certain conditions must be observed to ensure that the readout is correct. These conditions are described in detail in the chapter "Spectrum Analyzer Measurements, "Setting the Sweep".

### 2.5.11 Trace Settings

The CLEAR/WRITE, AVERAGE, MAX HOLD and MIN HOLD trace display modes are available. AUTO PEAK, MAX PEAK, MIN PEAK, SAMPLE or RMS can be selected as the detector. An automatic detector selection mode is also available.

Table 2-1: Detector setting in automatic mode

Trace mode	Detector
Clear/Write	Auto Peak
Average	Sample
Max Hold	Max Peak
Min Hold	Min Peak

The trace settings are described in detail in the chapter "Spectrum Analyzer Measurements, [Setting the Trace](#)".

### 2.5.12 Using Markers

You can activate up to six markers to record other measurement values. How to use markers is described in detail in the chapter "Spectrum Analyzer Measurements, [Using the Markers](#)".

### 2.5.13 Working with the Limit Lines

Limit lines are used to mark limits for level characteristics over frequency in the measurement window; these limits must not be exceeded. They indicate, for example, the upper limits of spurious emissions or nonharmonics that are permissible for a DUT. With the R&S ETC, the lower and upper limit can be preset using a limit line. A spectrum can thus be checked either visually in the measurement window or automatically by verifying limit violations.

A limit line is determined by at least two and a maximum of 25 value pairs (points) for the frequency axis and level. The R&S ETC links the individual points with straight lines. The frequency points can be specified in absolute or relative units referenced to the center frequency of the measurement diagram. Relative units are of advantage, for example, when modulated emissions are measured. If the center frequency is varied, the mask on the screen remains unchanged. The level points are always decibel units.

With linear scaling (where the dimensional unit is V or W), the R&S ETC automatically switches to the appropriate decibel unit after a limit line has been activated.

Define limit lines using the supplied R&S ETC View software. The limit lines are loaded to the memory of the R&S ETC via the USB or LAN interface. Approx. 100 limit lines can be stored simultaneously in the internal memory of the R&S ETC. The maximum number of limit lines may become smaller if transducer factors, channel tables, cable models or data sets are also stored (see also the chapter "[Saving and Recalling Measurement Results and Settings](#)").

### Displaying the Limit Lines

1. Press the LINES key.

The R&S ETC displays the menu for controlling the limit lines.

The R&S ETC makes a distinction between upper limit lines (UPPER LIMIT) and lower limit lines (LOWER LIMIT). With an upper limit line, the R&S ETC checks whether a measurement value exceeds the limit line. With a lower limit, it checks whether a measurement value falls below this limit. Limit lines stored in the R&S ETC can be used both as upper limits and as lower limits.

2. Depending on the application, press the UPPER LIMIT or LOWER LIMIT.

The R&S ETC displays the list of available limit lines. If no limit lines have yet been activated, the first limit in the list is highlighted. If there are no limit lines stored in the R&S ETC, the focus is on the "\Public\" directory.

Select Limit Line		02/05/12 15:22		
Stat	Name	Size	Date	Time
<	\Public\Limit Lines\..			
📁	\Public			
📁	\Storage Card			
	DVB Emission Crit 7MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Crit 8MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Critical 7MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Critical 8MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncr 7MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncr 8MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncritical 7MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncritical 8MHz.rellim	1 kB	23/08/2010	11:09
	GSM_Lower.rellim	1 kB	23/08/2010	11:09
	GSM_Upper.rellim	1 kB	23/08/2010	11:09
	My ISDB-T Limits.isdlim	1 kB	23/08/2010	11:09
	My Limit Table.dvblim	1 kB	14/11/2011	15:02
	ShAtt 7MHz critical.rellim	1 kB	23/08/2010	11:09
	ShAtt 7MHz uncritical.rellim	1 kB	23/08/2010	11:09
	ShAtt 8MHz critical.rellim	1 kB	23/08/2010	11:09
	ShAtt 8MHz uncritical.rellim	1 kB	23/08/2010	11:09
Free: 5 MB				
	Select	Sort/ Show	Delete	Refresh
				Exit

3. The unit of the limit line and the unit currently selected for the x axis must be identical. In order to determine which lines are suitable for the current instrument setup, only the compatible lines are displayed:
  - a) Tap SORT/SHOW.
  - b) Select SHOW COMPATIBLE.



The R&S ETC only displays the lines compatible with the instrument setup.

4. To display all limit lines again:
  - a) Tap SORT/SHOW.
  - b) Select SHOW ALL.

The extensions ".abslim" and ".rellim" of the line names indicate whether the limit line is assigned to absolute frequencies (abslim) or whether it is defined relative to the center frequency (rellim).

### Activating a Limit Line

1. Select the required limit line from the available limit lines.
2. Tap SELECT to activate the selected limit line.

### Closing the Limit Lines List

- Close the list of limit lines using the EXIT menu.

After a limit line has been activated, the R&S ETC returns to the limit lines menu and the selected limit line is shown again in the measurement diagram. The name and type of limit line is also displayed (i.e. UPPER LIMIT or LOWER LIMIT).



### Deactivating a Limit Line

1. Press the LINES key.
2. Tap UPPER LIMIT or LOWER LIMIT.

3. Select UNSELECT LIMIT.



All active limit lines together can be deactivated and activated again using the LIMITS ON/OFF menu.

### Measuring with Limit Lines

During the measurement, the R&S ETC checks the trace after each frequency sweep for upper and lower limit violations. If all measurement values are within the specified limits, PASS together with "Upper Limit" or "Lower Limit" is shown in the display line above the diagram. FAIL is indicated even if just one measurement value (= pixel of the trace) exceeds a limit.

The automatic limit check can be disabled using the LIMITS ON/OFF menu. Limit violation can additionally be signaled acoustically.

### Activating the Beeper

1. Tap OPTIONS.
2. Select AUDIO BEEP.

If the beeper is activated, the R&S ETC issues a warning beep if a limit is violated.



### Definition Range of Limit Lines

If a limit line is not defined in the entire frequency range, a check is not performed outside the definition range.

### **Loading Data Sets Containing Limit Lines**

When data sets are stored, the R&S ETC places the activated limit lines in the internal data memory together with the other setting data. When a data set is loaded, the limit lines are therefore also available. However, these limit lines do not appear in the list of limit lines.

## 3 Spectrum Analyzer Measurements

### 3.1 Setting the Frequency

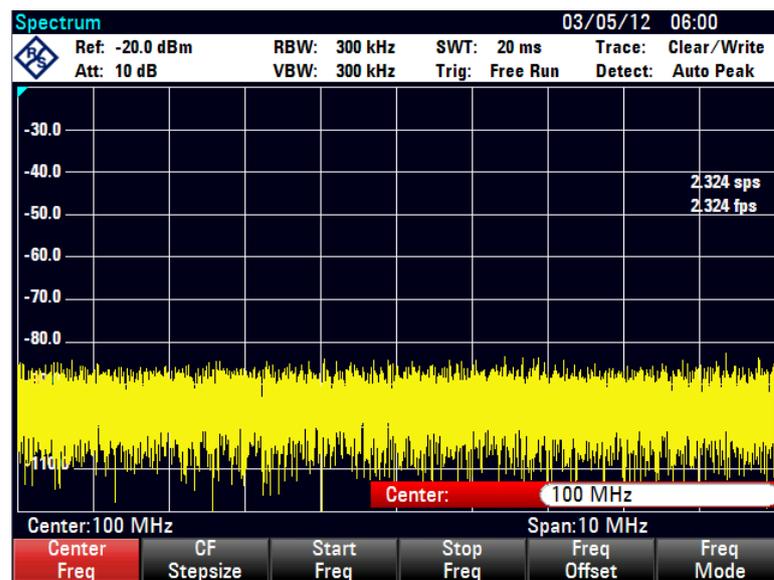
Set the frequency of the R&S ETC with the **FREQ** key. The frequency can be specified in terms of the center frequency (center freq. = frequency at the center of the frequency axis in the measurement diagram) or the start and stop frequency for a particular span.

It is best to enter the center frequency when a signal is to be measured at a known frequency. When you are investigating signals, e.g. harmonics, that are within a particular frequency range, the best option is entering a start and stop frequency to define the span.

#### Setting the Center Frequency

1. Press the **FREQ** key.

The R&S ETC opens the frequency menu. Center frequency entry is always activated, so that the frequency settings can be made with the minimum number of keystrokes. The current center frequency is displayed in the entry field.



2. Set the frequency.

The frequency you have entered becomes the new center frequency. The entry field remains open for any further entries.

The smallest step for adjusting the center frequency with the rotary knob is a pixel, in other words, as the trace comprises about 631 pixels, each step is equal to 1/631 of the span. When you use the cursor keys, a frequency step is equal to 10 % of the span (= 1 grid division). If you want to use a different step size, you can define it with the **CF STEPSIZE** function (CF = center frequency).

When you are adjusting the center frequency, you may obtain a value that is outside the R&S ETC's maximum span. If this happens, the R&S ETC automatically reduces the span.

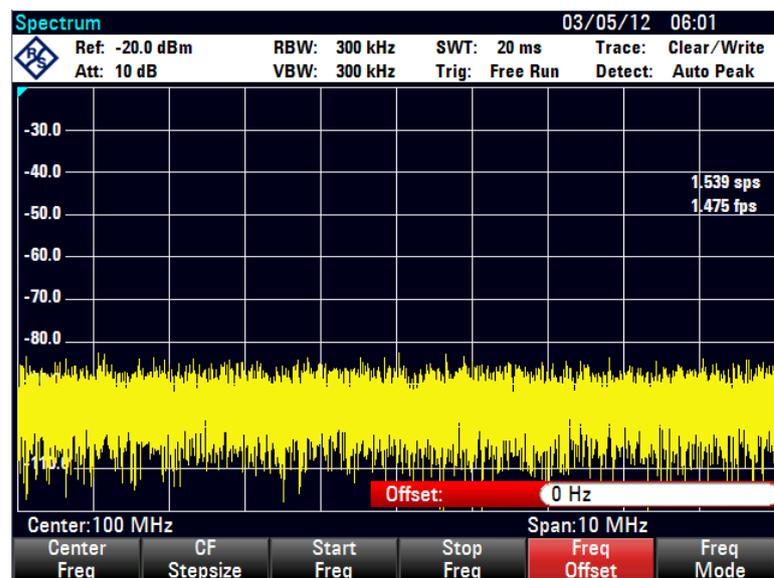
### Setting a Frequency Offset

For measurements on frequency converters such as satellite downconverters, it is often convenient to reference the results to the frequency prior to conversion. For this purpose, the R&S ETC offers a frequency offset, which arithmetically shifts the center frequency to higher or lower frequencies; thus, the R&S ETC displays the input frequency of the DUT.

Positive frequency offset is possible in the 1 Hz to 100 GHz range, in 1 Hz steps. The size of the negative frequency offset permitted depends on the start frequency setting; the start frequency, taking into account the frequency offset, is always  $\geq 0$  Hz.

1. Press the **FREQ** key.
2. Tap **FREQ OFFSET**.

The R&S ETC opens the frequency offset entry field.



3. Set the required frequency offset.

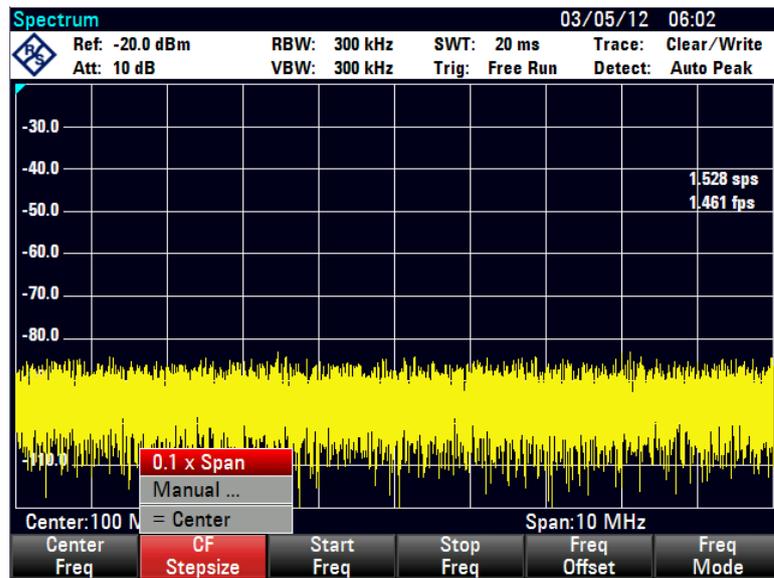
The R&S ETC adds the frequency offset to the set center frequency. The center frequency display is marked by a red dot to indicate that a frequency offset has been set.

4. To cancel the frequency offset again, enter an offset of 0 Hz.

### Setting the Center Frequency Step Size

1. Tap **CF STEPSIZE**.

A submenu opens containing various step size setting options.



- With 0.1 x SPAN (default setting), the step size is equal to 10 % of the span (= 1 division on the horizontal scale).
  - With = CENTER, the step size is equal to center frequency. This setting is ideal for measurements on harmonics. On each frequency increment, the center frequency moves to the next harmonic.
  - With MANUAL, you can select any step size. This makes it easy to investigate spectra with frequencies at constant intervals.
2. Select the desired item.

If you select 0.1 x SPAN or = CENTER, the R&S ETC makes the setting directly itself. If you select MANUAL, the entry field opens and indicates the current step size.

3. Set the step size.

### Setting the Start and Stop Frequency

1. Tap START FREQ.

The entry field for the start frequency opens. The box displays the current frequency.

2. Set a new start frequency.

The R&S ETC sets the new start frequency. The x axis labeling changes from CENTER and SPAN to START and STOP.

3. Tap STOP FREQ.

The R&S ETC opens the entry field for the stop frequency. The box indicates the current frequency.

4. Set a new stop frequency.

The new stop frequency is set on the R&S ETC.

If you enter a stop frequency on the R&S ETC which exceeds the maximum stop frequency of the instrument model, the R&S ETC will set the stop frequency to the

maximum permissible stop frequency. If you reach this frequency limit with the rotary knob or the cursor keys, the R&S ETC will ignore any further rotary ticks or cursor steps.

### 3.1.1 Working with Channel Tables

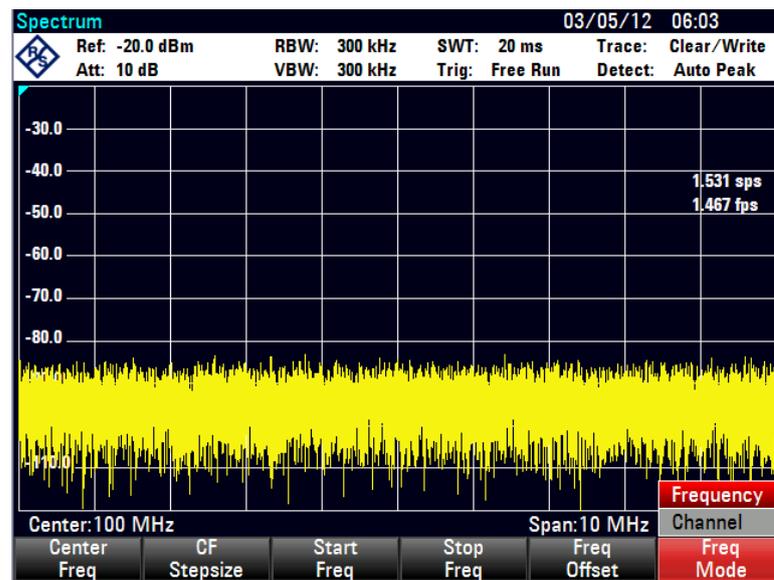
Almost all transmission systems divide their assigned frequency ranges into channels, with a specific frequency assigned to each channel. The R&S ETC therefore allows users to define channel assignments using familiar terms to keep operation simple.

Channel tables are defined with the supplied R&S ETC View software and loaded into the R&S ETC. The R&S ETC can store more than 100 different channel tables which can be activated from the front panel as required. The maximum number of channel tables may be reduced if transducer factors, cable models, limit values or data sets are stored simultaneously (see chapter "Saving and Loading Instrument Settings").

The R&S ETC View software manual describes how to generate channel tables.

#### Switching to the Channel Entry

1. Press the FREQ key.
2. Tap FREQ MODE.



3. Select CHANNEL.

The R&S ETC opens the list of channel tables loaded via R&S ETC View software.

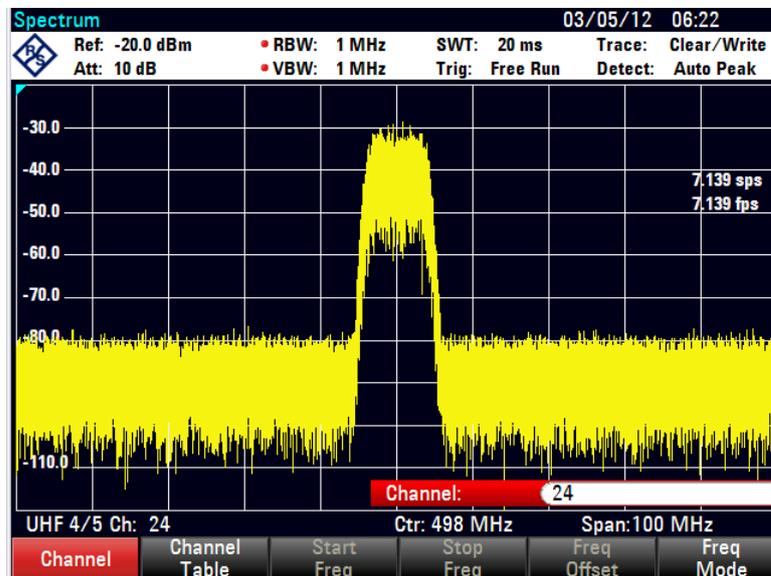
Select Channel Table					03/05/12 06:04	
Stat	Name	Size	Date	Time		
	TV Australia.chntab	1 kB	14/11/2011	15:02	▲	
	TV Brazil.chntab	1 kB	14/11/2011	15:02		
	TV China.chntab	1 kB	14/11/2011	15:02		
	TV DK_OIRT.chntab	1 kB	14/11/2011	15:02		
	TV Europe.chntab	1 kB	14/11/2011	15:02		
	TV France.chntab	1 kB	14/11/2011	15:02		
	TV French Overs.chntab	1 kB	14/11/2011	15:02		
	TV Ireland.chntab	1 kB	14/11/2011	15:02		
	TV Italy.chntab	1 kB	14/11/2011	15:02		
	TV Japan ISDB-T.chntab	1 kB	14/11/2011	15:02		
	TV Japan.chntab	1 kB	14/11/2011	15:02		
	TV Morocco.chntab	1 kB	14/11/2011	15:02		
	TV South Africa.chntab	1 kB	14/11/2011	15:02		
	TV UK negative offset.chntab	1 kB	14/11/2011	15:02		
	TV UK positive offset.chntab	1 kB	14/11/2011	15:02		
	TV UK.chntab	1 kB	14/11/2011	15:02		
	TV USA Air.chntab	1 kB	14/11/2011	15:02		
	TV USA CATV.chntab	1 kB	14/11/2011	15:02		
	TV USA HRC.chntab	1 kB	14/11/2011	15:02		
	TV USA IRC.chntab	1 kB	14/11/2011	15:02	▼	

Free: 5 MB

Select Sort/Show Delete Refresh Exit

4. Select the desired channel table.
5. Tap SELECT to activate it.
6. To sort the table entries by name/date/size, tap SORT/SHOW. You can also hide entries that are incompatible with the current instrument setup.

The channel number together with the name of the selected channel (e.g. TV Europe Ch: 24) is displayed instead of the center frequency. The FREQUENCY is called CHANNEL.



The R&S ETC center frequency is the frequency corresponding to the displayed channel number from the channel table. The R&S ETC accepts only channel numbers when entering the center frequency. Tuning the frequency with the rotary knob or the cursor keys is also done using channel numbers. All other parameters such as SPAN or RBW (resolution bandwidth) are user-selectable as with the entry of frequencies.

The entries for the start frequency (START FREQ) and the stop frequency (STOP FREQ) are inactive when defining channels.

Channel numbers are assigned to frequencies as follows:

- The first channel is assigned a channel number and a frequency.
- All subsequent channels have ascending numbers.
- The frequency spacing between channels is fixed. It can also be negative, i.e. the center frequency of the R&S ETC decreases with ascending channel number.
- In transmission systems containing gaps in the frequency range (as in the case of television, for example), a channel table can comprise multiple ranges.

### 3.1.2 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 ETC 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.

#### Presetting the R&S ETC

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

1. Press the MODE key.
2. Tap SPECTRUM ANALYZER.
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.

#### Setting the Start and Stop Frequency

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

1. Press the FREQ key.  
The R&S ETC opens the frequency input menu.
2. Tap START FREQ.
3. Set the start frequency.
4. Tap STOP FREQ.
5. Set the stop frequency.

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

### Setting the Resolution Bandwidth

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

1. Press the BW key.
2. Tap MANUAL RBW.
3. Reduce the resolution bandwidth until the second harmonic power is greater than the noise floor power.

### Setting the Markers

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

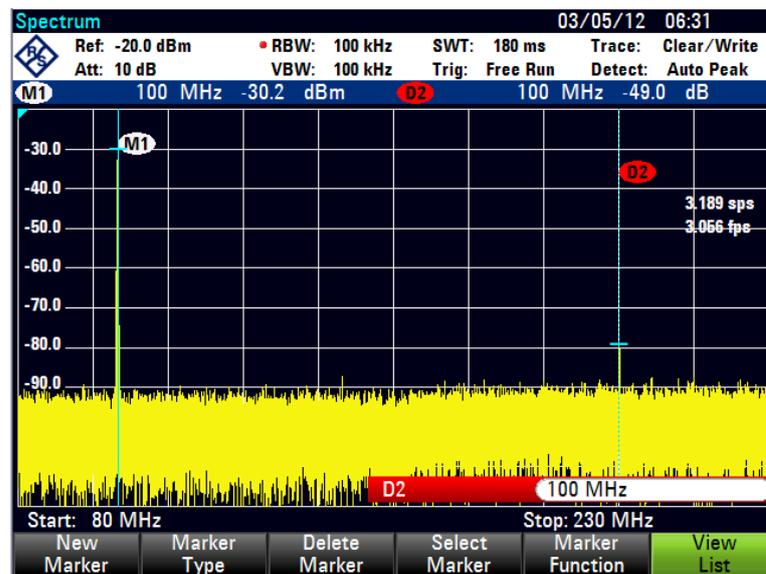
1. Press the MARKER key.

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

2. Tap NEW MARKER.

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.



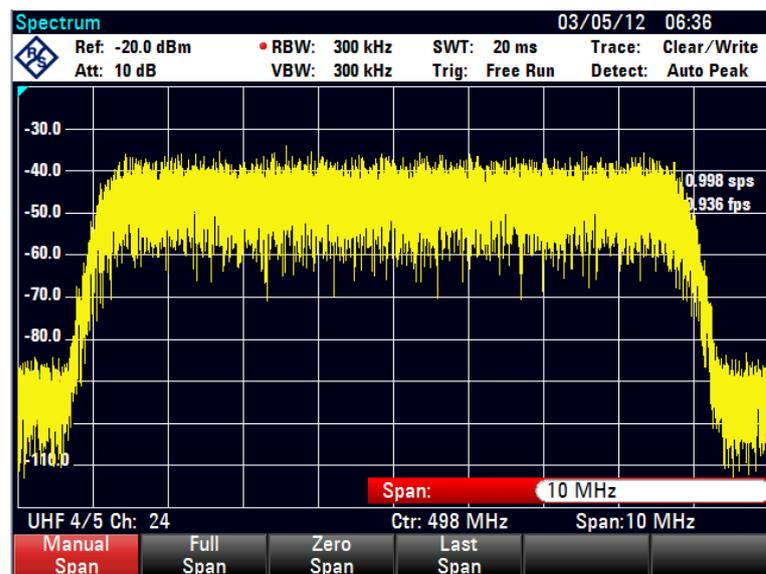
## 3.2 Setting the Span

The span is the frequency range centered on the center frequency which a spectrum analyzer displays on the screen. What span should be selected for a particular measurement depends on the signal to be investigated. It should be larger than the OFDM signal bandwidth of the signal under test.

When displaying the spectrum, the R&S ETC 04 model have a span that ranges from 100 Hz to a maximum of 3.6 GHz. The R&S ETC 08 model have a maximum frequency span of 8 GHz. If the span is set to 0 Hz, the display shows the time characteristic of the signal.

1. Press the SPAN key.

The R&S ETC automatically activates the MANUAL SPAN menu and indicates the current value so that a new span can be entered immediately. If another function in the SPAN menu has been used beforehand, tap MANUAL SPAN to enter the span.



2. Set a new span.
3. Tap FULL SPAN to select the maximum span with a single keystroke.

The R&S ETC displays the spectrum over the full span which extends to 3.6 GHz or to 8 GHz.

(CENTER = 1.8 GHz, SPAN = 3.6 GHz or CENTER = 4 GHz, SPAN = 8 GHz).

4. Tap LAST SPAN to toggle between span settings with just one keystroke.

The span that was set immediately before the current span is restored.

The ZERO SPAN menu sets the span to 0 Hz. The R&S ETC measures the signal level only at the center frequency that has been set. As a spectrum cannot be displayed when measurements are made at a single frequency, the display mode switches to the time domain. The x axis of the measurement diagram becomes the time axis and level is plotted against time. The display always starts at 0 s and stops after the sweep time that has been set (set with the SWEEP key, see chapter "[Setting the Sweep](#)").

### 3.3 Setting the Amplitude Parameters

All R&S ETC settings referred to the level display are made with the AMPT key.

The reference level (REF) is the level represented by the uppermost grid line in the measurement diagram. The input signal gain up to the display stage is set with the reference level. If the reference level is low, the gain is high, which means that even weak signals are clearly displayed. If the input signals are strong, a high reference level must be set to prevent the analyzer signal path from being overdriven and to keep the signal display within the display range. When displaying the spectrum of a composite signal, the reference level should be at least high enough to ensure that all the signals are within the measurement diagram.

The RF attenuation setting at the input of the R&S ETC is directly coupled to the reference level. If the reference level is high, RF attenuation is activated in steps of 5 dB according to the following table so that the input mixer always remains in the linear range.

The R&S ETC has two different modes for the attenuation setting selected using the RF ATT/PRES/IMP menu.

- **AUTO LOW DISTORTION**

The R&S ETC sets the RF attenuation 10 dB higher in compliance to the table, making the stress of the input mixer 10 dB less at the specified reference level. If the spectrum is densely occupied with signals, as occurs in a television cable network, the input mixer reduces the R&S ETC's inherent spurious products. However, the inherent noise display of the R&S ETC increases due to the increased attenuation in front of the input mixer.

- **AUTO LOW NOISE**

The R&S ETC sets the RF attenuation 10 dB lower. This increases the sensitivity of the R&S ETC, which means that the inherent noise display decreases due to the lower attenuation in front of the input mixer.

Reference Level in dBm	Preamplifier OFF		Preamplifier ON	
	RF attenuation		RF attenuation	
	LOW NOISE	LOW DISTORTION	LOW NOISE	LOW DISTORTION
□ -45.0	0 dB	0 dB	0 dB	0 dB
-44.9 to -40.0	0 dB	0 dB	0 dB	5 dB
-39.9 to -35.0	0 dB	0 dB	0 dB	10 dB
-34.9 to -30.0	0 dB	0 dB	5 dB	15 dB
-29.9 to -25.0	0 dB	5 dB	10 dB	20 dB
-24.9 to -20.0	0 dB	10 dB	15 dB	25 dB
-19.9 to -15.0	5 dB	15 dB	20 dB	30 dB
-14.9 to -10.0	10 dB	20 dB	25 dB	35 dB
-9.9 to -5.0	15 dB	25 dB	30 dB	40 dB

Reference Level in dBm	Preamplifier OFF		Preamplifier ON	
	RF attenuation		RF attenuation	
-4.9 to 0.0	20 dB	30 dB	35 dB	45 dB
0.1 to 5.0	25 dB	35 dB	40 dB	50 dB
5.1 to 10.0	30 dB	40 dB	45 dB	50 dB
10.1 to 15.0	35 dB	40 dB	50 dB	50 dB
15.1 to 20.0	40 dB	40 dB	50 dB	50 dB

The current RF attenuation setting is displayed in the status bar on the measurement screen.

The reference level is in dBm for the default setting. However, the units dBmV, dB $\mu$ V, Watt and Volt can also be selected. Unit selection is of relevance to the level axis and the marker level display as the marker level is displayed in the unit of the reference level.

A reference offset (REF OFFSET) can be defined for the reference level. The reference offset is a way of increasing the reference level by a certain amount. This is useful if, for example, an attenuator or amplifier has been inserted before the RF input. The R&S ETC automatically takes the loss or gain into account when the level is displayed and no manual calculations are necessary. A loss introduced at the RF input must be entered as a positive number and a gain as a negative number.

The measurement range (RANGE) determines the resolution along the level axis in the measurement diagram. When the PRESET or default setting has been selected, the level axis is scaled in dB. The measurement range is 100 dB or 10 dB per division (10 dB/DIV). The R&S ETC also provides the level ranges 50 dB (5 dB/DIV), 20 dB (2 dB/DIV), 10 dB (1 dB/DIV) and 1 dB (0.1 dB/DIV), which enhance the resolution along the level axis. However, increasing resolution does not increase the accuracy of, for example, the marker level readout, but only makes it easier to read values off the trace. You can also select a linear level scale with LIN 0-100 %. The level is expressed as a percentage (0 % to 100 %) of the reference level. This mode is useful if you want to display, for example, a carrier being amplitude modulated in the time domain (SPAN = 0 Hz).

In order to suppress unwanted signals, the R&S ETC has an optional internal RF preselection feature. In contrast to a module without preselection, in this case the level of the useful RF signal can be set higher, whereby the dynamic range increases. The RF preselection is fitted behind the RF attenuator and in front of the input mixer. To increase sensitivity, a low-noise amplifier is activated after the signal passes through the preselection filter. This amplifier has 15 dB to 20 dB gain and increases sensitivity by 10 dB.

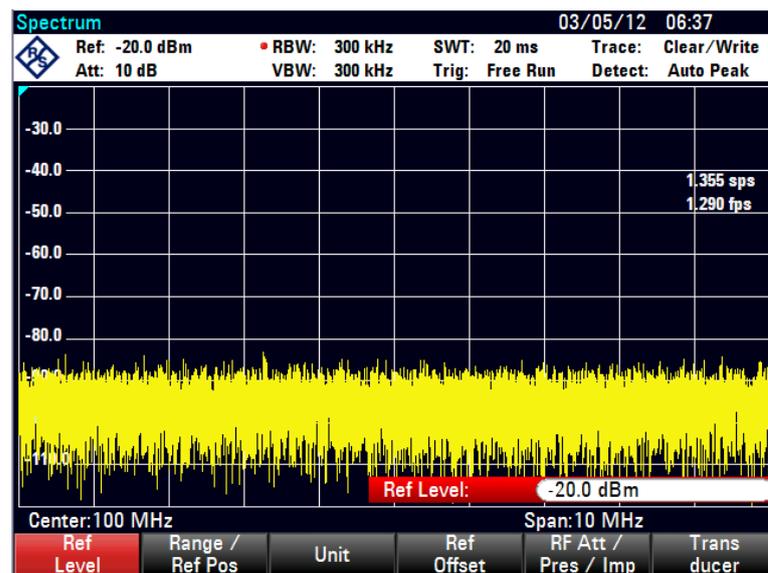
The R&S ETC can also handle measurements on 75  $\Omega$  systems. The R&S ETC does not select a 75  $\Omega$  RF input per se, but instead only a 75  $\Omega$  matching pad connected at the RF input. To match the impedance to 75  $\Omega$ , the R&S RAZ, R&S RAM and R&S FSH-Z38 matching pads are available (refer to recommended extras). The

R&S ETC automatically takes into consideration the conversion factor with the corresponding setting. Other matching pads can be used by applying a transducer factor. The generation of transducer factors is described in the R&S ETC View software manual.

### Setting the Reference Level

1. Press the AMPT key.

The reference level entry is activated immediately. The REF LEVEL menu is highlighted in red.

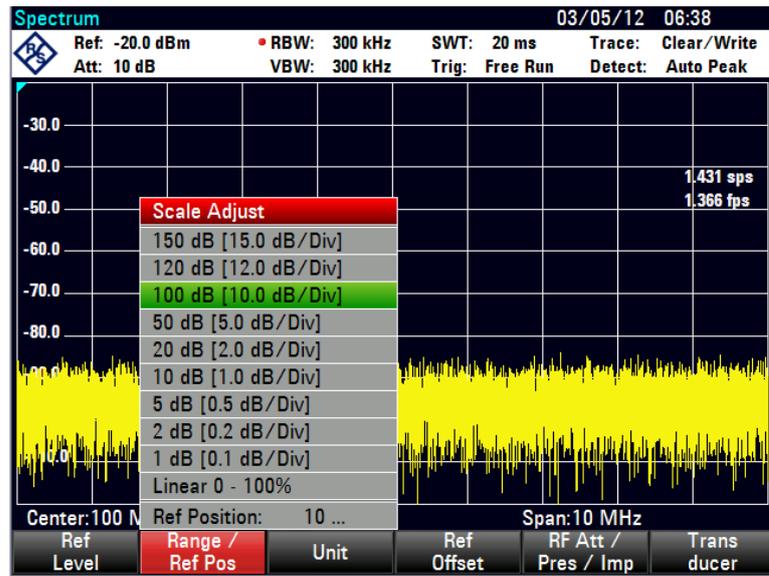


2. Set a reference level.

### Setting the Display Range

1. Press the AMPT key.
2. Tap RANGE/REF POS.

A submenu opens. The various options for scaling the level axis are displayed.



3. Select the scaling option.

The scaling option you have chosen is immediately set on the R&S ETC.

### Displaying Signals in Full

Setting the REF POSITION to "10" moves the position of the trace to another line on the diagram. This way you can display signals in full which would normally overlap with the top of the diagram.

1. Tap RANGE/REF POS.



2. Set REF POSITION to "10".
3. Select the desired grid line. The value 10 corresponds with the upper grid line, the value 0 corresponds with the lowest grid line.

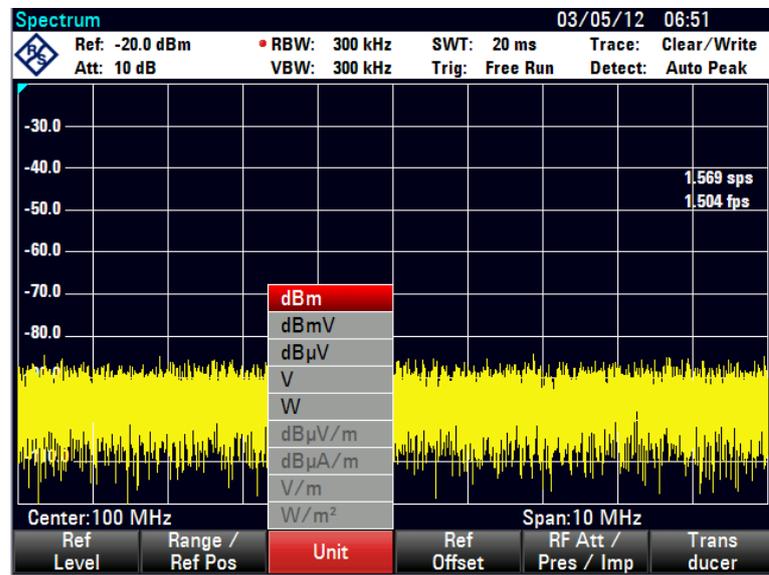
The position of the reference level is marked by a triangle on the selected grid line.



### Setting the Display Unit

1. Press the AMPT key.
2. Tap UNIT.

A submenu opens. The various unit options for the reference level are displayed.



3. Select the unit.

The R&S ETC sets the selected reference level and marker level unit.

### Setting the Reference Offset

1. Press the AMPT key.
2. Tap REF OFFSET.
3. Set a reference offset.

The reference offset unit is always dB – no matter what unit is used for the reference level.

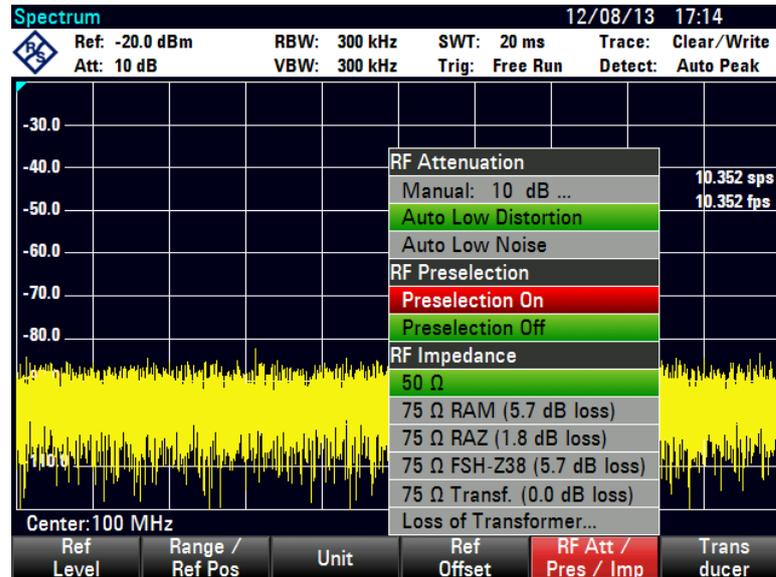
To indicate that a non-zero reference offset has been set, a red circle is placed before the reference level readout.



### Setting the RF Attenuation

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

The R&S ETC opens a submenu, to select RF ATTENUATION, RF PRESELECTION and RF IMPEDANCE.



You can manually preset the RF attenuation in 5 dB steps (MANUAL), or select the automatic setting to low sensitivity to interfering signals (AUTO LOW DISTORTION) or to high input sensitivity (AUTO LOW NOISE).

**Note:** If MANUAL is selected, a red dot is displayed in front of the RF attenuation output field ("Att.").



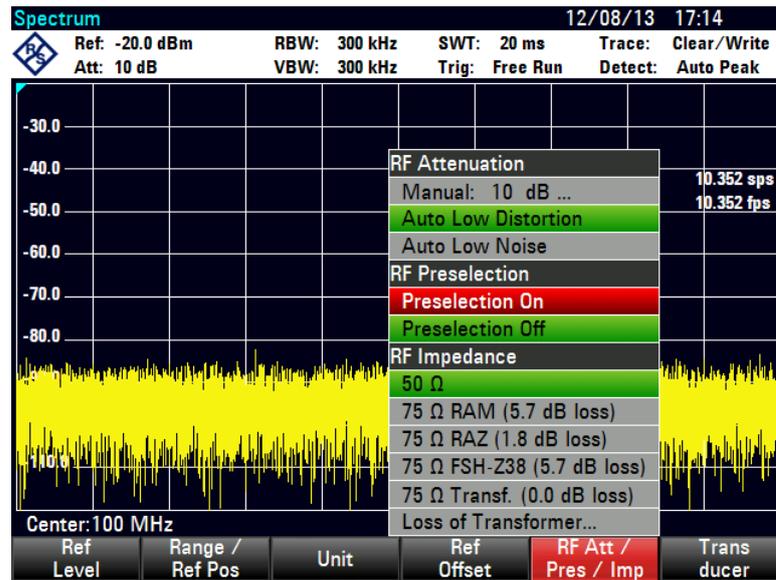
3. Select the desired entry.

### Activating the RF Preselection

Only available with the R&S ETC-K1 option.

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

The R&S ETC opens a submenu, to select RF ATTENUATION, RF PRESELECTION and RF IMPEDANCE.



3. Select PRESELECTION ON or PRESELECTION OFF.

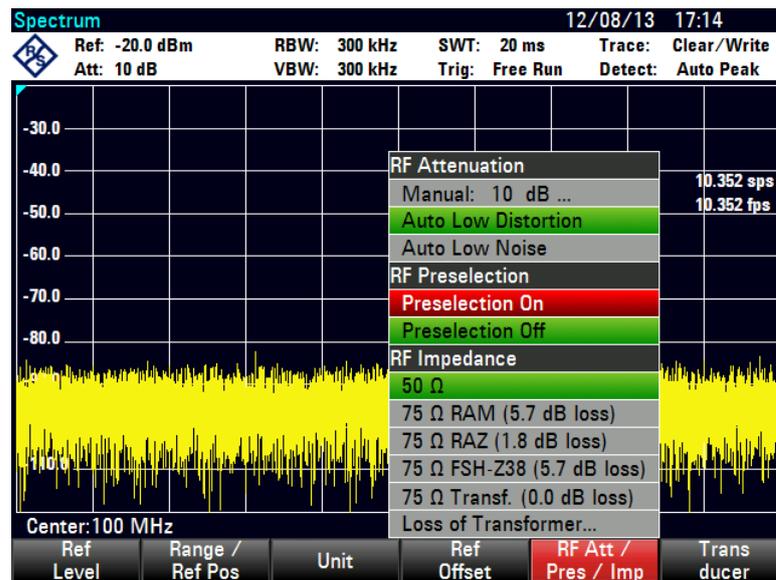
### Setting the Input Impedance

1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.

A submenu opens. The two input impedance options 50  $\Omega$  and 75  $\Omega$  are displayed.

**Note:** If the input impedance is set to 75  $\Omega$ , the corresponding matching pad must be connected in front of the RF input. Otherwise, the R&S ETC will display an incorrect level.

**Note:** For 75  $\Omega$  Transf. (xx dB loss), user can connect a transformer and indicate the transformer loss via the “Loss of Transformer...” menu. An entry box will appear to allow user-defined loss to be entered.



3. Select the input impedance.

### Selecting a Transducer Factor

In many cases, the R&S ETC is not connected directly with the output of the device under test, but the input signal is fed to the device via a cable, amplifiers or antennas, or a combination of these.

The R&S ETC can account for the frequency shifts of up to 2 connecting components in the measured results. For this purpose, so-called transducer factors have been defined. These can be loaded into the device with the R&S ETC View software. Each transducer factor consists of a list of frequency/level pairs, which describe the frequency shift of the measuring accessory. For antennas, the unit of the measured electrical or magnetic field strength is included, for isotropic antennas in each case the frequency stage for the x-, y- and z-directions.

You can enable two inputs (Primary/ Secondary Transducer) from the list of transducer factors loaded in the R&S ETC, so that, for example, the device can take a cable and antenna or cable and amplifier combination into account. Note that only one of the two transducers selected can have a unit differing from dB.

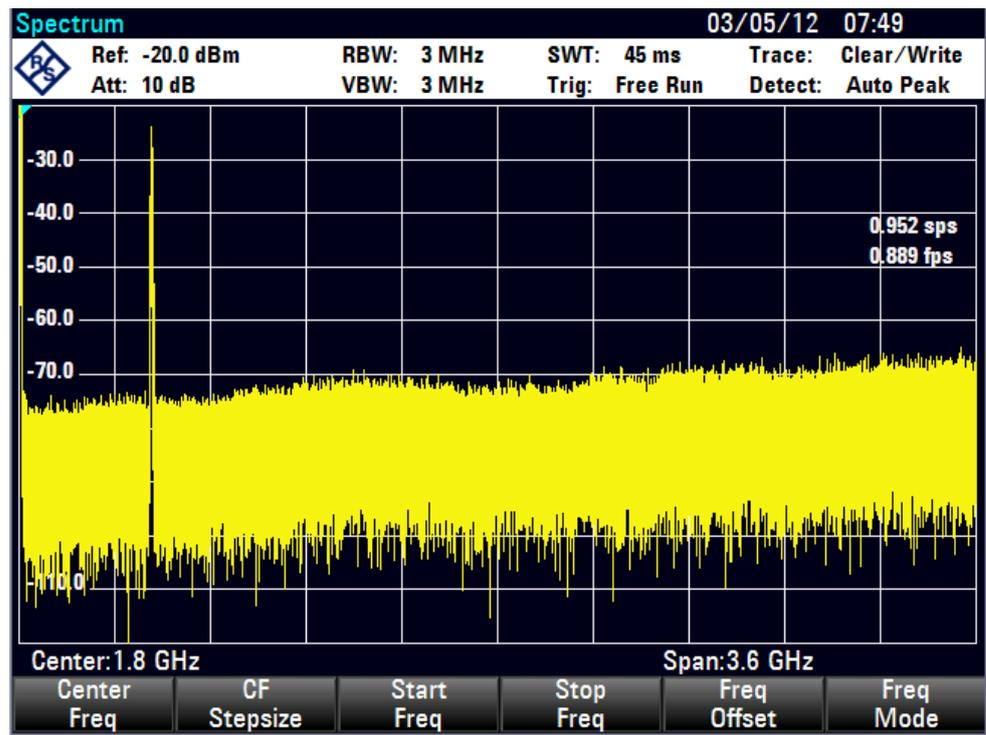
Working with transducer factors is described in chapter "Measuring with Transducer Factors".

### Measuring the Level

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

1. Press the MODE key.
2. Tap SPECTRUM ANALYZER key.
3. Press the PRESET key.

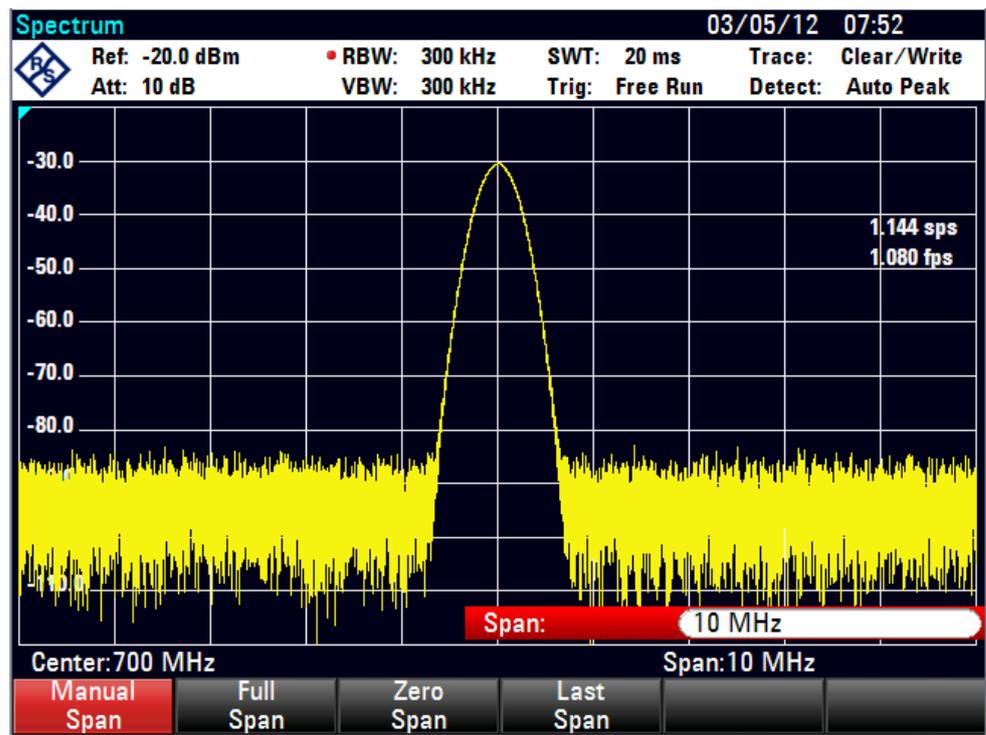
The analyzer displays the frequency spectrum over its maximum frequency span. At 700 MHz, the generator signal is displayed as a vertical line.



To analyze the generator signal at 700 MHz in more detail, reduce the frequency span of the R&S ETC. Set the center frequency of the R&S ETC to 700 MHz and reduce the span to 10 MHz.

1. Press the **FREQ** key.
2. Set the center frequency.
3. Press the **SPAN** key.
4. Set the span.

The R&S ETC displays the generator signal with a higher resolution.

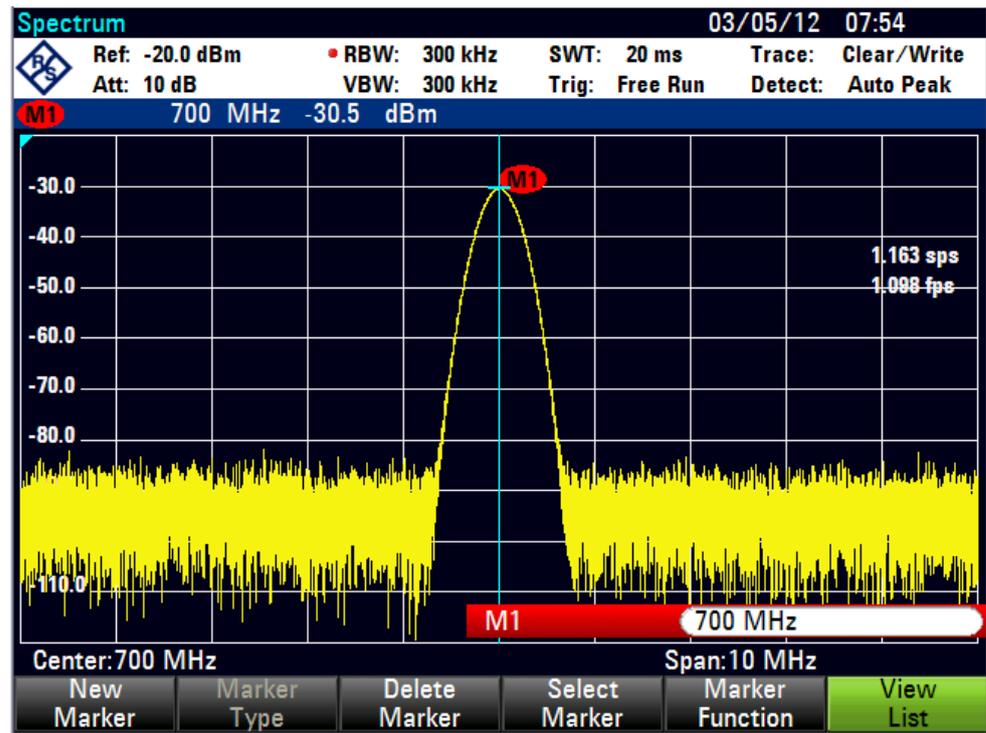


The R&S ETC has markers for identifying signal levels. Markers are always positioned on the trace. The level and frequency values are displayed at their respective positions.

- ▶ 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 ETC displays the level and frequency of the marker position numerically above the measuring screen.



### 3.4 Setting the Bandwidths

A key feature of a spectrum analyzer is that it can display the frequency spectrum of a signal. The resolution bandwidth determines how well a spectrum analyzer can separate adjacent frequencies. Spectrum analyzers usually also have switchable video bandwidths. The video bandwidth is determined by the cutoff frequency of the lowpass used to filter the video voltage before it is displayed. The video voltage is the spectrum analyzer term for the voltage produced when the IF signal which has been band-limited by the resolution filter is envelope detected. The video voltage is smoothed by video filtering to, say, reduce noise on the trace. Unlike the resolution bandwidth, the video bandwidth has no effect on the resolving power of the spectrum analyzer.

#### 3.4.1 Resolution Bandwidth

The resolution bandwidth (RES BW) of a spectrum analyzer determines the frequency resolution of spectrum measurements. A sine signal is displayed "through" the passband of the selected resolution filter. Therefore, a suitably small resolution bandwidth is required if two or more signals whose frequencies are close together are to be displayed separately. The frequency difference between two sinusoidal carriers, for example, cannot be less than the selected resolution bandwidth if the carriers are to be resolved. Which resolution bandwidth is selected also has an effect on the noise displayed by the spectrum analyzer. If the bandwidth is small, the noise displayed drops. If the bandwidth is reduced or increased by a factor of 3, the noise displayed drops or goes up by 5 dB. If the bandwidth is changed by a factor of 10, the displayed noise changes by 10 dB. Which resolution bandwidth is selected also has an effect on

the sweep speed. If the true spectrum is to be displayed, the band filters that determine the resolution bandwidth must settle at all frequencies of interest. Narrow band filters take longer to settle than wide filters. This is why a longer sweep time must be selected for narrow resolution bandwidths. If the bandwidth is reduced by a factor of 3 (e.g. from 10 kHz to 3 kHz), the sweep time must be increased by a factor of 9. If the reduction factor is 10 (e.g. from 10 kHz to 1 kHz) the sweep time must be increased by a factor of 100.

The R&S ETC has resolution bandwidths from 100 Hz to 3 MHz in a 1, 3, 10 sequence. When the default setting is selected, they are coupled to the span, i.e. if the span is reduced, a smaller resolution bandwidth is automatically set. This means that in many cases the resolution bandwidth does not have to be set separately – a higher frequency resolution is automatically set when the span is reduced.

All models offer a 200 kHz resolution bandwidth in addition. This bandwidth has to be selected manually, i.e. it will not be activated automatically in the AUTO RES BW mode (resolution bandwidth coupled to span).

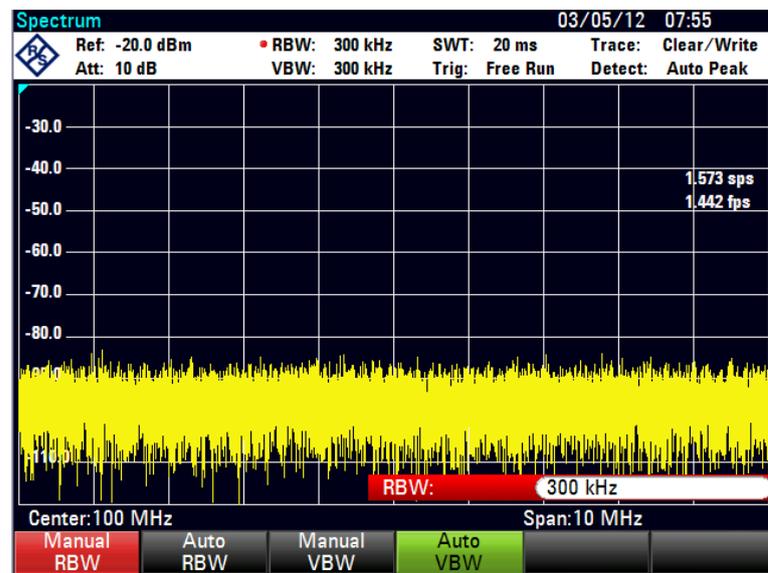
### Setting the Resolution Bandwidth

1. Press the BW key.

The menu for setting the bandwidth opens. If the default setting is activated, the menu for automatically setting the bandwidth is highlighted in green.

2. Tap MANUAL RES BW.

The menu is highlighted in red and the entry field for the resolution bandwidth (RBW) indicates the current bandwidth. To indicate that the resolution bandwidth is not coupled to the span, a small red circle is placed before the resolution bandwidth display.



3. Set the resolution bandwidth.

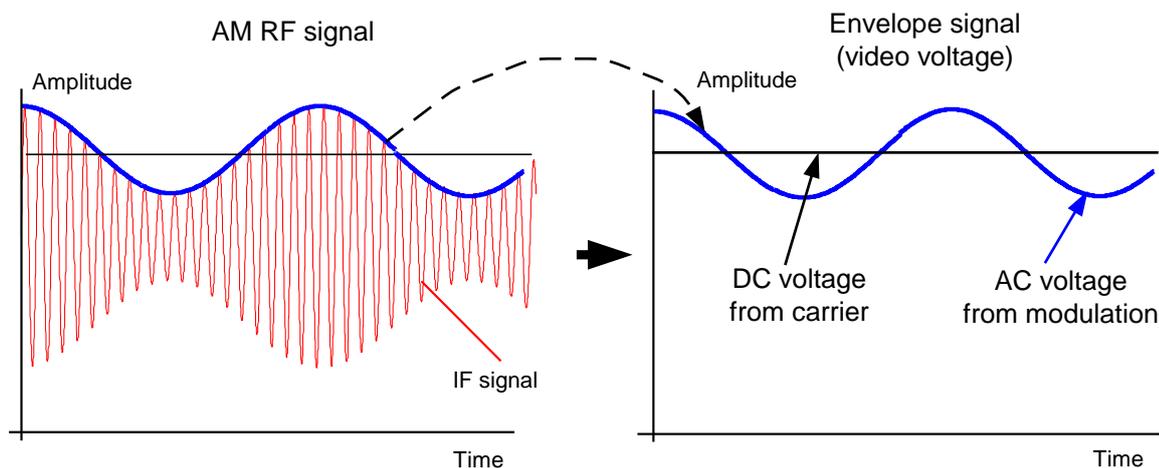
**Note:** The 200 kHz resolution bandwidth has to be entered by means of the numeric keys. When using the rotary knob or the cursor keys, the 200 kHz bandwidth will be skipped.

4. Tap AUTO RES BW.

The resolution bandwidth is coupled to the span that has been set. The AUTO RES BW menu is highlighted in green to show that the coupled mode has been selected. The red circle in front of the RBW readout disappears.

### 3.4.2 Video Bandwidth

The video bandwidth smoothes the trace by reducing noise. When the filtered IF signal is envelope-detected, an IF sine signal becomes a DC voltage in the video signal. If the sine signal is amplitude-modulated, a signal whose frequency is the same as the AM frequency is produced in the video signal apart from the DC voltage from the carrier. The Fig. below shows an RF signal modulated with a sine signal and the corresponding video signal in the time domain.



The envelope signal contains a DC component corresponding to the carrier level and an AC component whose frequency is the same as the AM frequency. If the bandwidth of the video filter is less than the frequency of the AC component, the latter will be suppressed depending on its maximum frequency. If the AM component is to be displayed faithfully, the cutoff frequency must be greater than the modulation frequency.

If there is noise on the sine signal, the modulation signal can be thought of as noise. If the video bandwidth is reduced, the high-frequency noise components above the cutoff frequency of the video filter will be rejected. The smaller the video bandwidth, the smaller the noise amplitude at the video filter output.

Therefore, the following rules of thumb can be applied to setting the video bandwidth:

- If you are performing measurements on modulated signals, the video bandwidth must be sufficiently large so that desired modulation components are not rejected ( $\geq$  RBW).

- If signals are to be kept free of noise, the smallest video bandwidth possible should be selected ( $\leq 0.1 \times \text{RBW}$ ).
- If measurements are being performed on pulsed signals, the video bandwidth should be at least three times greater than the resolution bandwidth so that the pulse edges are not distorted.

Like the resolution bandwidth, the video bandwidth has an effect on sweep speed. The spectrum analyzer must pause before each measurement to allow the video filter to settle.

The R&S ETC has video bandwidths from 10 Hz to 3 MHz in a 1, 3, 10 sequence. When the default settings are selected, they are coupled to the resolution bandwidth. The video bandwidth equals the resolution bandwidth. When the resolution bandwidth is changed, the R&S ETC automatically sets the appropriate video bandwidth. This means that, in many cases, the video bandwidth does not need to be set separately. When the resolution bandwidth is changed, the video bandwidth is changed automatically.

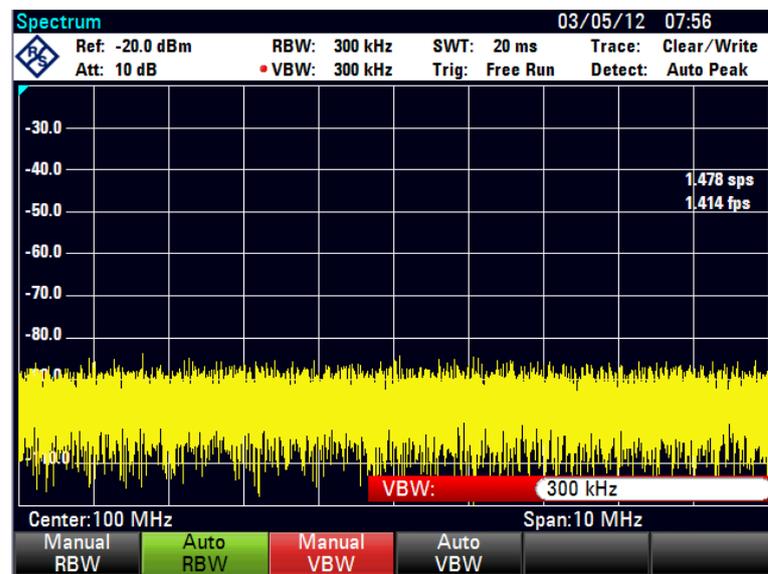
### Setting the Video Bandwidth

1. Press the BW key.

The menu for setting bandwidths opens. When the default setting has been selected, the menu for setting the bandwidth automatically is highlighted in green.

2. Tap MANUAL VIDEO BW.

The menu is highlighted in red and the video bandwidth entry field (VBW) indicates the current bandwidth. To indicate that the video bandwidth is not coupled to the resolution bandwidth (RBW), a small, red circle is placed in front of the video bandwidth readout.



3. Set the video bandwidth.
4. Tap AUTO VIDEO BW.

The video bandwidth is coupled to the resolution bandwidth that has been set. The AUTO VIDEO BW menu is highlighted in green to indicate coupling and the red circle marking the VBW readout disappears.

### 3.5 Setting the Sweep Parameters

If the span is  $> 0$ , the sweep time is the time the spectrum analyzer takes to traverse the displayed span to measure the spectrum. Certain boundary conditions must be met if a spurious spectrum is not to be displayed.

One boundary condition is the resolution bandwidth. If the resolution filter is to settle, the dwell time within the filter bandwidth must have the right value. If the sweep time is too short, the resolution filter does not settle and the displayed level is too low (see also chapter "[Setting the Bandwidths](#)").

The second boundary condition is the selected span. If the span is increased, the sweep time must be increased proportionally.

The R&S ETC provides automatic sweep time coupling to help users set the sweep time by coupling it to the resolution bandwidth and span that have been set. When automatic coupling (AUTO SWEEP TIME) is selected, it always sets the shortest sweep time possible to ensure that sine signals in the spectrum are displayed correctly. When you quit the auto sweep time mode (MANUAL SWPTIME is activated instead), a small, red circle is placed in front of the SWT readout to indicate that the uncoupled mode has been selected. If the sweep time is so short that level errors occur, the R&S ETC informs the user by displaying a red circle in the measurement diagram.

The R&S ETC requires a minimum sweep time of 20 ms per 600 MHz of span. If a larger span is set, the R&S ETC automatically adapts the minimum sweep time in the coupled mode.

If the span = 0 Hz, the R&S ETC displays video voltage versus time instead of a spectrum. The x axis of the measurement diagram becomes the time axis, starting at 0 s and ending at the sweep time you have selected.

The minimum sweep time when the span = 0 Hz is 200  $\mu$ s, the maximum 100 s.

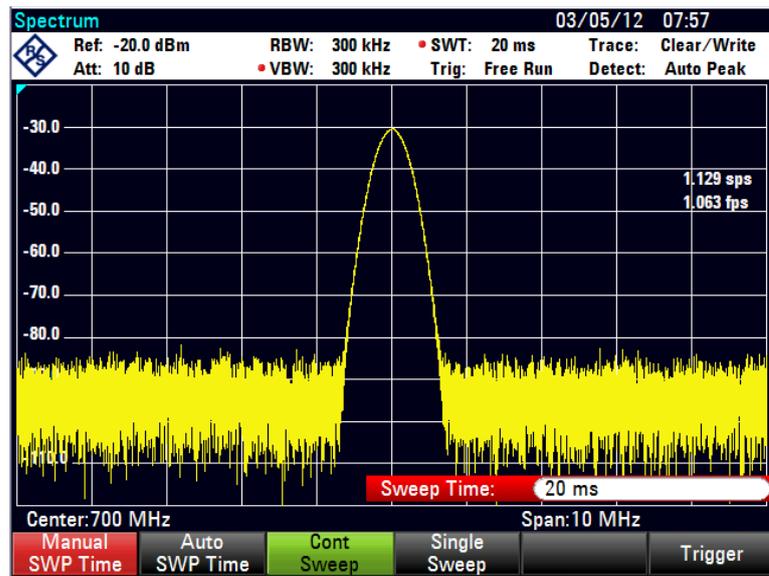
#### Setting the Sweep Time

1. Press the SWEEP key.

The menu for entering sweep parameters opens. If the default settings have been selected, automatic coupling (AUTO SWPTIME) is set. In this mode, the sweep time is coupled to the resolution bandwidth, the video bandwidth and the span.

2. Tap MANUAL SWPTIME.

The SWEEP entry field opens and indicates the current sweep time setting.



3. Set a new sweep time.

The sweep time that has been set is displayed in the SWT readout box.

### Setting the Sweep Mode

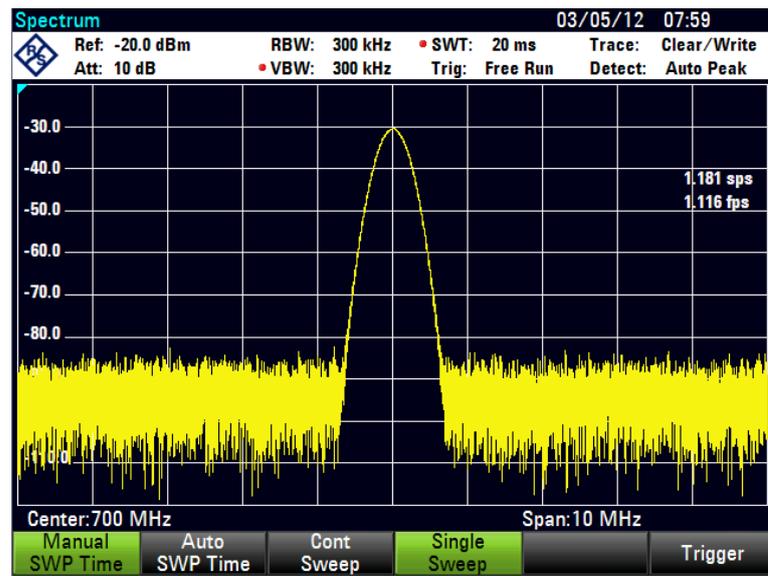
If the default settings are activated, the R&S ETC is in the continuous sweep mode, i.e. when one sweep of the span has been completed, the sweep is automatically repeated from the start of the span. The trace is refreshed after each sweep.

The continuous mode may not be needed for some applications, e.g. when a single event is to be recorded on certain trigger conditions being met. The R&S ETC, therefore, has a single sweep mode. If the single sweep mode is selected, the R&S ETC sweeps once over the span or displays the time-domain video signal once in the zero-span mode. The measurement will only be repeated if you tap SINGLE SWEEP.

1. Press the SWEEP key.

If the default setting is selected, the CONT SWEEP menu is highlighted in green to indicate that the continuous sweep mode has been set.

2. Tap SINGLE SWEEP.



The SINGLE SWEEP menu is highlighted in green. The R&S ETC performs a single sweep and waits for further entries.

3. Tap CONT SWEEP.

The R&S ETC sweeps continuously again.

### Trigger Modes

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

- FREE RUN

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

- VIDEO

A sweep starts when the video voltage exceeds a settable value. Video triggering is only available when span = 0 Hz. When a frequency spectrum is being displayed, (span  $\geq$  10 kHz), there is no guarantee that a signal to generate a video voltage is present at the start frequency. Under these circumstances, the R&S ETC would never perform a sweep.

- EXTERNAL RISE/EXTERNAL FALL

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

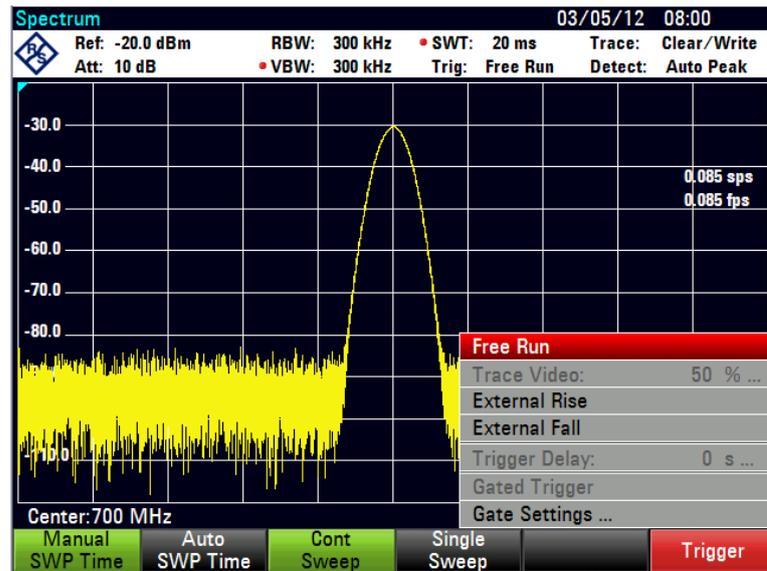
If a video trigger or an external trigger is selected, the start of measurement can be delayed with respect to the trigger event by entering a delay (DELAY). In this way, time differences between the trigger event and the measurement can be allowed for.

The current trigger setting is displayed centrally at the top of the screen (e.g. Trig: Free Run).

### Selecting the Trigger

1. Press the SWEEP key.
2. Tap TRIGGER.

The submenu for setting the trigger opens. If the default setting is selected, FREE RUN is highlighted in red. If span = 0 Hz, you can select any setting; otherwise the settings VIDEO and DELAY are in darker labeling to show that they are not available.



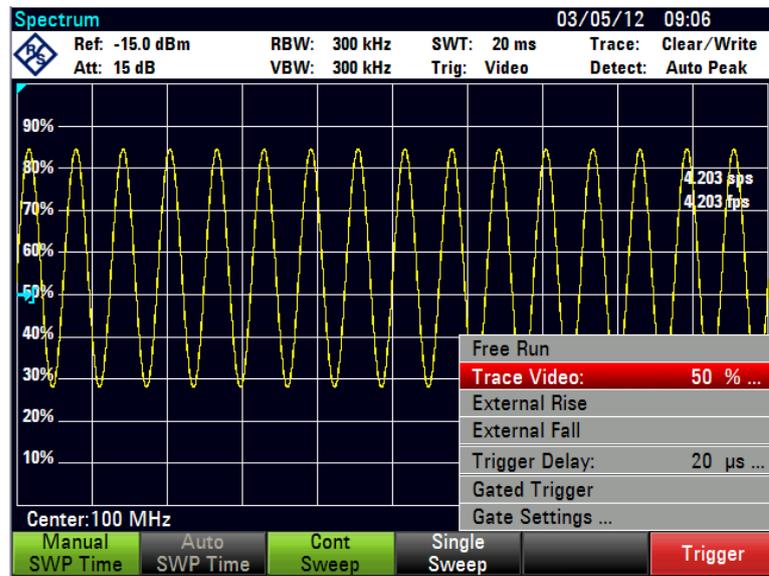
3. Select the trigger setting.

At the top of the screen, the trigger setting that has been selected is displayed.

### Setting the Video Trigger

If the VIDEO trigger setting has been selected, the trigger level and any trigger delay (DELAY) must be entered. The trigger level is expressed as a percentage (%) of the reference level. 100 % means that the trigger level equals the reference level, 50 % that the trigger level is in the middle of the y axis on the measurement diagram (default setting). The position of the video trigger on the level axis is shown by a ">".

1. Set the video trigger threshold (0 to 100 %).



2. If a trigger delay is required, tap TRIGGER.
3. Select TRIGGER DELAY.

The R&S ETC opens the value entry field for the trigger delay.



4. Set the delay.

The trigger delay range is 0 μs to 100 s.

The trigger delay resolution depends on the delay selected. The table below lists the values:

Trigger delay (DELAY)	Resolution
0 to 1 ms	10 μs
1 ms to 10 ms	100 μs
10 ms to 100 ms	1 ms
100 ms to 1 s	10 ms
1 s to 10 s	100 ms
10 s to 100 s	1 s

### 3.6 Setting the Trace

The R&S ETC provides one measurement trace and one reference trace in memory.

### Trace Modes

A variety of display modes are available:

- Clear/Write

The R&S ETC clears the old trace during a new sweep. This is the default setting.

- Average

The R&S ETC takes the level average over consecutive traces. In the default setting, averaging is on a pixel-by-pixel basis, sliding over the ten previous traces. Alternatively, you can set the number of averagings between 2 and 999. This reduces the effects of noise, for example, but has no effect on sine signals. The average mode, therefore, makes it easy to display sine signals in the vicinity of noise.

- Max Hold

The trace indicates the maximum value that has been measured up to that point in time. The Max Hold mode is only cancelled if another setting is selected and the trace pixels from the new setting cannot be compared with the trace pixels from the previous setting – for example if the span is changed. Intermittent signals in the spectrum or the maximum of fluctuating signals are easy to find with MAX HOLD.

- Min Hold

The trace indicates the minimum value that has been measured up to that point in time. The Min Hold mode is only cancelled if another setting is selected and the trace pixels from the new setting cannot be compared with the trace pixels from the previous setting – for example if the span or the center frequency is changed. With MIN HOLD, sine signals within the noise can be highlighted or intermittent signals suppressed.

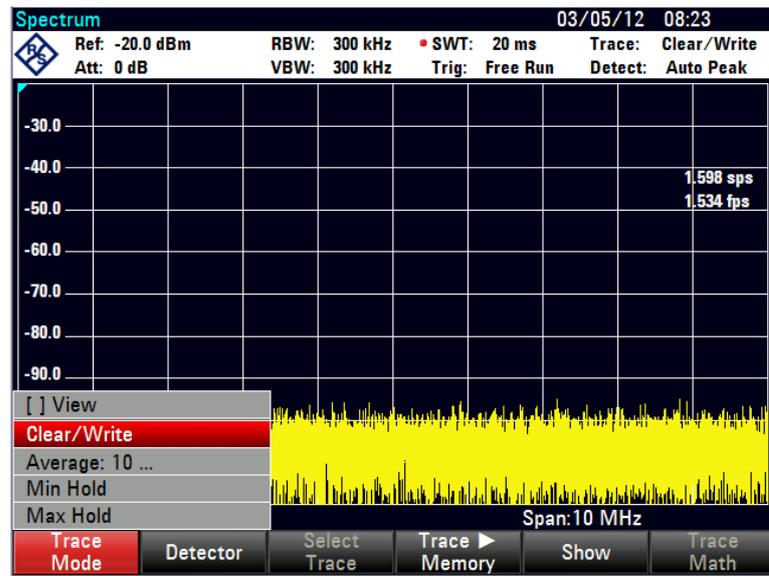
- VIEW

The R&S ETC freezes the presently displayed trace. The measurement is aborted. This, for instance, allows subsequent evaluation of spectra with the aid of the marker.

### Setting the Trace Mode

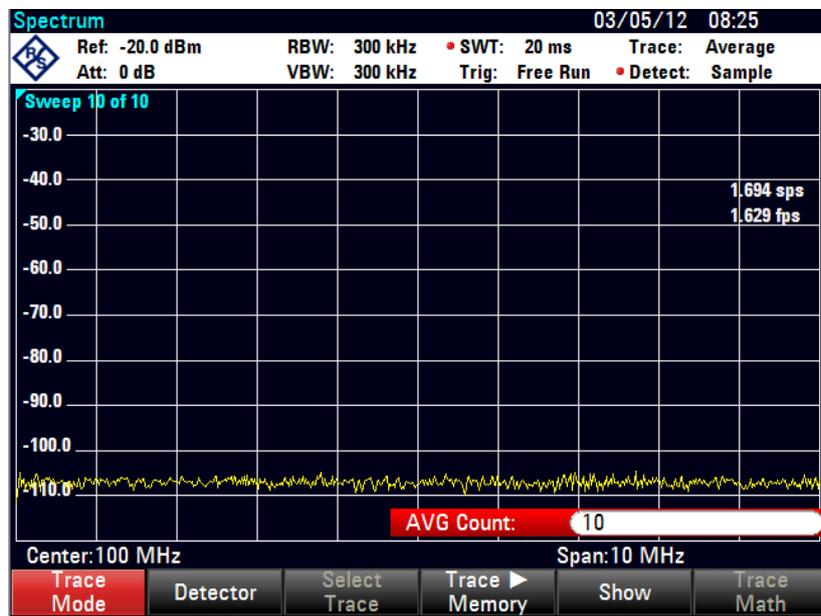
1. Press the TRACE key.
2. Tap TRACE MODE.

The submenu for setting the trace mode opens.



3. Select the trace mode  
At the top of the display, the selected trace mode is displayed.
4. If the AVERAGE trace mode is selected, the AVG COUNT entry field opens to select the number of averagings.

The R&S ETC averages the pixels of the trace across the set number of averagings.



If the sweep is continuous, the R&S ETC then performs a sliding averaging. In the single sweep mode, it performs exactly those sweeps defined with AVG COUNT and averages the traces. It then stops the sweep and displays the averaged trace.

In the VIEW trace mode, the settings used for measuring the trace are displayed. This ensures that the measurement conditions can be clearly specified in result

documentation. In the status display, it is indicated in brackets that the view mode is currently selected, e.g. TRACE MODE Maximum Hold (View).

### Available Detectors

The detector processes a spectrum analyzer's video voltage before it is displayed. The detector is pixel-oriented, i.e. it determines how the level at each pixel will be displayed. The R&S ETC always measures the whole spectrum. However, the trace only has 631 pixels in the x direction for displaying results. If a large span is selected, all the spectrum information must somehow be represented using only 631 points. Each pixel represents a frequency range equal to span/631. Four different detectors are available:

- Auto Peak

When the Auto Peak detector is selected, the R&S ETC displays the maximum and minimum level at each pixel for the frequency range in question. This means that when Auto Peak detection is selected no signals are lost. If the signal level fluctuates, as is the case with noise, the width of the trace is a measure of signal fluctuation. Auto-peak detection is the default setting.

- Max Peak

Unlike the Auto Peak detector, the Max Peak detector only finds the maximum value within the frequency range associated with one trace pixel. Its use is recommended for measurements on pulse-like signals or frequency-modulated signals.

- Min Peak

The Min Peak detector yields the minimum value of the spectrum within a pixel of the trace. Sine signals are displayed with correct level but noise-like signals are suppressed. The Min Peak detector can be used to highlight sine signals in the noise spectrum.

- Sample

The Sample detector does not "summarize" any aspect of the spectrum which is available in its complete form in the R&S ETC, but instead shows only one arbitrary measurement point within a pixel. The Sample detector should always be used for measurements with span = 0 Hz, as this is the only way of correctly representing the timing of the video signal. The Sample detector can also be used to measure noise power as noise usually has a uniform spectrum with a normal amplitude distribution. When measuring signal spectra, the sample detector can cause signals to be lost if the span is larger than the 631-fold resolution bandwidth.

- RMS

The RMS detector measures spectral power over a pixel. No matter what the signal shape, power measurements with the RMS detector always give the true power. RMS detection is recommended for power measurements on digitally modulated signals in particular. This is because the RMS detector is the only R&S ETC detector that can give stable, true power readings. Display stability can easily be obtained by increasing the sweep time, as the measurement time for the

power/pixel increases the greater the sweep time. If you are making noise measurements, for example, the trace will be highly stable if a long sweep time is selected.

However, the bandwidth occupied by the signal to be measured should at least equal the frequency covered by a trace pixel or the selected resolution bandwidth (whichever is larger). Otherwise, the power shown by the R&S ETC is too low because there are spectral components within the frequency range covered by the pixel which do not come from the signal under measurement (e.g. noise).

To obtain the true power, the video bandwidth (VBW) too should be selected to be greater than the resolution bandwidth (RBW). Otherwise, an averaging effect caused by video band limiting comes into play before the RMS value is calculated.

Both automatic operation and manual operation are available for setting the detector. In automatic operation, the R&S ETC selects the detector that is suitable for the trace mode that is set. In manual operation, the selected detector is always maintained regardless of the trace mode.

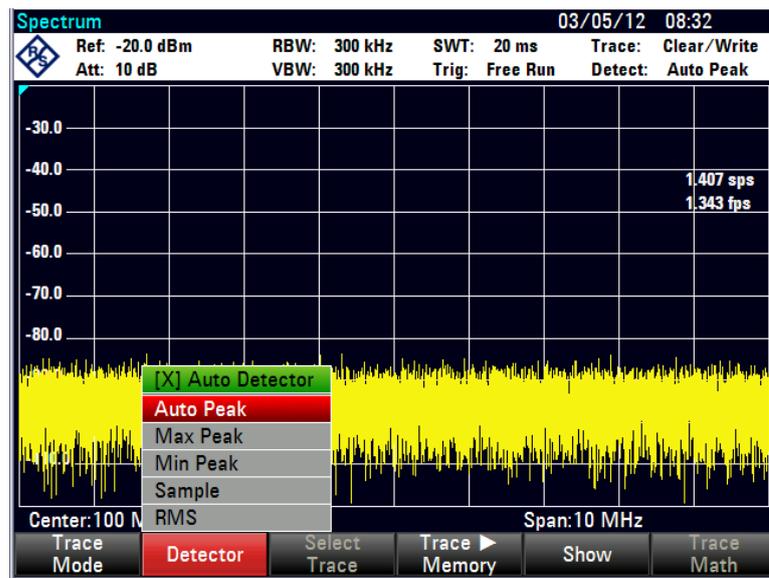
**Table 3-1: Setting of the detector in automatic operation**

Trace mode	Detector
Clear/Write	Auto Peak
Average	Sample
Max Hold	Max Peak
Min Hold	Min Peak

### Setting the Detector

1. Press the TRACE key.
2. Tap DETECTOR.

The submenu for selecting the detector opens. If automatic operation has been selected, the AUTO DETECTOR menu item is marked with X and the R&S ETC displays the detector that is set to match the trace mode that is set.



### Activating or Deactivating the Automatic Operation

3. Select AUTO DETECTOR .
4. Press the ENTER key or tap DETECTOR to activate or deactivate automatic operation.

If automatic operation is activated, the R&S ETC also sets the detector that matches the trace mode that is set.

### Setting the Detector Manually

- ▶ Select the detector.

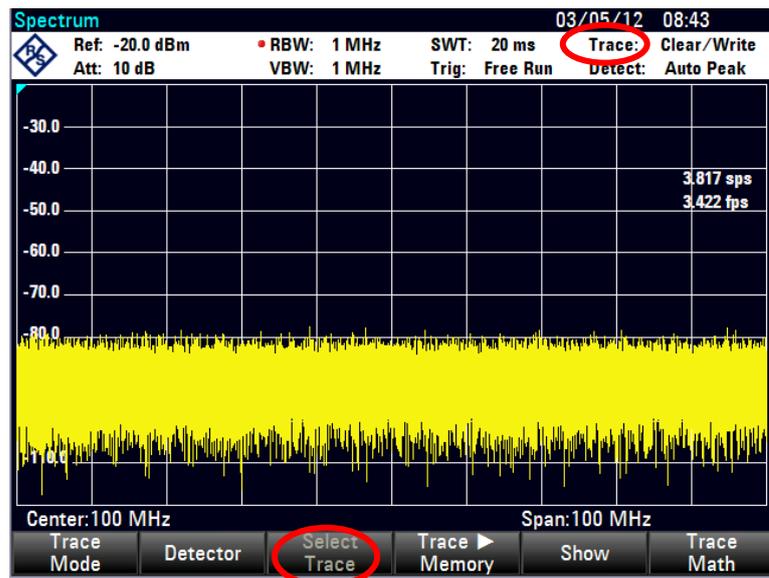
The R&S ETC switches to the selected detector and displays it in the upper right-hand area of the screen (Detect: Auto Peak). If AUTO DETECTOR is activated and a detector that does not accommodate automatic operation is set, the R&S ETC will switch automatic operation off. The detector indicator is preceded by a red-filled circle.

### Selecting the Trace

The R&S ETC can display two active traces TRACE 1 and TRACE 2 simultaneously. Each active trace is allocated a trace memory (MEMORY 1 or MEMORY 2). To establish to which measurement curve the control inputs are to refer, you must select a trace. All inputs relating to trace mode, Detector, and copying of the trace into the trace memory relate to the selected trace. In the default setting, TRACE 1 is selected for inputs.

1. Press the TRACE key.
2. Tap SELECT TRACE.

The R&S ETC switches from the entry for trace 1 to trace 2. The selected trace is shown in the upper area of the screen (trace 1/trace 2)



3. Select the settings for trace 2 (TRACE MODE/DETECTOR/TRACE > MEMORY).
4. To change the settings of trace 1, tap SELECT TRACE again.

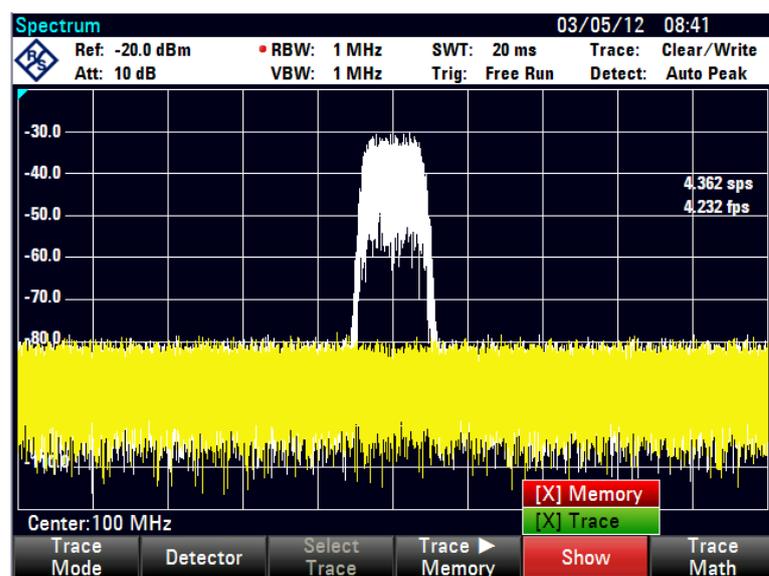
### Setting the Trace Memory

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

1. Press the TRACE key.
2. Tap TRACE -> MEMORY.

The R&S ETC transfers the selected trace (see chapter "[Selecting the Trace](#)") to the trace memory.

3. Tap SHOW.



4. Select the memory trace.

The R&S ETC displays the saved trace in white. The menu entry of the selected memory trace is marked with an X to indicate that the trace in the trace memory is being displayed.

5. To remove the selected trace from the screen:

- a) Tap SHOW again.
- b) Select the memory trace marked with X.

**Note:** The memory traces are bit-mapped into the picture memory. Therefore, when the memory trace is recalled, it will not be adapted to any modifications of the reference level or span that may have been made in the meantime. When a stored data set is called, the R&S ETC stores the associated trace in the trace memory. The stored trace can be displayed with SHOW MEMORY.

### Setting the Trace Mathematics

The R&S ETC can subtract a saved trace from the active trace and display the difference.

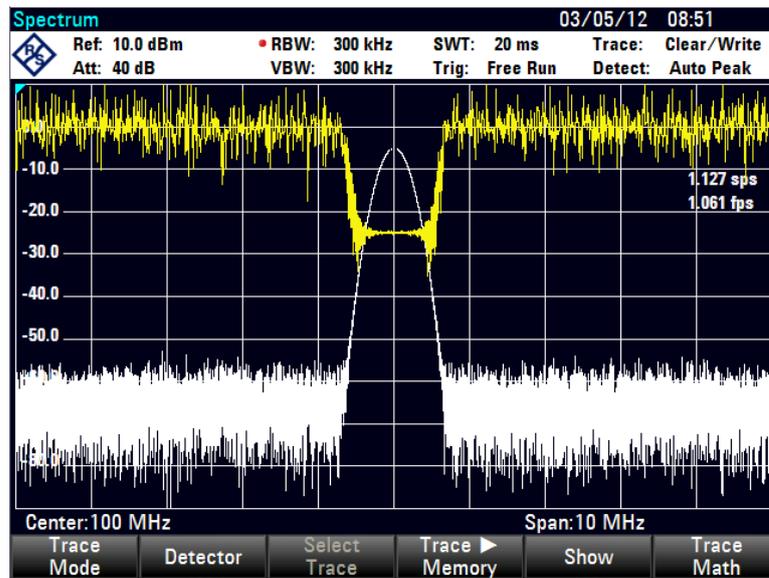
1. Press the TRACE key.
2. Tap TRACE > MEMORY.

The R&S ETC transfers the currently displayed trace to the trace memory.

3. Tap SHOW.
4. Select the memory trace.

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

5. To remove the selected trace from the screen:
  - a) Tap SHOW again.
  - b) Select the memory trace marked with X.
6. Tap TRACE MATH.
7. Select TRACE – MEM or MEM – TRACE.



The R&S ETC displays the difference between the saved trace and the active trace.

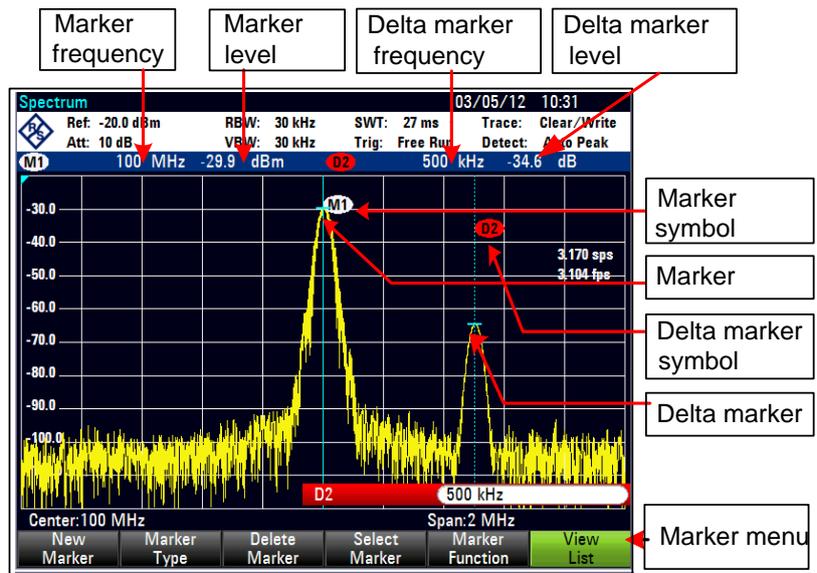
8. To remove the saved trace from the screen:
  - a) Tap TRACE MATH again.
  - b) Select OFF.

### 3.7 Using the Markers

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

The markers cannot leave the trace and indicate the frequency and level of the point they are positioned on. The frequency indicated by a marker is shown by a vertical line which extends from the top to the bottom of the measurement diagram. The numeric frequency and level readouts are displayed in the top left-hand corner of the screen. The unit is the same as the unit of the reference level.

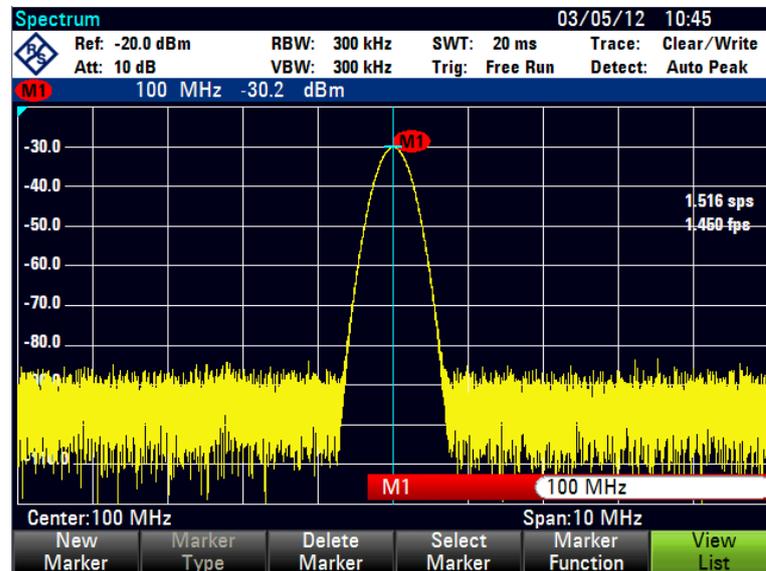
The position of the delta marker is indicated by a dashed line to distinguish it from the other marker. The delta marker level is always a level relative to the main marker level and so the delta marker level unit is always dB. The delta marker frequency is always relative to the main marker – in other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



**Controlling the Marker**

1. Press the MARKER key.

The marker menu opens. If, as yet, no marker has been activated, the main marker (MARKER) is turned on automatically and placed on the maximum level in the spectrum. The frequency and level at the point indicated by the marker are displayed at the top of the screen in the selected unit (= reference level unit). The entry field for the marker frequency opens.

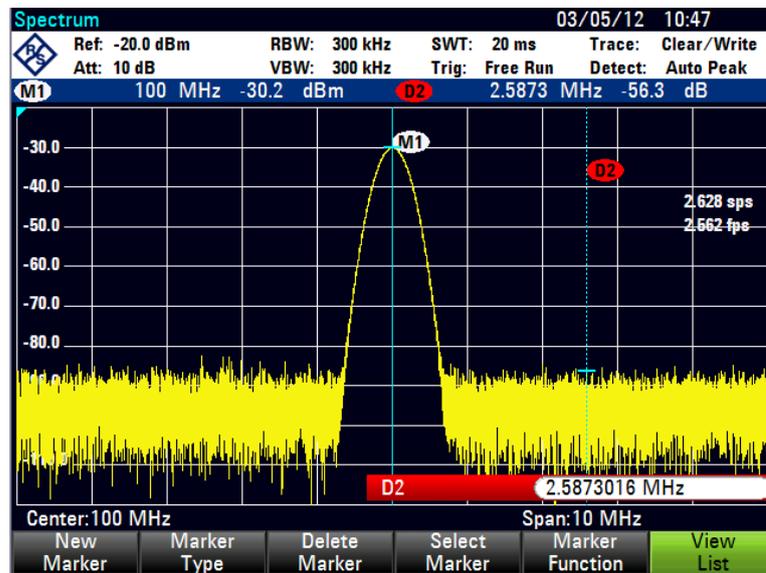


2. Set the marker position.

**Controlling the Delta Marker**

3. Press the MARKER key.
4. Tap NEW MARKER.

The R&S ETC turns on the delta marker and places it on the second largest signal on the trace. The frequency and level displayed at the top of the screen are relative to the main marker, i.e. the R&S ETC always outputs the frequency difference and the level difference between the points marked by the main marker and the delta marker. Simultaneously, the entry field for the delta marker frequency difference is opened.



- Set the delta marker position.

### Automatic Marker Positioning

The R&S ETC has functions that make setting markers easier or allow instrument settings to be made on the basis of the current marker position:

- PEAK

This function places the marker or the delta marker on the highest value of the trace. The function acts on the active marker, whose associated marker labeling is highlighted in red.

- NEXT PEAK

Relative to their current positions, this function places the active marker or the delta marker on the next highest peak of the trace.

- Minimum

The marker or delta marker is placed on the lowest value of the trace. The function acts on the active marker. When the trace is displayed in the clear/write mode, the marker is placed on the lowest maximum of the trace.

- CENTER = MRK FREQ

When this function is called, the center frequency (CENTER) is made equal to the current marker frequency or the delta marker frequency, depending on which marker is activated (menu highlighted in red). This function is particularly useful if you want to investigate a signal more closely using a smaller span. This is

accomplished by first placing the signal in the center of the span and then reducing the span.

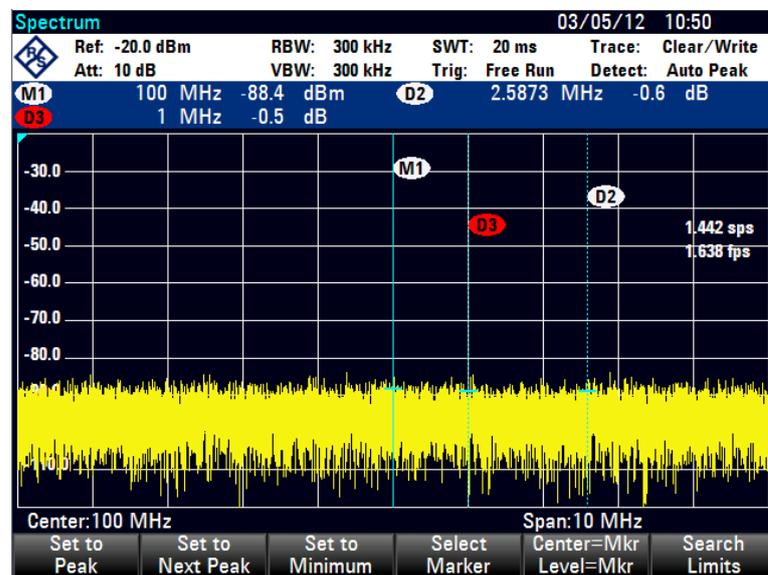
- REF LVL = MRK LVL

This function makes the level indicated by the marker the reference level. This makes it easy to optimize the R&S ETC's level display range if the levels being investigated are low.

### Using the Marker Functions

1. Press the MKR-> key.
2. Tap the menu with the desired marker function.

The R&S ETC performs the action you have selected.



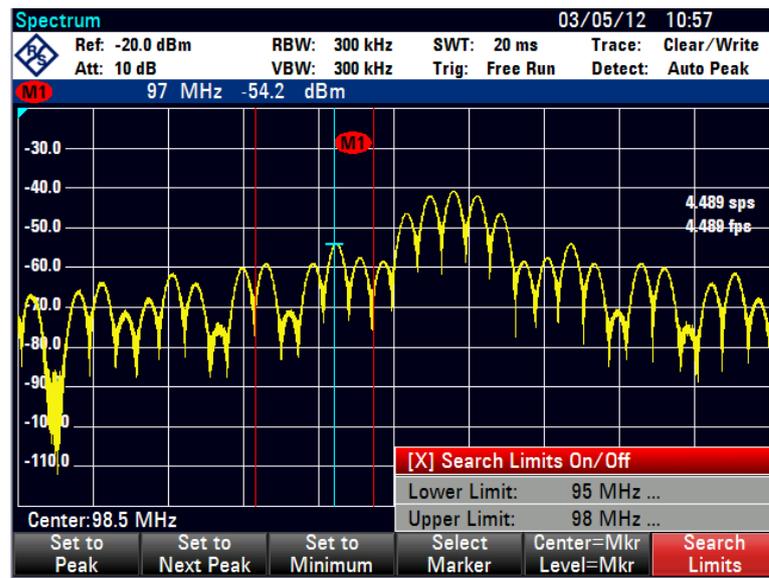
### Limiting the Search Range for the Marker Functions

The R&S ETC allows you to use only a limited section of the trace for the PEAK, NEXT PEAK and MINIMUM functions. This is beneficial, for example, if you want to sample only spurious emissions with the marker search functions and want to omit useful signals.

1. Tap SEARCH LIMITS.
2. Select SEARCH LIMITS ON/OFF.

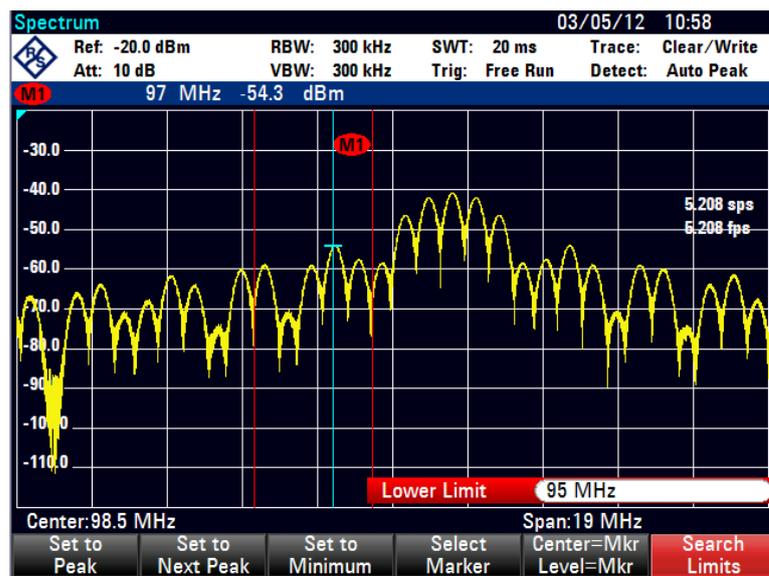
The R&S ETC activates the restricted area of the marker search range. Two vertical lines appear in the diagram to mark this area.

3. Press SEARCH LIMITS to set the start of the search range.



4. Select LOWER LIMIT.

The R&S ETC opens the entry field for the start frequency of the search range.



5. Set a start frequency.

The R&S ETC indicates the start of the search range by means of a vertical line in the diagram.

6. The procedure for entering the stop frequency for the search range is analogous to that for entering the start frequency.

### Deactivating the Marker Search Range

If a marker search range is activated, the SEARCH LIMITS menu in the MKR-> menu is highlighted in green.

1. Tap SEARCH LIMITS to deactivate the marker search range.

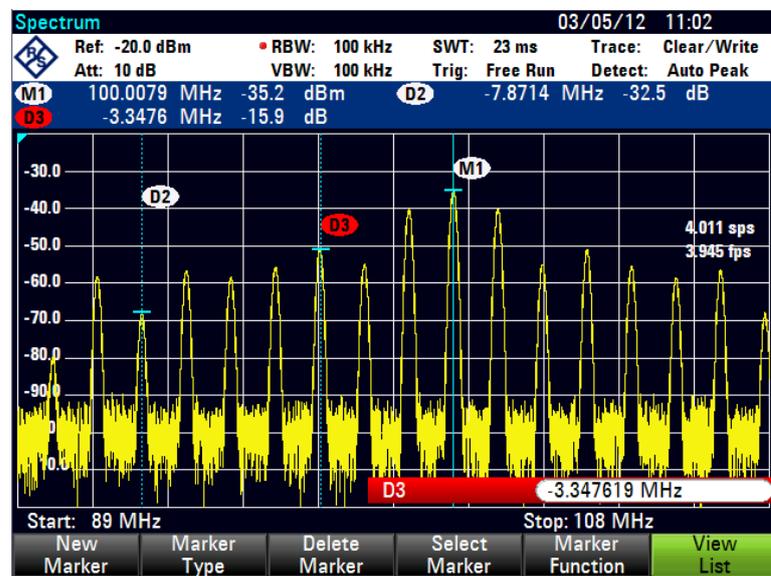
2. Select SEARCH LIMITS ON/OFF.

The SEARCH LIMITS menu is no longer highlighted.

### Using More than One Marker at a Time (Multimarker Mode)

To measure different signals in a trace, the R&S ETC has the multimarker function. Up to six different markers are available. Marker 1 measures in absolute units. Markers 2 to 6 can measure in absolute units (marker) as well as relative units (delta). The reference for delta markers is always marker 1.

1. Press the MARKER key.
2. Tap NEW MARKER several times. On each keystroke a new marker will be created and placed on the next lower signal peak.

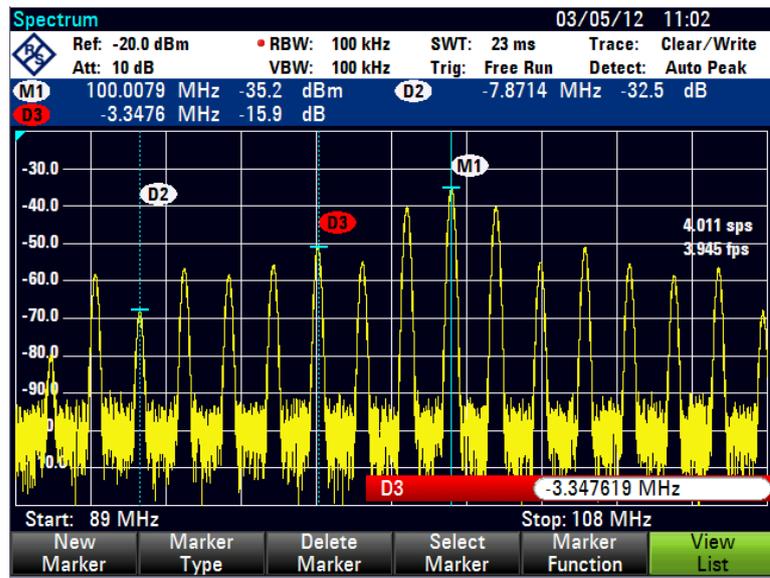


The marker designation contains the number of the marker in question (M1, D2, D3 etc.). The designation of the marker which is active for editing (= active marker) has a red background, whereas the other markers have a grey background.

As a default, new markers are created as delta markers, which means that their position is displayed relative to marker 1.

3. To transform a delta marker into a marker, press MARKER TYPE.  
The marker designation changes (e.g. D2 -> M2), and the marker position is displayed in absolute values.
4. To select a previously created marker, press SELECT MARKER repeatedly until the symbol of the desired marker is highlighted in red.

The R&S ETC opens the entry field for the frequency of the selected marker or the spacing between the delta marker and the reference marker M1.



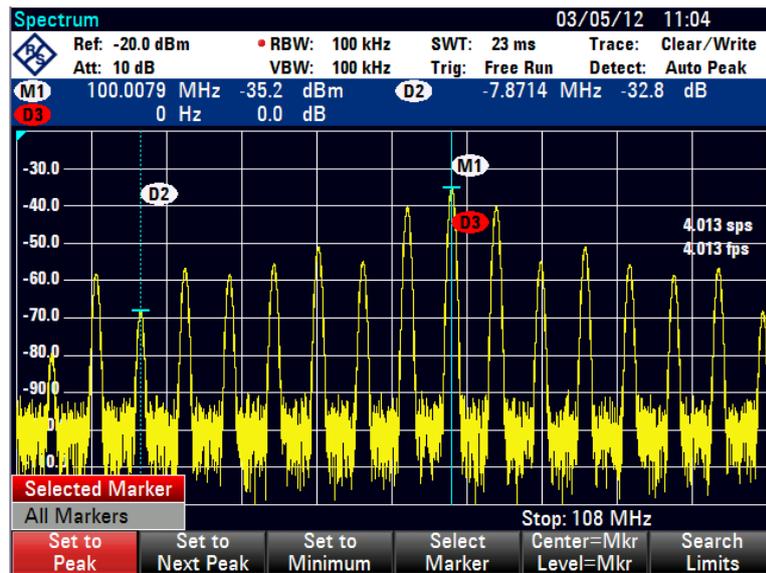
5. Set the marker or delta marker position.

**Tip:** You can first set the marker close to the desired position using the rotary knob or cursor keys (step width is 10 % of the X axis) and then fine-tune it.

The R&S ETC displays the last edited marker or delta marker (= active marker) by means of a red highlighted marker symbol. All marker functions relate to the active marker.

### Positioning the Marker Automatically

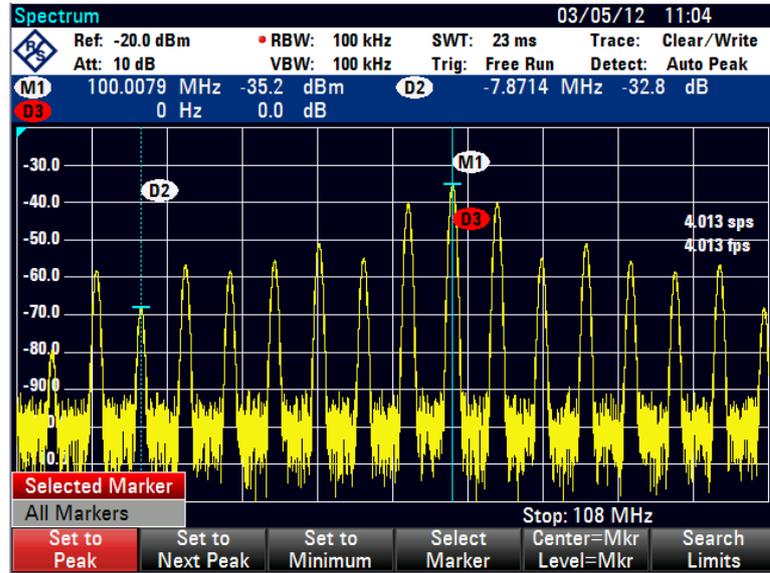
Automatic positioning of markers in multimarker mode is similar to that of the normal marker. The different functions always apply to the active marker, which is also indicated for the various functions in the MKR-> menu (example: SET TO PEAK : SELECTED MARKER).



In addition, it is possible to position all activated markers (M1 to M6) at the peak of a trace.

1. Tap SET TO PEAK.
2. Select ALL MARKERS.

The R&S ETC sets all activated markers to the maxima of the trace.

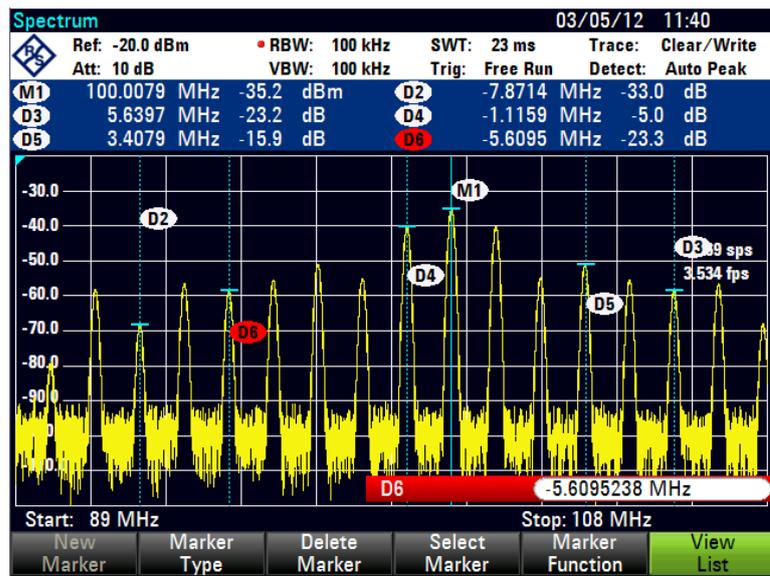


### Displaying All Multimarker Values

The R&S ETC can display a list of all activated markers and their values.

1. Tap VIEW LIST.

The R&S ETC displays a list of all activated markers and delta markers.

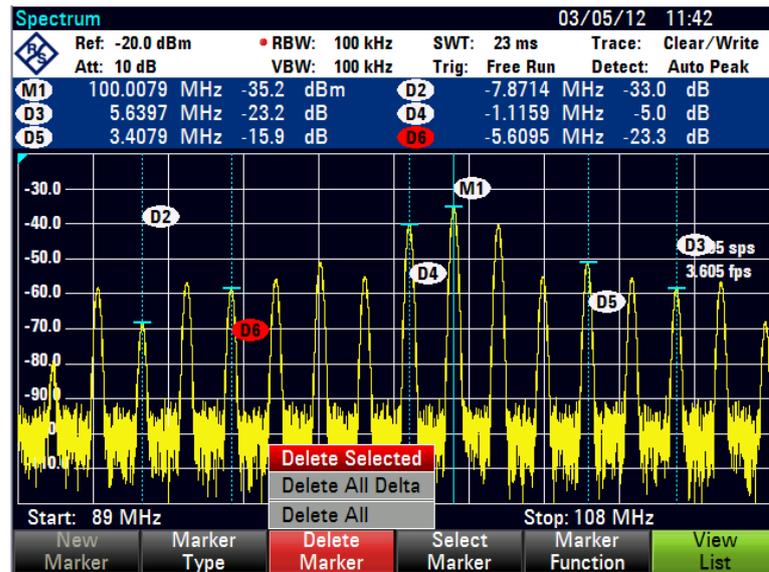


2. If you tap VIEW LIST again, the R&S ETC closes the marker table extension from marker 3 to 6.

Markers can be deactivated one at a time or all at once.

### Deactivating One Marker or Delta Marker at a Time

1. Tap SELECT MARKER repeatedly until the desired marker is highlighted in red.  
The value entry field for the selected marker appears.
2. Tap DELETE MARKER.
3. Select DELETE SELECTED.

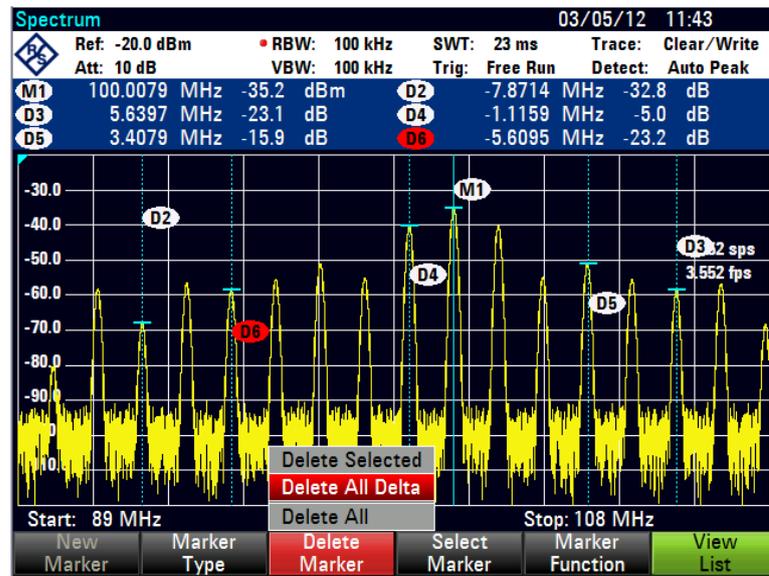


The selected marker is deleted.

**Note:** If marker 1 (M1) is deactivated, the R&S ETC also deactivates all delta markers, because they use marker 1 as a reference.

### Deactivating All Markers or Delta Markers

1. Tap DELETE MARKER.
2. Select DELETE ALL DELTA or DELETE ALL.



**Note:** When the markers are deactivated, the R&S ETC also deactivates all delta markers, because they use marker 1 as a reference.

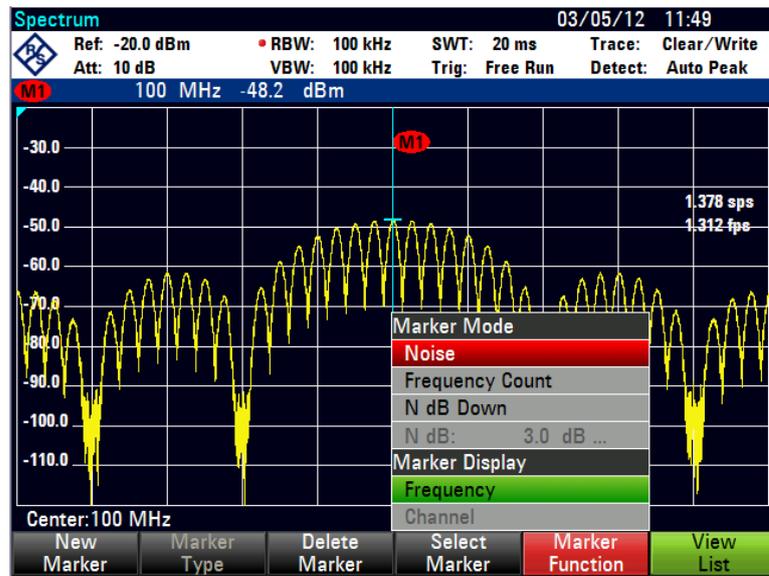
### 3.7.1 Marker Functions

Apart from displaying the level and frequency at the marker position (NORMAL setting), the R&S ETC can also perform other forms of analysis at the marker position. For example, the R&S ETC can calculate the noise power density referred to 1 Hz bandwidth (NOISE function) or measure the frequency of a signal at the marker position (FREQ COUNT function). The filter bandwidth or the signal bandwidth is measured with the N DB DOWN function.

#### Measuring the Noise Power Density

The NOISE function is used to calculate the noise power density at the marker position. The R&S ETC calculates the noise power density in dBm/(1 Hz) from the trace pixel values, the selected resolution bandwidth, the detector and the level display mode (absolute or relative). To stabilize the noise power display, the R&S ETC uses the pixel on which the marker is positioned and the four pixels to the right and the four pixels to the left of the marker pixel. Noise power density can provide useful information when measurements are made on noise or digitally modulated signals. However, valid results are obtained only if the spectrum in the vicinity of the marker has a flat frequency response. The function gives incorrect results if measurements are made on discrete signals.

1. Press the MARKER key.
2. Tap MARKER FUNCTION.



3. Select the NOISE menu item.

The R&S ETC indicates the marker level in dBm/Hz. If the delta marker is the active marker, it displays the result in dBc/Hz. The reading is referred to the main marker1.

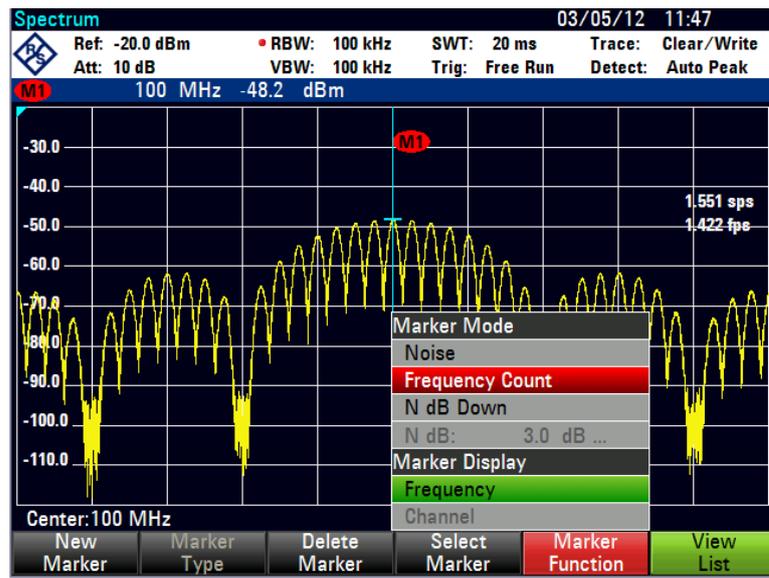
### Measuring the Frequency

The FREQUENCY COUNT function is used to measure the frequency at the marker position. The accuracy of the marker frequency readout is then no longer dependent on the pixel resolution of the trace, but only on the accuracy of the internal reference frequency.

The R&S ETC calculates the marker frequency from the center frequency, the span and the frequency of the trace pixel on which the marker is positioned. The trace has 631 pixels corresponding to 631 frequency coordinates. The frequency resolution is therefore relatively coarse – especially if a large span is set. To circumvent this problem, the R&S ETC's internal frequency counter can be used. When frequency measurements are being made, the R&S ETC briefly stops the sweep at the marker position and measures the frequency using the frequency counter. The resolution of the frequency counter is 0.1 Hz and so is considerably higher than the resolution that is obtained without the FREQUENCY COUNT function. Even though the resolution is high, frequency counting is extremely fast due to a special algorithm for the IQ baseband signal (approx. 30 ms at a resolution of 1 Hz). Basically, the accuracy of the frequency readout depends only on the accuracy of the internal reference frequency (TCXO).

The frequency counter only gives completely accurate readings for sine signals that are at least 20 dB above the noise floor. If the S/N ratio is less, noise affects the results.

1. Press the MARKER key.
2. Tap MARKER FUNCTION.



3. Select FREQUENCY COUNT.

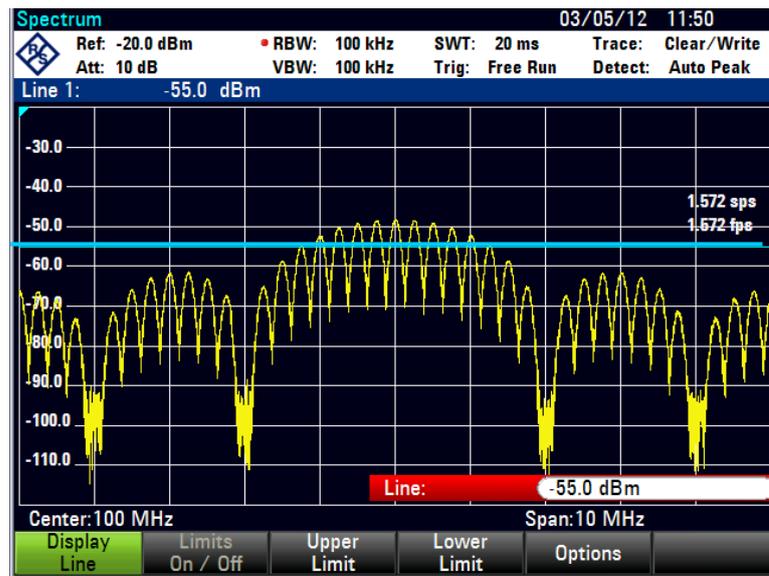
The R&S ETC displays the counted marker frequency with a resolution of 1 Hz. To indicate that the FREQUENCY COUNT function is on, the marker symbol changes from M1 to C1.

### 3.8 Using the Display Line

In addition to the markers, the R&S ETC provides a horizontal line for determining the signal level in the display.

1. Press the LINES key.
2. Tap DISPLAY LINE.

The R&S ETC displays a horizontal line across the entire diagram. The Y position of the line is indicated at the top left of the diagram (Line: -55 dBm in the diagram shown at the right).



3. Select the line position in the Y direction.

The DISPLAY LINE menu is highlighted in green and the entry field is cleared.

The position of the displayed line is pixel-oriented. The line resolution in the Y direction therefore depends on the measurement range set in the Y direction. For a display range of 100 dB, it is 0.3 dB. When the line is set with the rotary knob, the R&S ETC always uses the step width of the display resolution in the Y direction, e.g. 0.3 dB for a 100 dB level measurement range. The cursor keys, on the other hand, always move the line by 10 % of the display range in the Y direction. For fast setting of the display line, therefore set the line near the desired position with the cursor keys and then use the rotary knob for fine adjustment.

### 3.9 Using Limit Lines

Limit lines are used to set limits for level characteristics versus time or versus frequency; they must not be exceeded. For instance, the upper limits of permissible spurious or harmonics of a DUT are marked by limit lines. In the R&S ETC, the upper and lower limit value can be preset by way of limit lines. Thus, a spectrum or level characteristic in the time domain (span = 0 Hz) can be checked either visually on the screen or automatically by verifying limit violations.

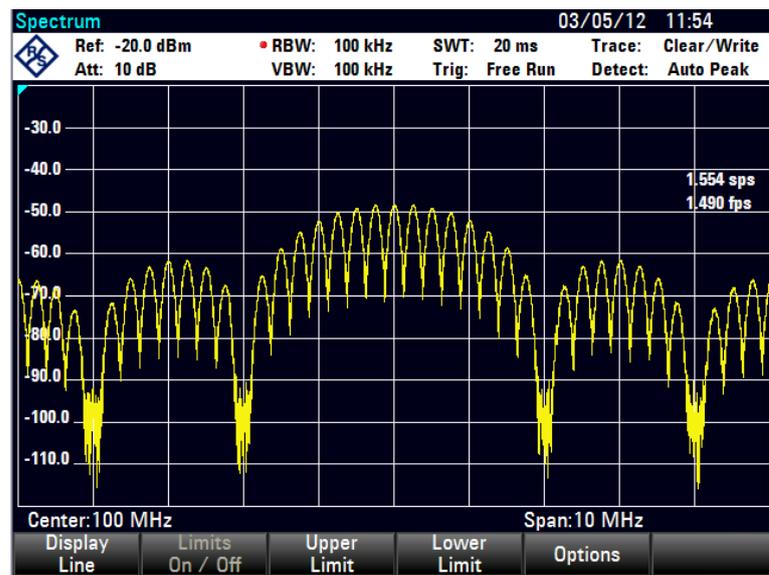
A limit line consists of at least two and at most 25 value pairs (points) on the x axis (frequency or time) and the y axis (level). The R&S ETC links the individual points by straight lines. The values on the x axis may be specified in absolute units (e.g. frequency in MHz) or relative units referenced to the center of the measured trace (e.g. center frequency). Relative units are of advantage, for instance, when modulated output signals are measured. If the center frequency is varied, the mask remains unchanged. The points on the y axis are always dB values. If the scale on the y axis is linear (unit V or W), the R&S ETC automatically switches to the respective dB unit after a limit line has been activated.

Limit lines are defined with the aid of the supplied R&S ETC View software. They are loaded into the memory of the R&S ETC via the USB or the LAN interface. About 100 limit lines can be stored simultaneously in the R&S ETC memory. The maximum number of limit lines may be reduced if transducer factors, channel tables, cable models, or data sets are stored simultaneously (see chapter "Saving and Loading Instrument Settings").

### Displaying the Limit Lines

1. Press the LINES key.

The menu for the control of limit lines is displayed.



The R&S ETC makes a distinction between upper limit lines (UPPER LIMIT) and lower limit lines (LOWER LIMIT). It checks whether a measured value is above the upper limit line or below the lower limit line. The limit lines stored in the R&S ETC can be used to mark both upper and lower limit values.

2. Tap UPPER LIMIT or LOWER LIMIT.

The R&S ETC displays a list of available limit lines. If no limit line is activated, the first value in the list is marked. If no limit lines are stored in the R&S ETC, the focus will be placed on folder "\Public\".

Select Limit Line		02/05/12 15:22		
Stat	Name	Size	Date	Time
<	\Public\Limit Lines\..			
<	\Public			
<	\Storage Card			
	DVB Emission Crit 7MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Crit 8MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Critical 7MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Critical 8MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncr 7MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncr 8MHz up to 25W.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncritical 7MHz.rellim	1 kB	23/08/2010	11:09
	DVB Emission Uncritical 8MHz.rellim	1 kB	23/08/2010	11:09
	GSM_Lower.rellim	1 kB	23/08/2010	11:09
	GSM_Upper.rellim	1 kB	23/08/2010	11:09
	My ISDB-T Limits.isdlim	1 kB	23/08/2010	11:09
	My Limit Table.dvblim	1 kB	14/11/2011	15:02
	ShAtt 7MHz critical.rellim	1 kB	23/08/2010	11:09
	ShAtt 7MHz uncritical.rellim	1 kB	23/08/2010	11:09
	ShAtt 8MHz critical.rellim	1 kB	23/08/2010	11:09
	ShAtt 8MHz uncritical.rellim	1 kB	23/08/2010	11:09
				Free: 5 MB
Select		Sort/ Show	Delete	Refresh
				Exit

The unit of the limit line and the unit currently set on the x axis must be identical.

3. To determine which lines are compatible to the current settings, display only compatible lines:

a) Press SORT/SHOW.



b) Select SHOW COMPATIBLE.

The R&S ETC will display only the limit lines which are compatible to the current instrument settings.

4. To display all lines again:

a) Press SORT/SHOW.

b) Select SHOW ALL.

The file name extension indicates whether the limit lines are assigned to absolute frequency, time or distance values (.abslim) or whether they are specified relative the center of the x axis (.rellim).

### Activating a Limit Line

1. Select the desired limit line from the list.
2. Press SELECT to activate it.

### Closing the Limit Lines List

- ▶ Tap EXIT to close the limit lines list.

After a limit line has been activated, the R&S ETC returns to the menu and the selected line is displayed in the diagram. The name and type of the limit line are also marked (UPPER LIMIT for an upper limit line and LOWER LIMIT for a lower line).



### Deactivating a Limit Line

1. Press LINES.
2. Press UPPER LIMIT or LOWER LIMIT.
3. Select DESELECT LIMIT.



All active limit lines together can be deactivated and activated again using the LIMITS ON/OFF menu.

### Measuring with Limit Lines

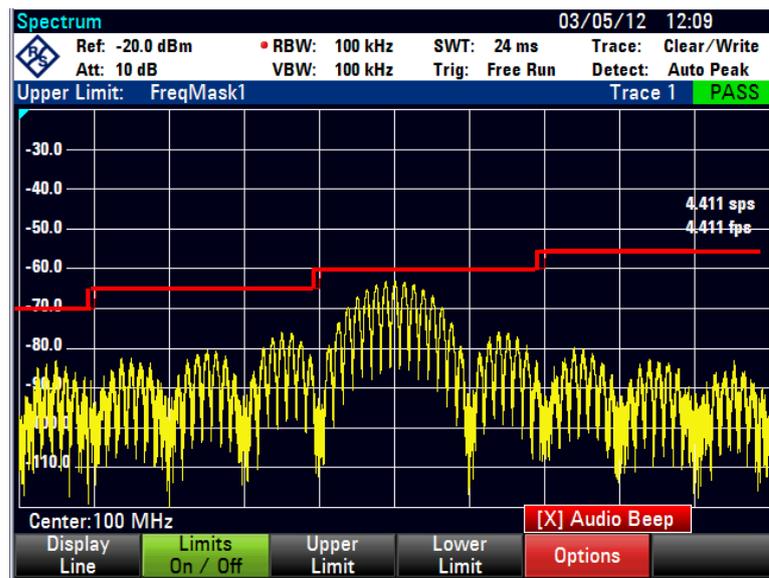
During a measurement, the R&S ETC checks the trace after each frequency sweep for upper and lower limit violations. If all measured values are within specified limits, PASS is displayed at the top in the center of the diagram. FAIL is indicated even if only a single measured value (= pixel of the trace) exceeds a limit value.

The automatic limit check can be deactivated using the LIMITS ON/OFF menu. A limit violation can also be indicated by an acoustic signal.

### Activating the Beeper

1. Tap OPTIONS.
2. Select AUDIO BEEP.

The R&S ETC outputs a beep each time a limit is exceeded.



### Definition Range

If a limit line is not defined in the entire frequency range or displayed span, a check is not performed outside the definition range.

### Saving Limit Lines

The R&S ETC stores data sets together with any limit lines that may have been active for the measurement in question. When such a data set is recalled, the associated limit lines are available too. They do however not appear in the list of limit lines.

## 3.10 Setting and Using the Measurement Functions

If you want to perform complex measurements, the R&S ETC provides measurement functions which perform certain measurement tasks with a minimum of keystrokes or, in conjunction with various accessories, will allow you to perform advanced measurements.

### 3.10.1 Measuring the Channel Power of Continuously Modulated Signals

Due to the channel power measurement function, the power of modulated signals can be measured selectively. Unlike a power meter which measures power over its whole frequency range, the channel power mode allows the power in a specific transmission channel to be measured. Other signals in the frequency spectrum have no effect on the result.

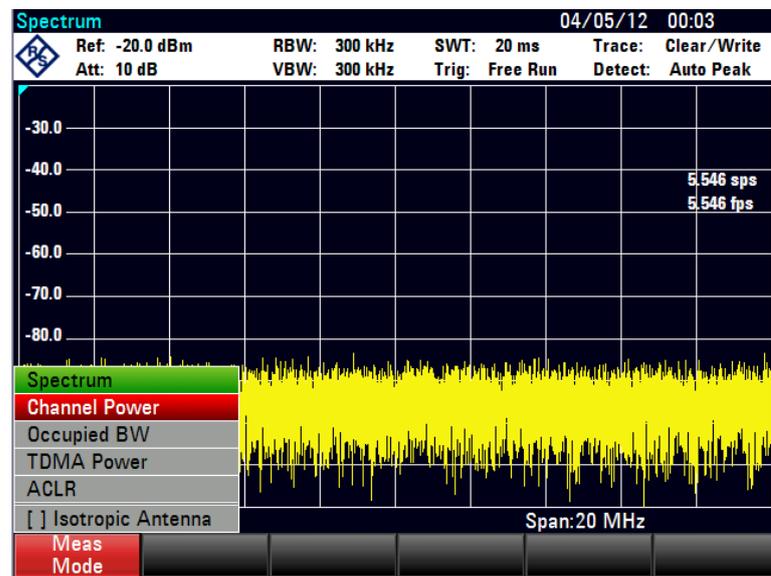
When the channel power mode is selected, the R&S ETC determines the spectrum within the channel using a resolution bandwidth that is small in comparison with the channel bandwidth. The measured values on the trace are then integrated to give the total power. The R&S ETC takes into account the selected display mode (absolute or relative), the selected detector and the resolution bandwidth, which means that the

result is comparable to the result that would have been obtained from a thermal power meter. The small resolution bandwidth acts like a narrow channel filter and so prevents out-of-channel emissions from affecting the result.

The R&S ETC has presets for the DVB-T/H, 3 GPP W-CDMA, cdmaOne and CDMA2000 1x systems and so the user does not have to enter any settings himself. However, user-defined channel settings can also be entered to set up the R&S ETC for other communications systems.

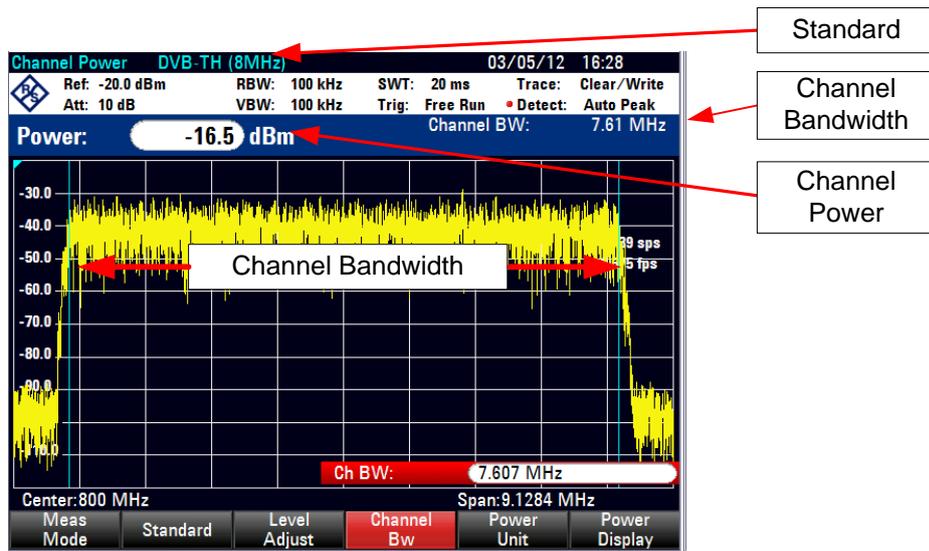
1. Press the MEAS key.
2. Tap MEAS MODE.

The submenu for selecting the measurement functions opens.



3. Select the CHANNEL POWER (CHANNEL POWER highlighted in red).

The R&S ETC displays the menu for setting the channel power measurement. Two vertical lines in the measurement diagram indicate the channel bandwidth. The measured channel power is shown in large letters above the measurement diagram.



The default setting is power measurement for 3GPP WCDMA signals which has a channel bandwidth of 3.84MHz.

**Selecting the Standard**

The R&S ETC has a channel power measurement default setting for various standards. It is also possible to define and save user-specified configurations. The generation of standards is described in the R&S ETC View software manual.

1. Tap STANDARD.

A submenu with the available standards opens.

Select Standard				
Stat	Name	Size	Date	Time
Public \Standards\..				
Public				
Storage Card				
	3GPP WCDMA.chpstd	1 kB	14/11/2011	15:02
	cdma2000 1x.chpstd	1 kB	14/11/2011	15:02
	cdmaOne.chpstd	1 kB	14/11/2011	15:02
	DVB-TH (8MHz).chpstd	1 kB	03/05/2012	16:27
	LTE (ChBw 10 MHz).chpstd	1 kB	14/11/2011	15:02
	LTE (ChBw 15 MHz).chpstd	1 kB	14/11/2011	15:02
	LTE (ChBw 1.4 MHz).chpstd	1 kB	14/11/2011	15:02
	LTE (ChBw 20 MHz).chpstd	1 kB	14/11/2011	15:02
	LTE (ChBw 3 MHz).chpstd	1 kB	14/11/2011	15:02
	LTE (ChBw 5 MHz).chpstd	1 kB	14/11/2011	15:02
	TD-SCDMA.chpstd	1 kB	14/11/2011	15:02

2. Select the desired standard.

The R&S ETC sets the selected standard. The optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard are selected automatically.

Using the supplied R&S ETC View software, additional standards can be generated and permanently loaded into the R&S ETC. You can also delete the factory-set standards provided by the R&S ETC if you do not need them. The R&S ETC then offers only the standards you require, for example for measurements on TV signals.



### Setting the Reference Level

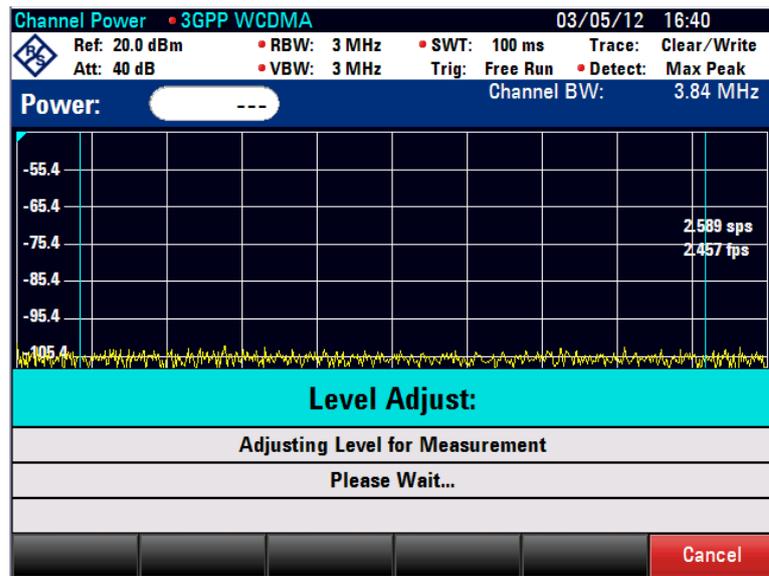
When selecting the reference level, ensure that the R&S ETC is not overdriven. As the power is measured with a resolution bandwidth that is small in comparison with the signal bandwidth, the R&S ETC may still be overdriven even though the trace is still within the measurement diagram. To prevent the R&S ETC from being overdriven, the signal can be measured at the largest resolution bandwidth possible using the peak detector. If this setting is selected, it is not possible for the trace to exceed the reference level.

To simplify operation and to prevent incorrect measurements, the R&S ETC has an automatic routine for setting the reference level.

- ▶ Tap LEVEL ADJUST.

The R&S ETC starts the measurement of the optimal reference level using a resolution bandwidth of 3 MHz, a video bandwidth of 3 MHz and the peak detector. During the measurement, the message "Adjusting level for channel power measurement, please wait..." is output.

The optimal reference level is then set.

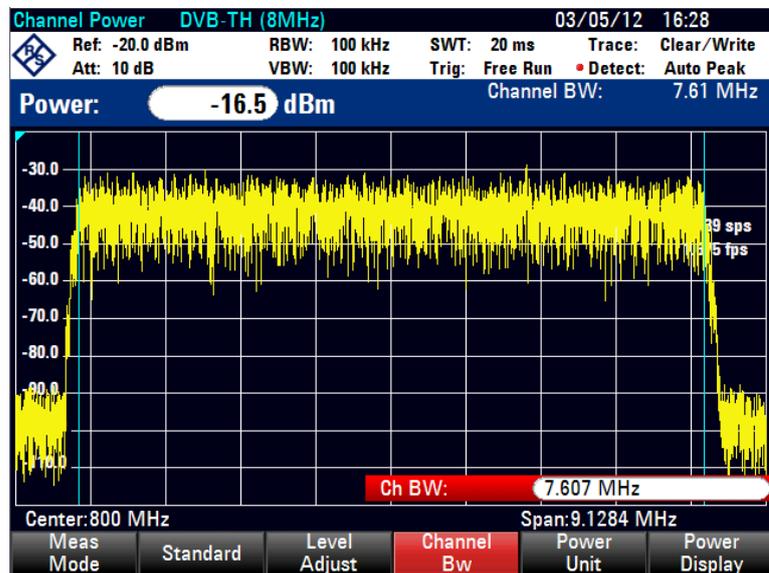


### Setting the Channel Bandwidth

The channel bandwidth specifies the frequency range about the center frequency, over which the R&S ETC performs the power measurement.

1. Tap CHAN BW.

The entry field showing the current channel bandwidth setting opens.



2. Set a new channel bandwidth.

The R&S ETC automatically sets the appropriate span for the channel bandwidth that has been entered (span = 1.2 x channel bandwidth) to ensure that no incorrect channel power measurements are made.

The minimum channel bandwidth that can be set is 833 Hz at a span of 1 kHz.

### Changing the Span

The span set by the R&S ETC yields extremely precise measurement results. However, signals in the environment of the measurement channel are no longer detectable. To enable users to see the spectrum outside the measurement channel, the span can be changed up to a factor of ten times the channel bandwidth during the channel power measurement.

1. Press the SPAN key.

The AUTO SPAN menu is highlighted in green to indicate that the optimum span for the channel power measurement is set. MANUAL SPAN is activated to allow immediate entry of another span.



2. Set a new span.

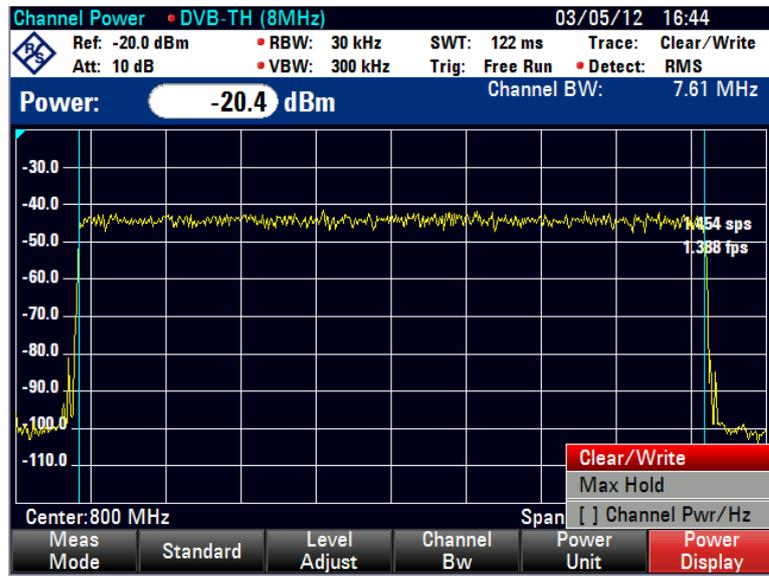
The largest permissible span for the channel power measurement is ten times the channel bandwidth. At larger spans, the result of the channel power measurement would be increasingly imprecise, because too few points of the trace occur in the channel to be measured.

3. To again set the optimum span, tap AUTO SPAN.
4. To return to the menu for channel power measurement, press the MEAS key.

### Measuring the Maximum Channel Power

If signal levels fluctuate significantly, you can define the maximum channel power by using the MAX HOLD function.

1. Tap POWER DISPLAY.

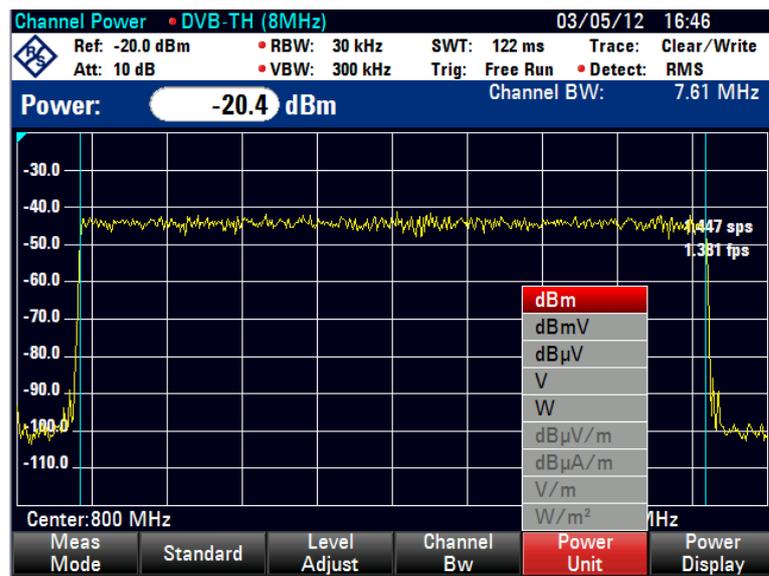


2. Select MAX HOLD.  
The power display will switch from POWER to MAX POWER.
3. To deactivate the MAX HOLD function, tap POWER DISPLAY or Select CLEAR/WRITE.  
The power display will switch from MAX POWER to POWER.

**Setting the Unit for the Power Display**

The R&S ETC can use different units for power output. The basic unit is dBm.

1. Tap PWR UNIT.  
The R&S ETC opens the submenu with the units: dBm, dBmV, dBµV, ...



2. Select the required unit.

The R&S ETC displays the power level in the selected unit.

### 3.10.2 Measuring the Adjacent Channel Power

The Adjacent Channel Power (ACP) measurement is a method to measure the power over more than one transmission channel and also evaluate the power of the adjacent (or alternate) channels of the transmission channel. The ACP performs measurements according to a specific channel configuration, e.g. a particular radio communications standard.

#### Starting the Measurement

1. Press the MEAS key.
2. Tap MEASURE.

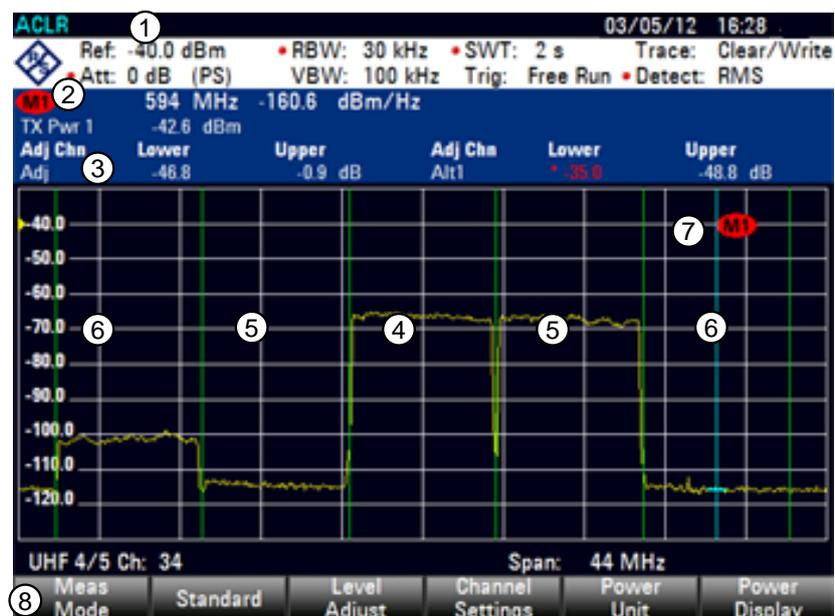
The submenu for selecting the measurement functions opens.

3. Select ACP/ACLR.

In principle, the ACP measurement works like the Channel Power measurement in that it determines the spectrum within the channel using a resolution bandwidth that is small compared to the channel bandwidth. In addition to the channel bandwidth, the ACP measurement is also defined by the channel spacing, the bandwidth of adjacent channels and the adjacent channel spacing. The R&S ETC offers measurements on up to 12 carrier channels and 12 adjacent channels to either side of the carrier. When measuring more than one carrier or adjacent channels, the R&S ETC shows the powers of each channel in a list below the marker list. The channel itself is marked by red (transmission channels) or green (adjacent channels) vertical lines.

#### Screen Layout for Adjacent Channel Power Measurements

- ① Standard
- ② Marker information
- ③ Channel information
- ④ TX channel (green line)
- ⑤ Adj channel (green line)
- ⑥ Alt channel (green line)
- ⑦ Marker (blue line)
- ⑧ ACP menu



The predefined standards are the same as for Channel Power measurements (3GPP WCDMA, cdmaOne and CDMA2000 1x systems). However, you can also customize the settings to set up the R&S ETC for other radio communication standards. You can define the settings directly on the R&S ETC or define and manage them using the R&S ETC View software.

When customizing settings, make sure to consider the following points to get valid and accurate measurement results.

### Reference Level

Make sure not to overload the R&S ETC as the power is measured with a resolution bandwidth that is small in comparison with the signal bandwidth. As with Channel Power measurements, use the LEVEL ADJUST menu in the MEAS menu to automatically set the reference level to an optimal level.

### Setting the Span

The frequency span must at least cover the carriers and the adjacent channels plus a measurement margin of about 10% to get valid results.



If the frequency span is too large in comparison to the channel bandwidth (or the adjacent-channel bandwidths) being examined only a few points on the trace are available per channel. This reduces the accuracy of the waveform calculation for the channel filter used, which has a negative effect on the measurement accuracy. It is therefore strongly recommended that the formulas mentioned be taken into consideration when selecting the frequency span

If the span is automatically calculated by the R&S ETC with the AUTO SPAN menu, the span is calculated as follows:

$$(\text{No. of transmission channels} - 1) \times \text{transmission channel spacing} + 2 \times \text{transmission channel bandwidth} + \text{measurement margin}$$

The measurement margin being approx. 10% of the value obtained by adding the channel spacing and the channel bandwidth.

### Setting the Resolution Bandwidth

The RBW should not be too high or too small to get both an acceptable measurement speed and a suppression of spectral components outside the channels. As a rule of thumb, it is recommended to set it to about 1% to 4% of the channel bandwidth.

A larger resolution bandwidth can be selected if the spectrum within the channel to be measured and around it has a flat characteristic. In the standard setting, e.g. for standard cdmaOne at an adjacent channel bandwidth of 30 kHz, a resolution bandwidth of 30 kHz is used. This yields correct results since the spectrum in the neighborhood of the adjacent channels normally has a constant level. For standard NADC/IS136 this would not be possible, for example, since the spectrum of the transmit signal penetrates into the adjacent channels and a too large resolution

bandwidth causes a too low selection of the channel filter. The adjacent-channel power would thus be measured too high.

If the RBW is automatically calculated by the R&S ETC with the AUTO RBW menu, the RBW is calculated as follows:

$$RBW \leq 1/40 \text{ of channel bandwidth}$$

The R&S ETC then selects the maximum possible resolution bandwidth resulting from the available RBW steps (1, 3) is selected.

### Setting the Video Bandwidth

To obtain correct power measurements, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). Therefore, the VBW should be at least three times the RBW.

If the RBW is automatically calculated by the R&S ETC with the AUTO VBW menu, the RBW is calculated as follows:

$$VBW \geq 3 \times RBW$$

The R&S ETC then selects the smallest possible VBW with regard to the available step size will be selected.

### Selecting the Detector

It is best to use the RMS detector. This detector correctly indicates the power irrespective of the characteristics of the signal to be measured. The whole IF envelope is used to calculate the power for each measurement point. The IF envelope is digitized using a sampling frequency which is at least five times the resolution bandwidth which has been selected. Based on the sample values, the power is calculated for each measurement point using the following formula:

$$P_{RMS} = \sqrt{\frac{1}{N} \cdot \sum_{i=1}^N s_i^2}$$

with

$s_i$  = linear digitized video voltage at the output of the A/D converter

N = number of A/D converter values per measurement point

PRMS = power represented by a measurement point

When the power has been calculated, the power units are converted into decibels and the value is displayed as a measurement point.

In principle, the sample detector would be possible as well. Due to the limited number of measurement points used to calculate the power in the channel, the sample detector would yield less stable results.

### Loading Predefined Standards

The R&S ETC already comes with several predefined standards when it is shipped. It is also possible to create a new standard and permanently store it on the R&S ETC via the R&S ETC View software.

1. Tap STANDARD.

A dialog box with all available standards opens.



2. Select the desired standard.

The R&S ETC sets the selected standard. The optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard are selected automatically.

### Creating Standards with the R&S ETC View Software

Using the R&S ETC View software, additional standards can be generated and permanently loaded into the R&S ETC. You can also delete the factory-set standards provided by the R&S ETC if you do not need them. The R&S ETC then offers only the standards you require, for example for measurements on TV TDMA signals.

Refer to the R&S ETC View software manual for details on the software functionality.

### Setting the Number of Channels

1. Tap CHANNEL SETTINGS.
2. Select TX CHANNELS.



3. Set the number of transmission channels.
4. Select ADJ CHANNELS.



- Set the number of adjacent/alternate channels.

The borders of Tx channels are displayed red in the trace diagram, the borders of adjacent and alternate channels are displayed green.

### Setting the Channel Bandwidth

The channel bandwidth specifies the frequency range about the center frequency, over which the R&S ETC performs the power measurement.

- Tap CHANNEL BW.

The entry field showing the current channel bandwidth setting opens.

TX / ACP Channel Bandwidth	
<b>TX</b>	14 kHz
Adj	14 kHz
Alt1	14 kHz
Alt2	14 kHz
Alt3	14 kHz
Alt4	14 kHz
Alt5	14 kHz
Alt6	14 kHz
Alt7	14 kHz
Alt8	14 kHz
Alt9	14 kHz
Alt10	14 kHz
Alt11	14 kHz

Exit

- Set a new channel bandwidth.

The R&S ETC automatically sets the appropriate span for the channel bandwidth according to the criteria described above to ensure that no incorrect channel power measurements are made.

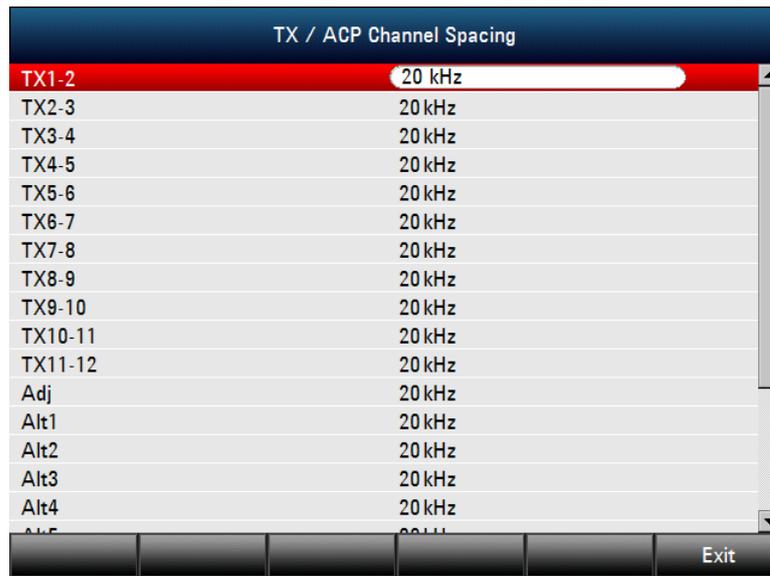
### Setting the Channel Spacing

In case of the R&S ETC, the channel spacing is defined as the distance between the center frequency of the transmission channel and the center frequency to the next transmission channel or the distance between the center frequency of the transmission channel and the center frequency of the adjacent channel.



Note that some radio communication standards, e.g. CDMA2000 DS/MC1/MC3 and IS95 B/C, IS97 B/C, IS98 B/C, define the channel spacing differently, namely the distance from the center of the transmission channel to the closest border of the adjacent channel. The R&S ETC does not consider these specifics. It always regards the channel spacing as the distance between the center of a channel and the center of its neighboring channel.

1. Tap CHANNEL SETTINGS.
2. Select CHANNEL SPACING.  
The R&S ETC opens a dialog box to define the spacings for all transmission channels and adjacent/alternate channels.
3. Select the transmission or adjacent channel you want to change the spacing for.
4. Set the channel spacing.



5. Tap EXIT to exit the dialog box.

The R&S ETC takes the new values into account for future measurements.

When performing measurements on multi-carrier signals, you can define the spacing of the transmission (Tx) channels to one another. By default, the R&S ETC assumes equal spacing between all Tx channels in the system. Therefore, the spacing you enter for the first two Tx channels is automatically applied to all other Tx channels.

If you do measurements on systems with a different channel spacing for each Tx channel, you can also set the channel spacing for each Tx channel separately by entering the respective number in the fields.

If the spacings are not equal, the channel distribution according to the center frequency is as follows:

- Odd number of TX channels  
The middle TX channel is centered to center frequency.
- Even number of TX channels  
The two TX channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

Adjacent or alternate channel spacing is also available for single-carrier measurements. The R&S ETC can perform measurements on up to 12 adjacent channels. Usually the first adjacent channel to the Tx channel is referred to as the Adjacent Channel (ADJ). All others are called Alternate Channels (ALT1 to ALT11).

By default, the R&S ETC assumes that the distance of the adjacent channels to each other is the same. In that case, you only have to enter the first spacing value. The R&S ETC then calculates all higher adjacent channels from that value. If you change the spacing of one of the higher channels, the R&S ETC only updates the channel spacings above the one you have changed, but not those below.

So, for example, if you set the first adjacent channel spacing (ADJ) to 20 kHz, the following spacings are 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), 100 kHz (ALT4), 120 kHz (ALT5) and so on.

If you then change the spacing of the third alternate channel (ALT3) to 100 kHz, the R&S ETC adjusts the alternate channels above the third one accordingly: 125 kHz (ALT4), 150 kHz (ALT5) and so on.

### Normalization of Measurement Results

By default, the power of the channels and adjacent channels is displayed in the unit dBm. It is also possible to display the power density of the signal to, for example, measure the signal/noise power density or obtain the signal to noise ratio.

1. Tap CHANNEL SETTINGS.
2. Select CHANNEL PWR/HZ to activate normalization.

The R&S ETC changes the unit from dBm to dBm/Hz.

The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:

$$\text{channel power density} = \text{channel power} - \log_{10}(\text{channel bandwidth})$$

### Displaying Absolute and Relative Results

You can set up the result display to either show the absolute power of the adjacent channels or the power relative to one of the transmission channels.

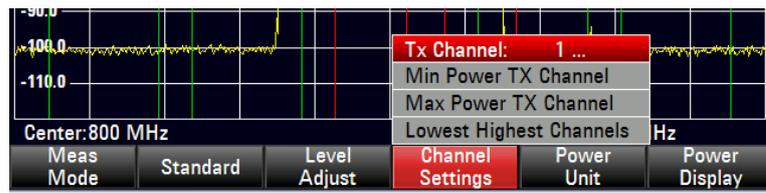
1. Tap POWER DISPLAY.
2. Select the item:
  - ABSOLUTE to display the absolute results.
  - RELATIVE to display the power relative to one of the transmission channels.

### Selecting the Reference Channel

When determining relative power values for the adjacent channels, you can set a specific transmission channel as the reference channel.

1. Tap CHANNEL SETTINGS.
2. Select ACP/ACLR REF SETTING.

The R&S ETC opens another submenu to select the reference channel.



3. Select the method of determining the reference channel.

The following methods are available:

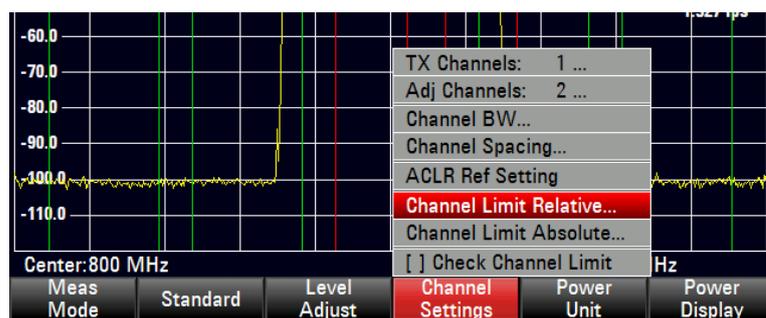
- TX CHANNEL  
Select a specific transmission channel by entering its number as the reference.
- MIN POWER TX CHANNEL  
The channel with the lowest power level is the reference channel.
- MAX POWER TX CHANNEL  
The channel with the highest power level is the reference channel.
- LOWEST HIGHEST CHANNEL  
The outer left-hand transmission channel is the reference channel for the lower adjacent channels. The outer right-hand transmission channel is the reference channel for the upper adjacent channels.

### 3.10.2.1 Using Limit Lines

Limit checks in the ACP measurement are independent of limit line handling. You can define a limit for each of the adjacent channels. Limits for adjacent channels can be set either in absolute or relative terms.

#### Defining Relative Limits

1. Tap CHANNEL SETTINGS.



2. Select CHANNEL LIMIT RELATIVE.

The R&S ETC opens a dialog box to define the relative limits for each adjacent channel.

Channel Limit Relative	
<input checked="" type="checkbox"/> Adj	0.0 dB
<input checked="" type="checkbox"/> Alt1	-10.0 dB
<input type="checkbox"/> Alt2	0.0 dB
<input checked="" type="checkbox"/> Alt3	0.0 dB
<input type="checkbox"/> Alt4	0.0 dB
<input type="checkbox"/> Alt5	0.0 dB
<input type="checkbox"/> Alt6	0.0 dB
<input type="checkbox"/> Alt7	0.0 dB
<input type="checkbox"/> Alt8	0.0 dB
<input type="checkbox"/> Alt9	0.0 dB
<input type="checkbox"/> Alt10	0.0 dB
<input type="checkbox"/> Alt11	0.0 dB

Select      Exit

- Select the channel.  
The channel turns green and the check box in the first column is marked.
- Set the limit value.  
The R&S ETC automatically activates the check flag, so that the limit is included in future limit checks.
- To deactivate the limit check for a specific channel, deselect it.

### Defining Absolute Limits

- Tap CHANNEL SETTINGS.
- Select CHANNEL LIMIT ABSOLUTE.  
The R&S ETC opens a dialog box to define the absolute limits for each adjacent or alternate channel.

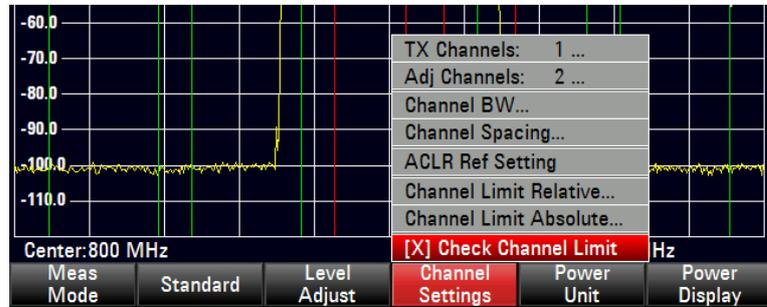
Channel Limit Absolute	
<input checked="" type="checkbox"/> Adj	-40.0 dBm
<input type="checkbox"/> Alt1	-45.6 dBm
<input type="checkbox"/> Alt2	0.0 dBm
<input type="checkbox"/> Alt3	0.0 dBm
<input type="checkbox"/> Alt4	0.0 dBm
<input type="checkbox"/> Alt5	0.0 dBm
<input type="checkbox"/> Alt6	0.0 dBm
<input type="checkbox"/> Alt7	0.0 dBm
<input type="checkbox"/> Alt8	0.0 dBm
<input type="checkbox"/> Alt9	0.0 dBm
<input type="checkbox"/> Alt10	0.0 dBm
<input type="checkbox"/> Alt11	0.0 dBm

Select      Exit

- The further procedure of defining absolute limits is analogous to that of [Defining Relative Limits](#).

### Performing a Limit Check

- Tap CHANNEL SETTINGS.



- Select CHECK CHANNEL LIMITS.

The R&S ETC automatically performs limit checks. The results of the limit check are displayed in the table above the trace. If a result fails the limit check, it turns red and has a star (\*) in front of its power level.

Power 1 (r)	-91.6 dBm				
Adj Chn	Lower	Upper	Adj Chn	Lower	Upper
Adj	* 0.2	-0.7 dB	Alt1	* -0.8	* -1.4 dB

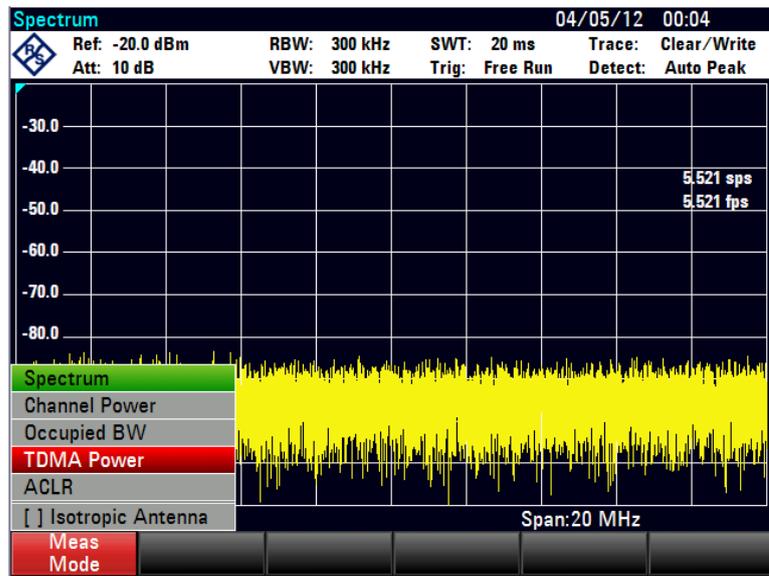
### 3.10.3 Power Measurements on TDMA Signals

When TDMA (time division multiple access) methods are used, e.g. for GSM, several users share a channel. Each user is assigned a period of time or timeslot. The R&S ETC's TDMA POWER function measures the power over one of these timeslots. This is a time-domain measurement (span = 0 Hz). The power measurement is started on an external trigger or the internal video trigger. The power measurement time is selected with MEAS TIME.

To prevent incorrect power measurements in the time domain, ensure that the whole signal lies within the selected resolution bandwidth. If the resolution bandwidth is too narrow, the displayed power will be lower than the current power.

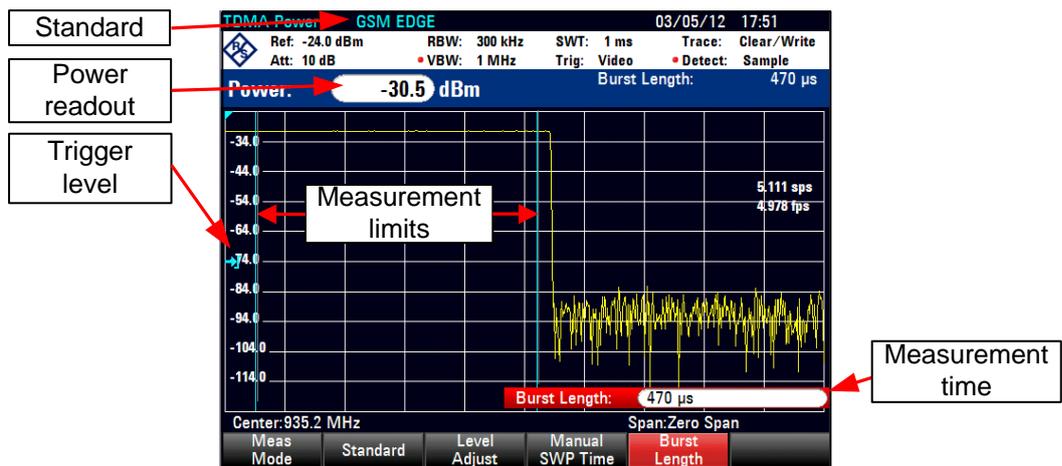
- Press the MEAS key.
- Tap MEAS MODE.

The measurement function menu will open.



3. Select TDMA POWER.

The R&S ETC will display the menus for configuring time-domain power measurements.



### Selecting a Standard

When the function is activated, the R&S ETC automatically selects the GSM/EDGE standard. All default settings are selected so that power measurements on GSM or EDGE bursts give true readings. The generation of standards is described in the R&S ETC View software manual.

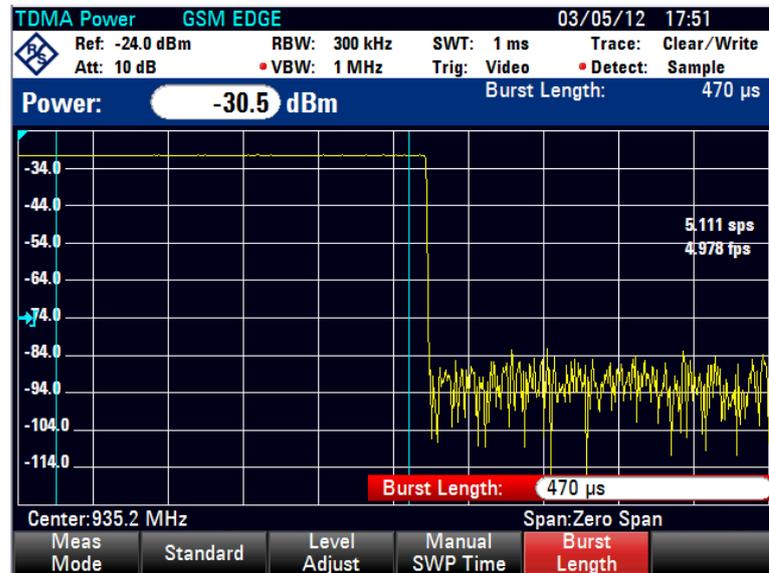
Using the supplied R&S ETC View software, additional standards can be generated and permanently loaded into the R&S ETC. You can also delete the factory-set standards provided by the R&S ETC if you do not need them. The R&S ETC then offers only the standards you require.

### Setting the Burst Length

The burst length is the measurement time over which the R&S ETC performs a power measurement. A value less than or equal to the sweep time can be selected.

1. Tap BURST LENGTH.

The entry field displaying the current measurement time opens.



2. Set a new measurement time.

If the measurement time you have entered is greater than the sweep time, the R&S ETC sets a burst length equal to the sweep time. If you want to set a longer measurement time, you must increase the sweep time first.

The minimum measurement time is at least one pixel of the sweep time. (= sweep time/631).

### Optimizing the Reference Level

To obtain the greatest possible dynamic range for burst signals, the lowest reference level possible must be set. If this is not done, the R&S ETC will be overdriven by the measurement signal, if its maximum level exceeds the maximum reference level. Because the R&S ETC's resolution bandwidths are implemented digitally after the A/D converter, depending on the resolution bandwidth selected, the signal level at the A/D converter can be higher than the level indicated by the trace. To prevent the A/D converter from being overdriven, the signal must be measured with the largest resolution bandwidth (3 MHz) and video bandwidth (3 MHz) with the peak detector. The trace maximum then determines the optimal reference level.

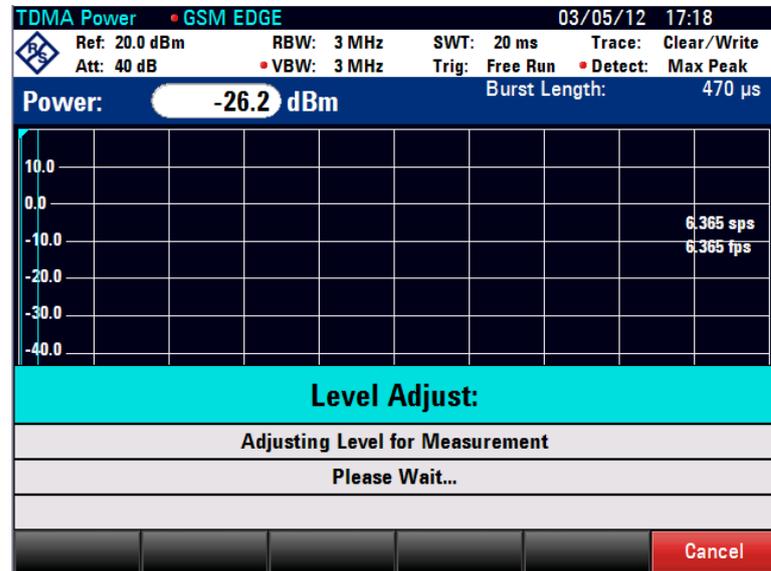
The R&S ETC's LEVEL ADJUST routine will automatically determine the optimal reference level for you.

- ▶ Tap LEVEL ADJUST.

The R&S ETC starts the measurement to determine the optimal reference level, using a resolution bandwidth of 3 MHz, a video bandwidth of 3 MHz and the peak

detector. While the measurement is in progress, the R&S ETC outputs the message "Adjusting level for measurement, please wait...".

The optimal reference level is then set.



### Power Readout

The R&S ETC displays the measured power and the selected burst length above the measurement diagram.

### Trigger Settings

A trigger is usually required to perform power measurements on bursts. In the default setting, the R&S ETC is configured to use the video trigger at 50 % of the Y scale on the measurement diagram. Assuming that the burst on which the measurement is to be made crosses the 50 % point of the trigger, the R&S ETC will trigger on the rising edge of the burst.

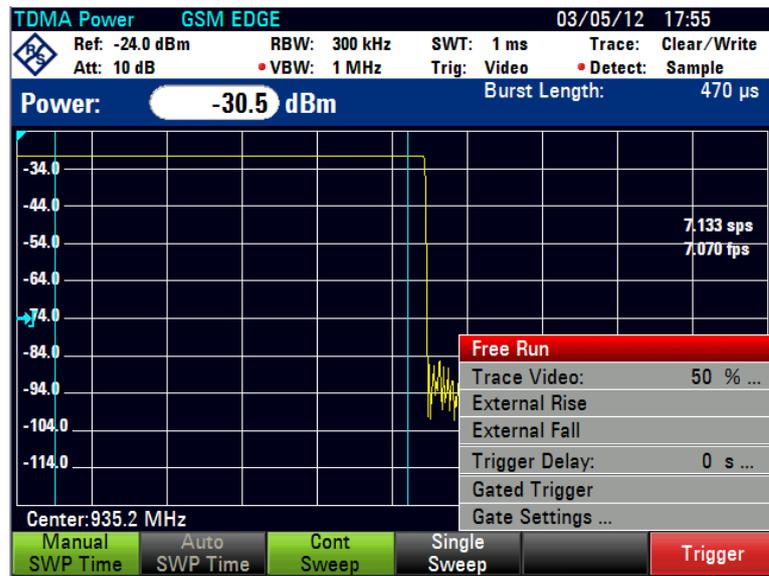
Should this not be the case, the trigger level must be adjusted so that the R&S ETC is triggered by the burst edge. Otherwise no measurement will be performed.

If the DUT has a trigger facility, the external trigger can also be used for the measurement.

### Selecting the Trigger

Measuring with an external trigger signal requires the following steps.

1. Connect the DUT's trigger output to the R&S ETC's trigger input.
2. Press the SWEEP key.
3. Tap TRIGGER.



4. Select EXTERNAL RISE or EXTERNAL FALL (rising or falling edge).

#### Selecting the Trigger Delay

Select the appropriate trigger delay to position the burst in the measurement window.

1. Tap TRIGGER.
2. Select TRIGGER DELAY.
3. Adjust the trigger delay until the TDMA burst is inside the vertical lines indicating the measurement range.

#### Selecting the External Trigger Input

The BNC female labeled Ext Trig/Ext Ref on the left-hand side of the R&S ETC can be used either as an input for an external trigger signal or as an input for an external 10 MHz reference signal. It must be configured as an external trigger input. Use the setup menu to configure the input accordingly.

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.

The R&S ETC opens a selection list of general settings.

Hardware	
Auto Accessory Detection	On
Detected Accessory	
BNC 1	Trigger Input
BNC 2	TS-ASI Output

3. Select BNC MODE.  
A selection list opens.
4. Select TRIGGER INPUT.

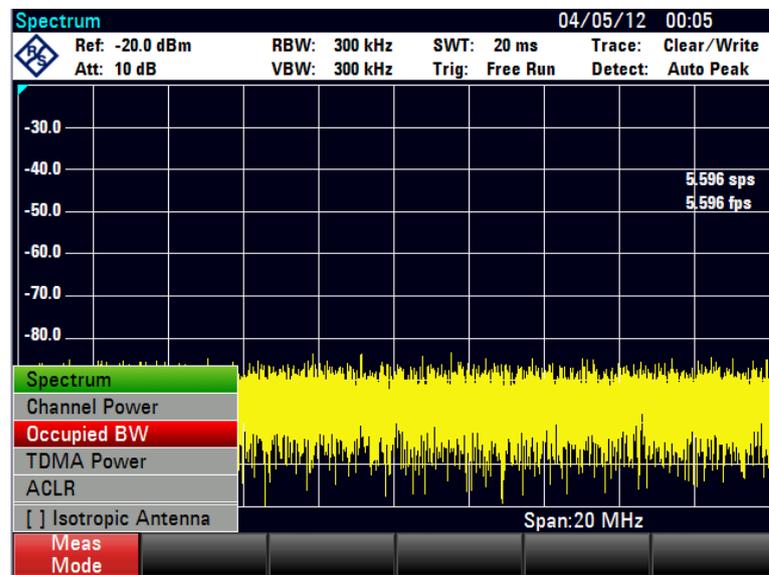
### 3.10.4 Measuring the Occupied Bandwidth

Ensuring the proper operation of a transmission network requires that all transmitters adhere to the bandwidths assigned to them. The occupied bandwidth is defined as the bandwidth that contains a specified percent of the entire power of the transmitter. In the R&S ETC, the power percent can be set between 10 % and 99.9 %. Numerous standards require a percent of 99 %, which corresponds to the default setting of the R&S ETC.

One of the measurement functions of the R&S ETC is the measurement of occupied bandwidth. After the channel bandwidth has been entered, the R&S ETC automatically selects the measurement parameters so that an optimal result is attained.

1. Press the MEAS key.
2. Tap MEAS MODE.

The R&S ETC will open the measurement function menu.



3. Select OCCUPIED BW (highlighted in red).

The R&S ETC displays the menu for setting the measurement. Two vertical lines in the measurement diagram indicate the occupied bandwidth. The measured numeric value (OBW) is shown in large characters above the measurement diagram.



### Selecting a Standard

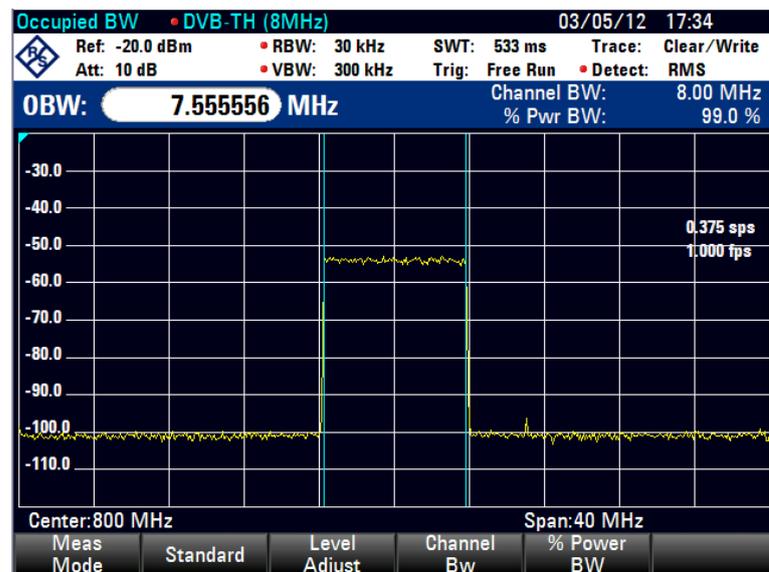
The R&S ETC offers a default for measuring the occupied bandwidth for different standards. It is also possible to define and save user-specific configurations. The generation of standards is described in the R&S ETC View software manual.

1. Tap STANDARD.

A table with the available standards opens.

2. Select the appropriate standard.

The selected standard is set. The optimal span, resolution bandwidth, video bandwidth, sweep time and detector for the standard are selected automatically.



The following should be noted when changes to the settings are made:

- The span is always coupled to the channel bandwidth (CHANNEL BW). When changes are made, the R&S ETC automatically sets the appropriate span (= 5 x channel bandwidth).
- The resolution bandwidth should be between 1% and 4% of the channel bandwidth. This ensures that the occupied bandwidth is measured with high accuracy.
- The video bandwidth must be at least three times the resolution bandwidth. This prevents incorrect results due to the compression of signal peaks by the video filter.
- The RMS detector is recommended. This ensures that the power measurement is always correct irrespective of the waveform being investigated.

The sweep time must be set so that the result is stable. If the sweep time is increased, the R&S ETC also increases the integration time for the RMS detector and thus ensures more stable measured values.

Using the supplied R&S ETC View software, additional standards can be generated and permanently loaded into the R&S ETC. You can also delete the factory-set standards provided by the R&S ETC if you do not need them. The R&S ETC then offers only the standards you require.

### Setting the Reference Level

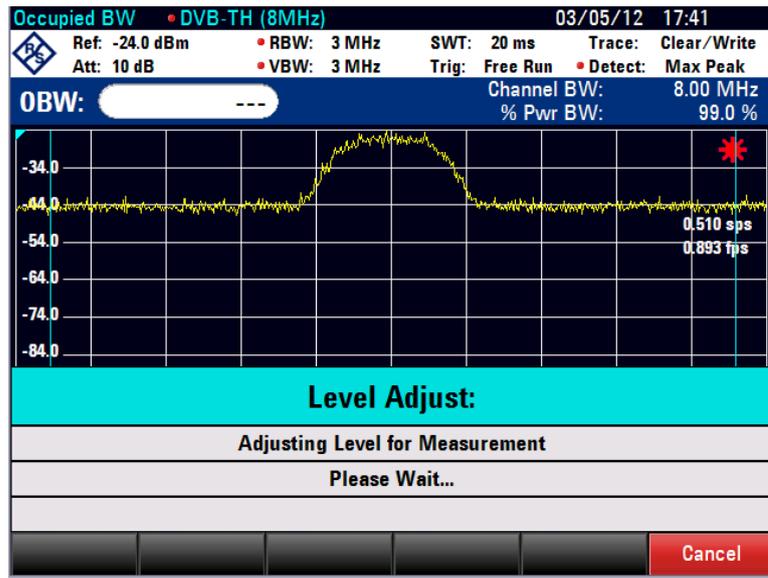
When selecting the reference level, ensure that the R&S ETC is not overdriven. As the power is measured with a resolution bandwidth that is small in comparison with the signal bandwidth, the R&S ETC may still be overdriven even though the trace is within the measurement diagram. To prevent the R&S ETC from being overdriven, the signal can be measured at the largest resolution bandwidth possible using the peak detector. If this setting is selected, the trace may not exceed the reference level.

To simplify operation and to prevent incorrect measurements, the R&S ETC has an automatic routine for setting the reference level.

- ▶ Tap LEVEL ADJUST.

The R&S ETC starts the measurement of the optimal reference level using a resolution bandwidth of 3 MHz, a video bandwidth of 3 MHz and the peak detector. While the measurement is in progress, the R&S ETC outputs the message "Adjusting level for measurement, please wait...".

The optimal reference level is then set.

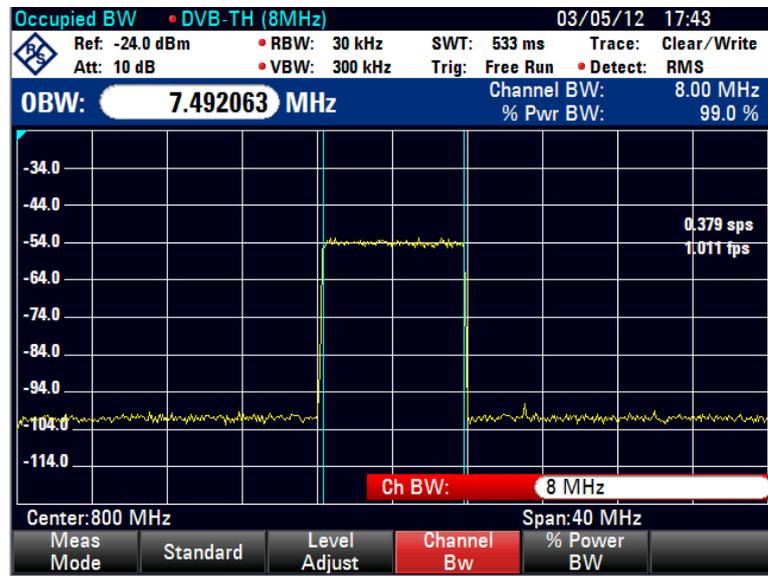


### Setting the Channel Bandwidth

The channel bandwidth determines the span, resolution bandwidth and sweep time the R&S ETC uses for measuring the occupied bandwidth.

1. Tap CHANNEL BW.

An entry field showing the current channel bandwidth setting opens.



2. Set a new channel bandwidth.

The R&S ETC automatically adapts the span to the channel bandwidth that has been entered (span = 5 x channel bandwidth) to ensure that no incorrect measurements of occupied bandwidth are made. The minimum channel bandwidth that can be set is 2 kHz. If you attempt to enter a smaller channel bandwidth, the R&S ETC will automatically set 2 kHz.

### Setting the Power Percent to Determine the Occupied Bandwidth

1. Tap % POWER BW.

The R&S ETC will open a field for entering the power percent relative to the total span power which defines the occupied bandwidth (percent of total power). The R&S ETC displays the value currently set.



2. Set the percent value.

The R&S ETC displays the occupied bandwidth above the measurement diagram.

### Changing the Span

The span set by the R&S ETC normally yields optimum measurement results. In some cases, however, a larger span needs to be selected. This is the case, for example, when the area outside the span that is automatically set contains signal components that need to be included in the measurement.

1. Press the SPAN key.

The AUTO SPAN menu is highlighted in green to indicate that the optimum span for measuring the occupied bandwidth is set. MANUAL SPAN entry is active for immediate entry of another span.



2. Set a new span.

The largest permissible span for measuring the occupied bandwidth is ten times the channel bandwidth. At larger spans, the result of the channel power measurement would be increasingly imprecise, because too few points of the trace occur in the channel to be measured.

3. To again set the optimum span, tap AUTO SPAN.
4. To return to the menu for measuring the occupied bandwidth, press the MEAS key.

## 4 Power/Return Loss Measurements

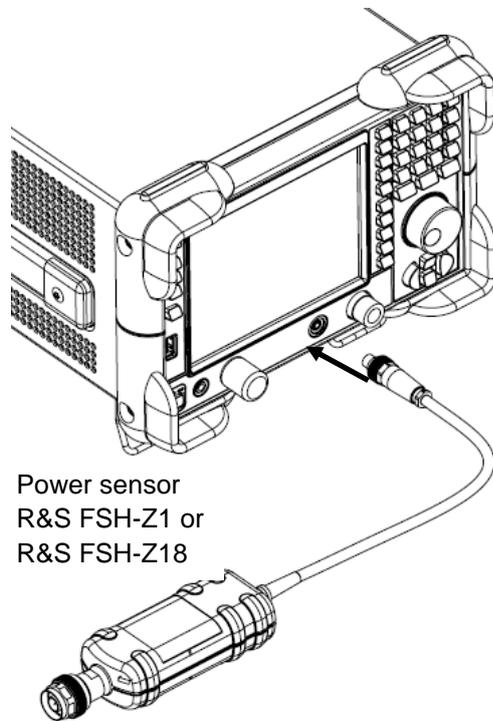
For these measurements, you need power sensors as additional equipment.

### 4.1 Power Measurements

Required options: 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 ETC. 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 front of the R&S ETC.



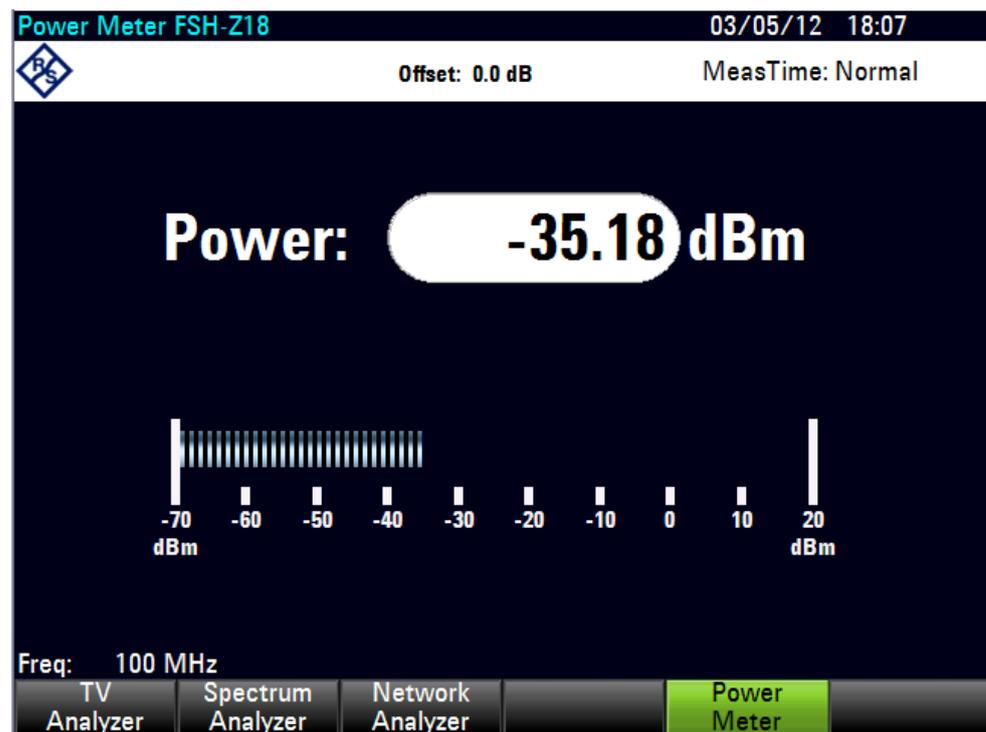
Power sensor  
R&S FSH-Z1 or  
R&S FSH-Z18

#### **NOTICE**

Continuous power applied to the power sensor's input must not exceed 400 mW (26 dBm). However, brief ( $\leq 10 \mu\text{s}$ ) 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 R&S ETC and tighten it.
2. Press the MODE key.
3. Tap POWER METER.

The R&S ETC 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 ETC 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 ETC generates error messages (sensor error: error number) indicating the possible causes.

### Performing a Zero Alignment

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

1. Press the MEAS key.
2. Tap ZERO.

The R&S ETC 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. Tap CONTINUE to start the zero alignment.

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

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

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

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

### Setting the Frequency

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

1. Press the **FREQ** key.
2. Set the desired frequency.

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

## 4.2 Power and Return Loss Measurements

Required options: R&S FSH-Z14 or R&S FSH-Z44 power sensors.

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 front of the R&S ETC.

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 R&S ETC.

1. Connect the power sensor cable to the ACCESSORIES female on the R&S ETC and tighten it. Insert the directional power sensor between the source and the load.
2. Press the MODE key.
3. Tap POWER METER.

The R&S ETC 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 ETC 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.

**Zeroing the Power Sensor**

Before performing the power measurement, zero the power sensor.

1. Press the MEAS key.
2. Tap ZERO.

The R&S ETC 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. Tap CONTINUE to start the zero alignment.

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

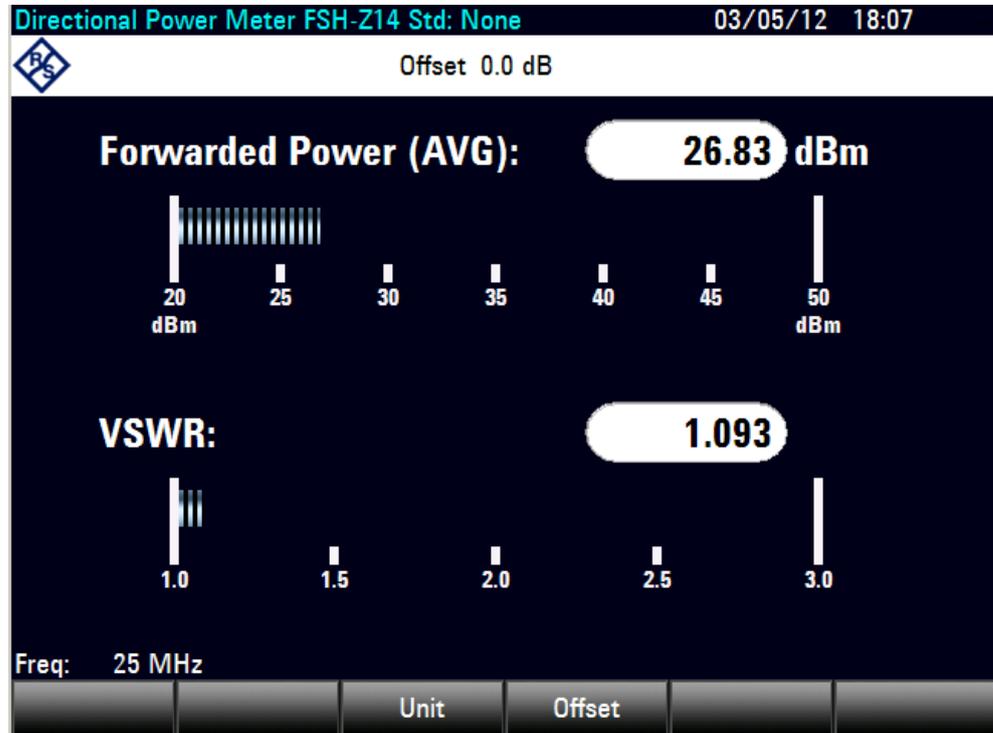
When the zero adjustment is complete, the R&S ETC generates the message "Power Sensor Zero OK" and switches back to the power sensor menu.

**Tip:** To cancel zeroing before it begins, use the CANCEL menu, e.g. if the signal source cannot be disconnected.

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



### Setting the Frequency

To achieve maximum measurement accuracy, enter the frequency of the signal under test.

1. Press the FREQ key.

The R&S ETC opens the frequency input menu.

2. Set the desired frequency.

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

## 5 Network Analyzer Measurements

Only for R&S ETC models equipped with the tracking generator software option (R&S ETC-K10). For the order numbers refer to the data sheet.

The R&S ETC can be supplied with an optional tracking generator to measure the transmission of two-ports or the reflection coefficients of one-ports and two-ports. The tracking generator outputs a signal at the current R&S ETC frequency. The nominal output level can be selected from 0 dBm to -40 dBm in 1 dB steps.

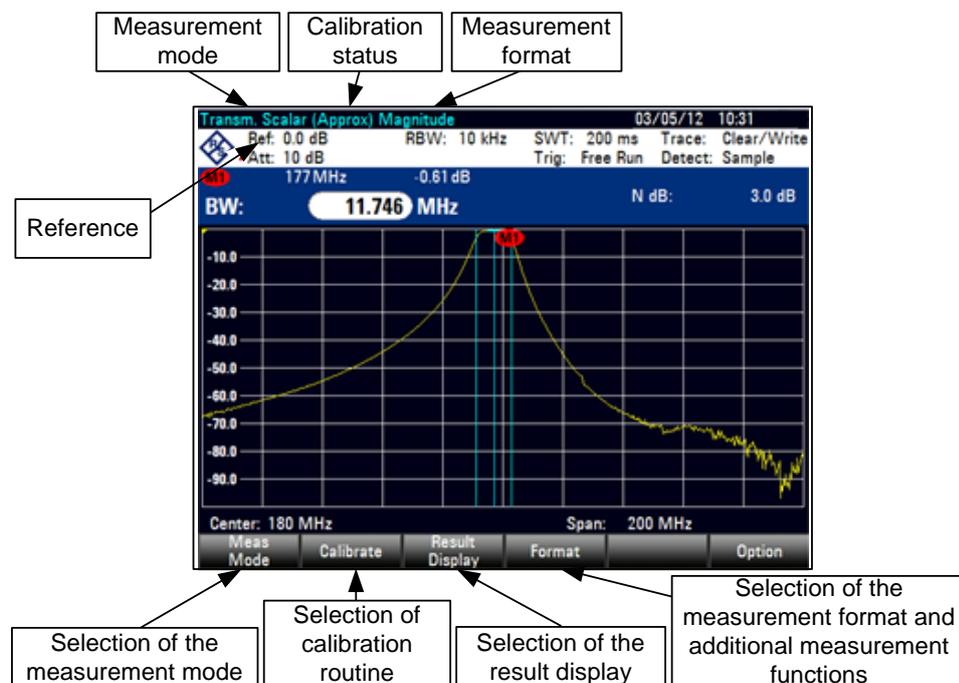
Two-port transmission measurements can be performed by directly connecting the input of the DUT to the tracking generator output and the DUT output to the RF input of the R&S ETC.

Reflection measurements require the use of a VSWR bridge. The R&S FSH-Z3 and -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 ETC in the level measurement. However, the accuracy of the level measurement is reduced.

Due to the calibration technique used, the R&S ETC's measurement accuracy is high for both transmission measurements and reflection measurements. The R&S ETC offers scalar calibration methods as standard; i.e. with transmission and reflection measurements, the magnitudes are corrected.

1. Press the MODE key.
2. Tap NETWORK ANALYZER.

The R&S ETC turns on the tracking generator and switches to the network analyzer measurement menu.



The level axis is in the relative unit dB. Apart from the level values, the 0 dB reference is also displayed. This corresponds to a reference level of 0 dBm in the spectrum analyzer mode (= nominal output level of the tracking generator).

In network analysis operating mode, measurement parameters like bandwidth or the frequency range are selected with the appropriate keys as in the spectrum analyzer mode. Pressing the MEAS key displays the menu for the network analysis.

## 5.1 Measuring the Transmission of Two Ports

The test setup should be calibrated prior to the measurement.



The R&S ETC is delivered with a transmission calibration (factory calibration). This does not, however, take into account the influence of the current test setup (cabling). Thus transmission measurement is possible, even without further calibration, however, the accuracy is limited because the current test setup is not taken into account. For this reason, the R&S ETC indicates "(Uncal)" in the status line. To achieve the best possible measuring accuracy, it is recommended that the calibration is repeated with the test setup in use

Before calibration, the output level of the tracking generator, the frequency range you want and the appropriate reference level should be set because calibration is only valid for the calibrated frequency range and reference. Changing these parameters after calibration invalidates calibration. Calibration is necessary because the tracking generator output level does not exactly match the values specified in the table and it is frequency-dependent.

### Setting the Frequency Range

1. Press the FREQ key.
2. Set the center frequency.
3. Press the SPAN key.
4. Set the span.

### Setting the Output Level of the Tracking Generator

The output level is set by selecting an attenuation value (0 dB to 40 dB). If you select 0 dB, the output level will be 0 dBm. If you select 40 dB, the output level will be -40 dBm.

1. Press the AMPT key.
2. Tap TG OUTPUT ATTENUATION.  
The input field for selecting the output level will open.
3. Set the attenuation.

### Setting the Reference

With measurements on amplifiers, the reference must be shifted so that the amplifier's transmission function can be seen on the screen. An increase of the reference level corresponds to an increase of the input attenuation. The R&S ETC provides a reference setting for this purpose. The position of the 0 dB reference can be shifted to positive or negative values. The RF input attenuator must be set to automatic control (AUTO LOW NOISE or AUTO LOW DISTORTION).

1. Press the AMPT key.
2. Tap REF.
3. Set the reference.

### Setting the Reference Position

The reference can also be shifted without increasing the input attenuation, for example, in order to move the trace to the center of the screen. This is done using the REF POS function. The values 0 to 10 indicate the horizontal lines from bottom to top (with 0 = bottom line, 10 = uppermost line). The value 5 indicates the center line of the diagram.

1. Press the AMPT key.
2. Tap REF POS.
3. Set the reference position.

### Setting the RF Input Attenuator Manually

The RF input attenuator can be also controlled manually.

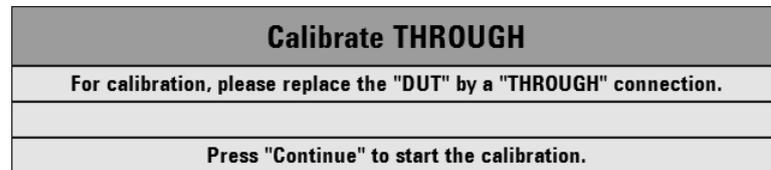
1. Press the AMPT key.
2. Tap RF ATT/PRES/IMP.
3. Select RF ATTENUATION MANUAL.
4. Set the attenuator.

Note: 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.

## 5.1.1 Scalar Measurement of Transmission

1. Press the MEAS key.
2. Tap MEAS MODE.
3. Select SCALAR.
4. Tap CALIBRATE.
5. Select NORMALIZE TRANSMISSION.

The R&S ETC 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.

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

Note: 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 ETC interpolates the correction data between the reference points of the calibration. In this case, the R&S ETC retains the calibration values but it 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. Connect the device under test between the RF input and the generator output.



The R&S ETC displays the transmission magnitude. Values can be read off with, for example, the markers.

If the reference is changed after calibration, greater measurement uncertainty must be anticipated. The R&S ETC retains the calibration data but displays APPROX in the upper area of the screen to indicate a possible increase in measurement uncertainty.



The calibration data are referred to the self-alignment data of the R&S ETC. In case of unsatisfied normalization results, the self-alignment routine shall be executed. For self-alignment calibration a 50  $\Omega$  load ( N male) and a N-cable (N male – N male) is required. Self-alignment start is to be made in menu SETUP – INSTRUMENT SETUP – rubric SELF ALIGNMENT. Detailed instructions are provided in chapter "Basic Instrument Configuration".

When a data set is stored with calibration performed, the calibration data are stored along with the other settings. Thus, once the setting has been retrieved, measurement can be performed without first performing a calibration.

## 5.2 Measuring the Reflection

Use an external VSWR bridge, R&S FSH-Z2 or R&S FSH-Z3 (order numbers see data sheet). You can also use 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 ETC 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 ETC.
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.

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

3. Press the MODE key.
4. Tap NETWORK ANALYZER.

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

### 5.2.1 Scalar Measurement of Reflection

The R&S ETC displays the reflection as return loss, reflection coefficient or as VSWR (voltage standing wave ratio) of the device under test.

The test setup must be calibrated before any measurements are made. This is done with a short at the point where the reflection measurement is to be made. If a cable is to be inserted between the DUT and the bridge, perform the calibration at the measurement end of the cable.

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

1. Press the **FREQ** key.
2. Set the center frequency.
3. Press the **SPAN** key.
4. Set the span.

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

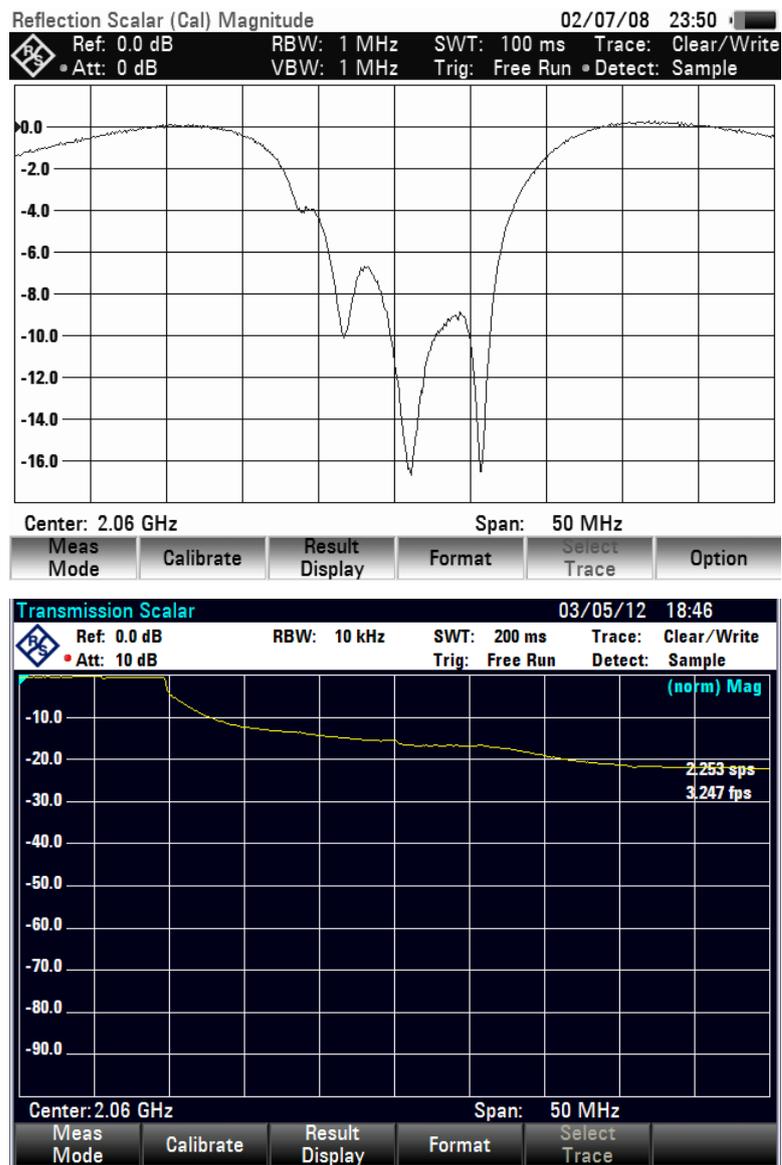
5. Press the **MEAS** key.
6. Tap **MEAS MODE**.
7. Select **SCALAR**.
8. Tap **CALIBRATE** in the main menu for the network analyzer.
9. Select **REFLECTION**.
10. Follow the instructions of the R&S ETC.

After the calibration is finished, the R&S ETC displays **(NORM)** at the top of the display. This indicates that the R&S ETC is calibrated for scalar reflection measurements.

#### Performing a 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 ETC displays the return loss of the device under test in dB:



Note: 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 ETC interpolates the correction data between the reference points of the calibration. The R&S ETC retains the calibration values but indicates a possible increase in measurement uncertainty by displaying (APPROX) in the upper area of the screen.

### Selecting the Measurement Parameter

The R&S ETC offers to display the reflection of the device under test as return loss, as voltage standing wave ratio (VSWR) or as a reflection coefficient. In case of active phase measurement, the R&S ETC measures the electrical length and displays it if desired.

1. Tap FORMAT.
2. Select the desired format.

### Setting the Display Range and the Display Unit

1. Press the AMPT key.
2. Tap RANGE.

The submenu for selecting the display ranges will open.

3. Select the desired display unit.

The available display units depend on the selected reflection measurement format: return loss in dB, linear in %, standing wave ratio (VSWR), reflection coefficient (REFL COEFF (ROH)) and reflection coefficient (REFL COEFF (mROH)).

## 6 Field-Strength Measurement with Isotropic Antenna

When used together with the R&S TS-EMF isotropic antenna (order no. 1158.9295.13), the R&S ETC can determine the resultant field strength in the frequency range from 30 MHz to 3 GHz. The antenna has three orthogonal elements for measuring the resultant field strength. The R&S ETC triggers the three antenna elements one after the other via the probe power socket and calculates the resultant field strength  $E_r$  from the results of the three individual measurements:

$$E_r = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The transducer factors for each antenna element and the cable loss of the antenna cable are compensated in the measurement. If an extension cable such as the R&S TS-EMFZ2 (1166.5708.02) is used, the additional cable loss can be taken into account by using transducer factors. The transducer factors are antenna-specific and are supplied together with the TS-EMF antenna. Transducers are loaded into the R&S ETC by means of the R&S ETC View software. In order to activate the measurement with the isotropic antenna, a transducer factor file with the extension \*.isotrd must be selected.

### Connecting to the Antenna

The isotropic antenna includes factory-attached cables. The RF cable with the N coaxial plug is connected to the RF input of the R&S ETC. The control cable for switching between the X, Y and Z axes with the 9-pin D-Sub plug is connected with the AUX connector of the R&S ETC by using the supplied adapter cable.

### Activating the Isotropic Antenna

1. Press the MEAS key.
2. Tap MEAS MODE.
3. Select ISOTROPIC ANTENNA to activate the use of an isotropic antenna.

The activation of the isotropic antenna influences all relevant measurements.

Before displaying final measurement results, the R&S ETC performs a measurement for each of the three antenna axes so that the update rate of the trace decreases accordingly.

If the connected accessory is an isotropic antenna from R&S, the use of an isotropic antenna is automatically activated.

### Using Transducer Factors for the Isotropic Antenna

1. Press the AMPT key.  
The R&S ETC opens the amplitude menu.
2. Tap TRANSDUCER.

The R&S ETC opens the menu for selecting the transducers.

3. Select a filename with extension \*.isotrd.

As soon as a transducer factor with that filename extension is selected, the R&S ETC will automatically activate the isotropic antenna measurement.

### **Compensating the Antenna Extension Cable**

1. Tap TRANSDUCER.
2. Select SELECT SECONDARY TRANSDUCER.

The R&S ETC opens the browser in order to select the second transducer factor.

Note: A file from the second transducer type must be stored in the internal memory, on the SD card or on a connected USB memory stick.

3. Select the appropriate transducer factor.

## 7 GPS Receiver

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

The GPS function locates and displays your exact position. 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.

### Enabling the GPS Receiver

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.

The R&S ETC 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.
4. Select ENABLED.

### Selecting the GPS Coordinate Format

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.
3. Select COORDINATE FORMAT.
4. Select ENABLED.

## 7.1 GPS Information

### Prerequisites

- The GPS receiver (HA-Z240, order no. 1309.6700.02) is connected to the AUX connector on the rear side of the R&S ETC
- A fix connection with enough satellites exists.

### Displaying the GPS Information

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.
3. Select SHOW GPS INFORMATION.
4. Select ENABLED.

The position is displayed if the prerequisites are met.

### GPS Connection Exists

The status of the satellite lock is indicated in the title bar of the display.

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

If a fix connection with enough satellites exists, **GPS** is displayed.

### Satellite Lock Is Lost

If the satellite lock is lost, the title 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]**

**GPS** is displayed.

### No GPS Receiver Is Connected

If the GPS receiver function is enabled but there is no GPS receiver connected (or the GPS receiver is defective), the title bar is red.

**GPS** is displayed.

### Re-Using the GPS Information

If the R&S ETC is booted with GPS enabled and a 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.

<b>! Warning !</b>
<b>Do you want to re-use the Position and Correction Factor</b>
<b>last acquired by the GPS mouse before the device was shut down?</b>
<b>Press YES to confirm, press NO to cancel</b>



## 8 Measuring with Transducer Factors

The frequency-dependent transducer factor of transducers and antennas can be directly considered in the measurement result. A transducer factor consists of a numeric values and a unit. The R&S ETC corrects the level values of the trace by the values of the transducer. At the same time, the unit of the transducer is assigned to the level axis. When field-strength measurements are performed with the aid of antennas, for instance, the electrical field strength is directly indicated in dB $\mu$ V/m on the R&S ETC. A transducer factor can also be used to correct a frequency-dependent attenuation, e.g. of a cable between DUT and RF input of the R&S ETC.

More than 100 transducer factors with 60 reference values each can be stored internally. The maximum number of transducer factors may be reduced if cable models, channel tables, limit lines, or data sets are stored simultaneously (see chapter "[Saving and Recalling Measurement Results and Settings](#)").

Interpolation between the values is performed with the aid of a modified spline algorithm. Even if only relatively few values such as maxima, minima and turning points are available, this algorithm can easily simulate the correction factors of common transducers. Two transducers can be activated at a time. The second transducer must be assigned the unit dB. The R&S ETC adds the two transducers to a total transducer.

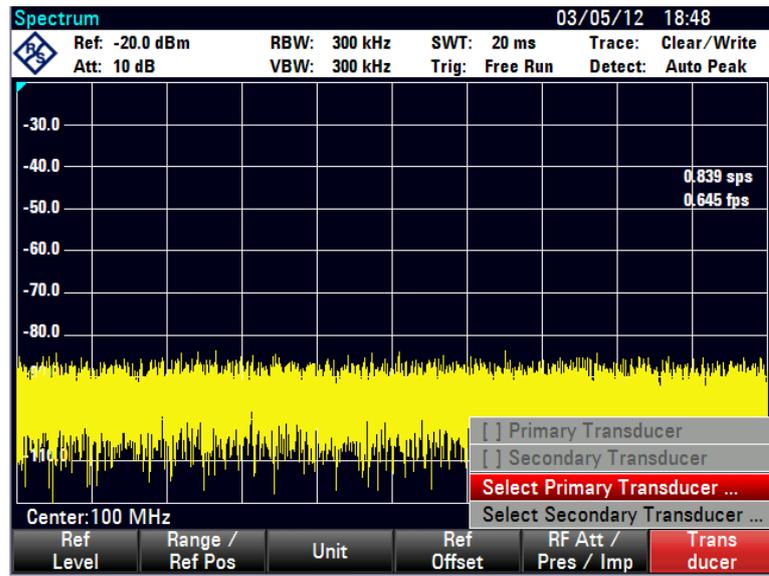
Transducer factors are defined with the aid of the supplied R&S ETC View software. They are transferred from the PC to the R&S ETC via LAN or the USB interface.

### 8.1 Using Transducers

#### Selecting a Transducer Factor

1. Press the AMPT key.
2. Tap TRANSDUCER.

The R&S ETC opens a submenu in which the primary and secondary transducer factor can be selected.



Note: Transducer factors are not available for measurements with the tracking generator or the power sensors. The TRANSDUCER menu is therefore interactive.

3. Tap SELECT PRIMARY TRANSDUCER.

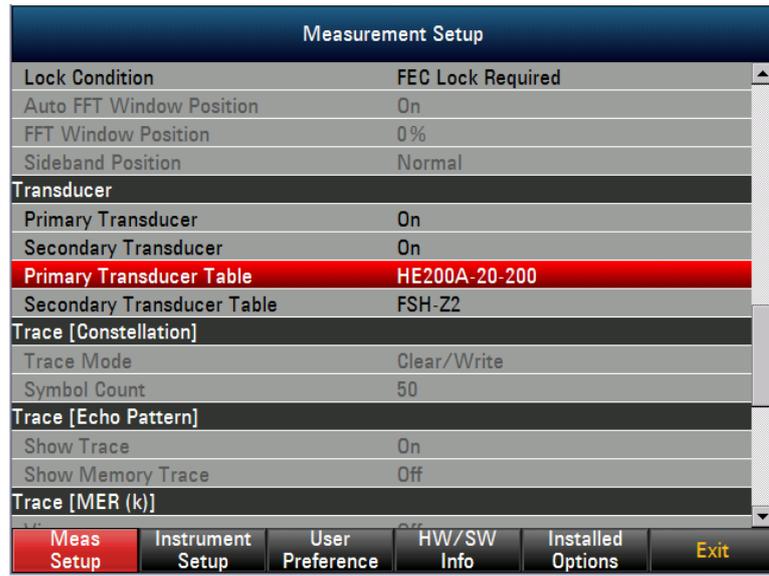
The R&S ETC displays a list of transducer factors available as the primary transducer factor. The cursor is on the active transducer factor (line highlighted). If no transducer is active, the cursor is on the first item in the list.

The screenshot shows the 'Select Transducer' dialog box. The title bar reads 'Select Transducer' and the date/time is '03/05/12 18:49'. The dialog contains a list of files with columns for 'Stat', 'Name', 'Size', 'Date', and 'Time'. The first row is highlighted in red. Below the list, there is a 'Free: 4 MB' indicator and a row of buttons: 'Select', 'Sort/Show', 'Delete', 'Refresh', and 'Exit'.

Stat	Name	Size	Date	Time
<	Public\Transducers\..			
>	Public			
>	Storage Card			
	CBL6111.pritrd	1 kB	14/11/2011	15:02
	FSH-Z2.sectrd	1 kB	14/11/2011	15:02
	FSH-Z3.sectrd	1 kB	14/11/2011	15:02
	FSH-Z38.sectrd	1 kB	14/11/2011	15:02
	HE200A-20-200.pritrd	2 kB	14/11/2011	15:02
	HE200A-200-500.pritrd	1 kB	14/11/2011	15:02
	HE200A-500-3000.pritrd	2 kB	14/11/2011	15:02
	HE200A-HF.pritrd	2 kB	14/11/2011	15:02
	HE200P-20-200.pritrd	2 kB	14/11/2011	15:02
	HE200P-200-500.pritrd	1 kB	14/11/2011	15:02
	HE200P-500-3000.pritrd	2 kB	14/11/2011	15:02
	HE200P-HF.pritrd	2 kB	14/11/2011	15:02
	HE300A-20-200.pritrd	1 kB	14/11/2011	15:02
	HE300A-200-500.pritrd	1 kB	14/11/2011	15:02
	HE300A-500-7500.pritrd	1 kB	14/11/2011	15:02
	HE300A-HF.pritrd	1 kB	14/11/2011	15:02
	HE300P-20-200.pritrd	1 kB	14/11/2011	15:02

4. Select the desired transducer factor.

The selected transducer factor is displayed in the SETUP – MEAS SETUP menu.



- To select an additional transducer factor, select SELECT SECONDARY TRANSDUCER.

If a transducer is activated, the R&S ETC shows the selected transducer after the AMPT key is pressed.

The complete name of the selected transducer is also displayed in the status line (press the STATUS key and scroll downward in the list), or in the list of transducer factors (entry highlighted in red).



The example shows the transducer factor of the R&S HL223 antenna, which is defined as between 200 MHz and 1300 MHz. The R&S ETC therefore displays the noise in this frequency range as a function of frequency incremented by the transducer factor. Outside the transducer range, the R&S ETC sets the transducer factor at zero, i.e. measurements in this range do not yield conclusive results.

A second transducer factor can be selected using the SELECT SECONDARY TRANSDUCER menu, which is then added to the first, as soon as the menu entry . [ ] SELECT SECONDARY TRANSDUCER is marked with an X. The unit of the second transducer factor must always be the relative unit dB as otherwise an addition would not be useful. When SELECT SECONDARY TRANSDUCER is selected, the R&S ETC offers only the transducer factors stored in the R&S ETC with dB as the unit.

### Deactivating the Selected Transducer Factor

1. Press the AMPT key.
2. Tap TRANSDUCER.

The R&S ETC opens a submenu in which the primary and secondary transducer factor can be selected.

3. Select the item to be disabled (PRIMARY TRANSDUCER or SECONDARY TRANSDUCER).

The transducer factor is no longer shown in the level display.

## 8.2 Units

The following units are supported for transducer factors:

- dB

The unit dB does not change the unit set on the R&S ETC. If the unit of the transducer is dB, the units dBm, dBmV or dB $\mu$ V remain unchanged. It can be used, for instance, to compensate for frequency-dependent loss and gain at the input of the R&S ETC.

- dB $\mu$ V/m and dB $\mu$ A/m

The units dB $\mu$ V/m and dB $\mu$ A/m convert the output power of an antenna into electric or magnetic field strength.

If the unit of the transducer is dB $\mu$ V/m or dB $\mu$ A/m, this unit is also used for the R&S ETC level display. This means that both the level axis of the diagram and the level at the marker position are assigned the unit of the transducer. If dB $\mu$ V/m is selected as the transducer unit, switchover to absolute level indication in V/m is possible.

- W/m<sup>2</sup>

The unit W/m<sup>2</sup> is used to calculate and display the power flux density.

The linear units Volt and Watt are not permissible. They are deactivated in the units menu.

For example, to compensate for the cable loss between the transducer and the RF input, the R&S ETC can use two transducers at the same time. One of them must have the unit dB, however, i.e. it must correspond to one loss or gain value.

### Switching Over to V/m Level Indication

1. Press the AMPT key.
2. Tap UNIT.
3. Select V.

If a transducer with the unit dB $\mu$ A/m is activated, no other unit can be selected in the AMPT menu. Level indication is entirely in dB $\mu$ A/m.

## 8.3 Reference Level Settings

The transducer shifts the trace by its value as a function of frequency. Positive transducer values increase the level, negative values reduce it. To ensure that the trace is always within the diagram, the R&S ETC adjusts the reference level accordingly. The reference level is shifted by the maximum transducer value in the positive or negative direction.

## 8.4 Frequency Range

If the set frequency range is wider than the span in which a transducer is defined, the R&S ETC assumes the transducer values outside the defined range to be zero.

## 8.5 Saving Transducer Factors

The R&S ETC stores data sets together with any transducer factors that may have been active for the measurement in question. When such a data set is recalled, the associated transducer factor(s) are activated as well. Transducer factors recalled as part of a data set do however not appear in the list of transducer factors.

## 8.6 Automatically Generating Transducers

Only for R&S ETC models equipped with the tracking generator software option (R&S ETC-K10). For the order numbers refer to the data sheet.

In the network analyzer mode, the R&S ETC offers the possibility to generate transducer data sets automatically. The R&S ETC saves the magnitude of the current measurement as a relative transducer in dB. The generated data set is of the SECONDARY TRANSDUCER type.

The "MeasTransducer000.sectrd" data set is stored in the "\\Public\Transducers\" directory of the internal memory. A new storage of a transducer data set does not overwrite older transducer data sets. The number within the name of the data set will be incremented.

The measurement data of the network analyzer (631 measurement points) is reduced to 60 measurement points for the transducer data set. With the supplied R&S ETC

View software, the transducer data set can be copied, modified and distributed to other instruments.

1. Press the MODE key.
2. Tap NETWORK ANALYZER.
3. Setup the network analyzer according to the device under test.
4. Press the SAVE/RECALL key.
5. Tap SAVE AS TRANSDUCER.

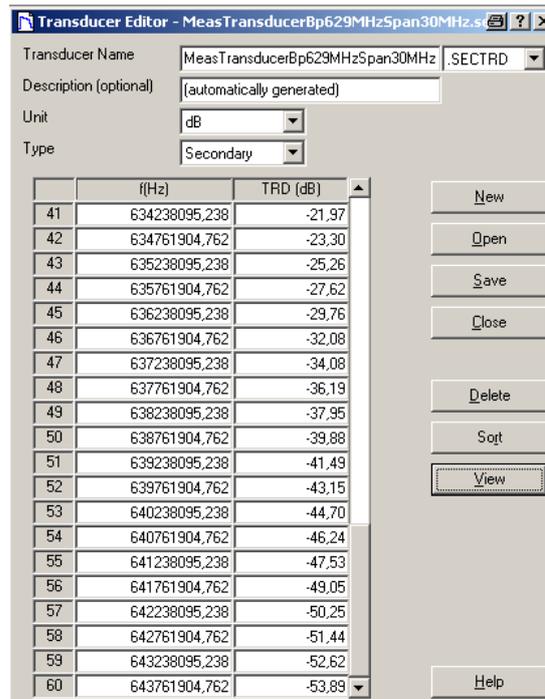
The R&S ETC stores the magnitude of the current measurement as "MeasTransducerxxx.sectrd" transducer data set in the "\\Public\Transducers\" directory of the internal memory.

## 8.7 Example of Use

A typical use of transducers is the "out of band emission" of transmitters. Mostly, the requirements cannot be checked even by high-end spectrum analyzers because of the transmitter requirements are very high. DVB-T transmitters for the UHF band for example must have a suppression of 120 dB in a frequency distance of  $\pm 12$  MHz. This implies a dynamic requirement of more than 90 dB for the spectrum analyzer.

If the emission is measured in front of the output filter, the dynamic requirement is reduced by the frequency response of the output filter.

1. Measure the output filter using the network analyzer.
2. Generate a transducer data set which represents the output filter using the "Save as Transducer" function.



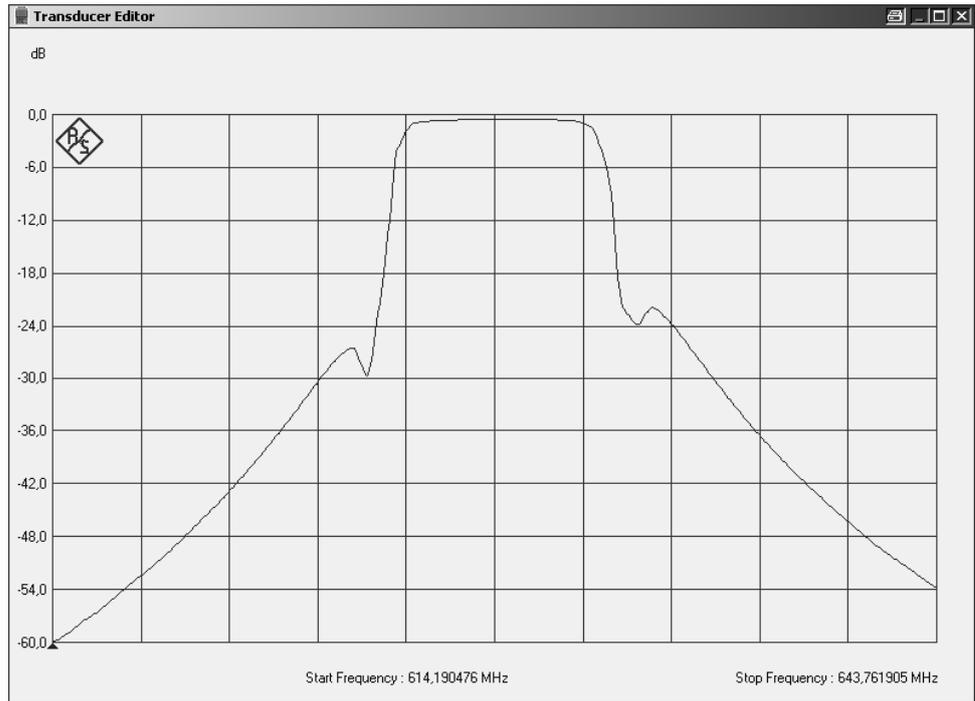


Fig. 8-1: Transducer data of a band pass filter in the UHF range which was generated by the "Save as Transducer" function

3. In the TV ANALYZER mode, select the SPECTRUM measurement function and setup the measurement.
4. Enable the transducer data of the output filter as SECONDARY TRANSDUCER.

Fig. 8-2 and Fig. 8-3 show the measurement results with and without using of the transducer data set of the output filter.



Fig. 8-2: Measurement without using of the transducer data set



Fig. 8-3: Measurement with using of the transducer data set

The measurement results show the following:

- Signal powers corresponding to the test port, excluding and including the insertion loss of the output filter
- Insertion loss of the output filter  
(= difference of the signal powers with and without transducer  
= 1.2 dB in the example above)
- Amplitude frequency responses with and without output filter
- Shoulder attenuations with and without output filter
- Out of band emission compliance using the "DVB Emission Critical" limit line
- Dedicated out of band emissions using the marker functions

## 9 Basic Instrument Configurations

### 9.1 Screen Settings

The R&S ETC has a TFT-LCD color display. You can switch from color to black-and-white display for maximum contrast. Under extreme lighting conditions, the high-contrast monochrome display provides the best readability.

#### Setting the Screen Color

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.
3. Under DISPLAY, select the DISPLAY COLOR SCHEME.

A submenu opens.

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

4. Select COLOR (color screen display) or BLACK/WHITE (monochrome display).

### 9.2 Setting the Volume

The R&S ETC 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. Tap INSTRUMENT SETUP.

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

Audio	
Key Click Volume	30 %
System Beeper Volume	30 %

3. Under AUDIO, select KEY CLICKS VOLUME.

An entry field opens. The currently set volume is displayed as percent value.

Audio	
Key Click Volume	10 %
System Beeper Volume	30 %

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

#### Setting the Beeper Volume

1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.

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

Audio	
Key Click Volume	10%
System Beeper Volume	30%

3. Under AUDIO, select SYSTEM BEEPER VOLUME.

An entry field opens. The currently set volume is displayed as percent value.

Audio	
Key Click Volume	10%
System Beeper Volume	39%

4. Set the volume. 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.

## 9.3 Setting the Date and Time

The R&S ETC 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. Tap INSTRUMENT SETUP.

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

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

3. Under DATE AND TIME, select SET DATE.

An entry field opens. The currently set date is displayed in the selected format in the entry field (dd/mm/yyyy or mm/dd/yyyy).

4. Set the day (dd) or month (mm).

The cursor 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. Tap INSTRUMENT SETUP.

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

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

3. Under DATE AND TIME, select SET TIME.

The currently set time is displayed in "hours:minutes:seconds" format in the entry field.

4. Set the time.

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

## 9.4 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 R&S ETC.

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

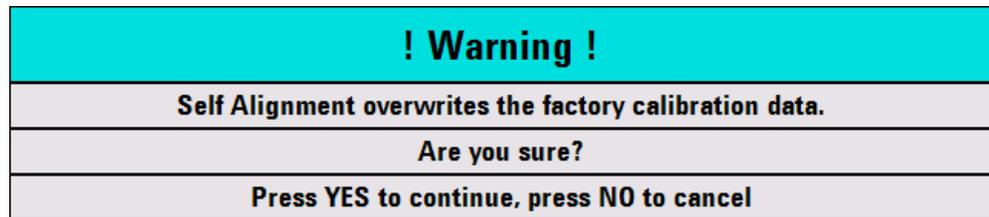
1. Press the MODE key.
2. Tap NETWORK ANALYZER.
3. Tap SETUP key.
4. Tap INSTRUMENT SETUP.

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

Self Alignment	
Self Alignment	
Last Alignment Date	03/12/2009

- Under SELF ALIGNMENT, select SELF ALIGNMENT.

A warning is displayed.



Pressing YES will perform the self alignment. Pressing NO discards this action.

- Follow the instructions displayed on the screen.

## 9.5 Preset Function

The PRESET key sets the R&S ETC 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 ETC is set to the default setup of the selected mode.

## 9.6 Reset to Factory Settings

RESET TO FACTORY SETTINGS sets the R&S ETC 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.

- Press the SETUP key.
- Tap INSTRUMENT SETUP.  
The R&S ETC opens a list of general settings.
- Select RESET TO FACTORY SETTINGS.



A warning is displayed.



Pressing YES will perform the reset. Pressing NO discards this action.

If YES is pressed, an information window is shown during the device rebooting.

## 9.7 Switching Between External Reference/External Trigger Input

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

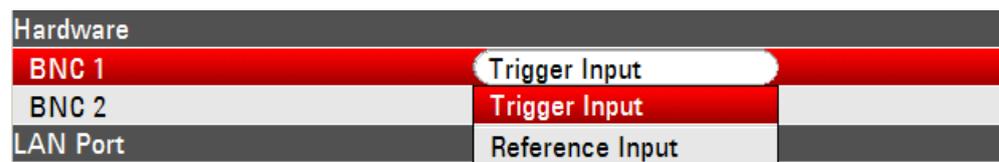
1. Press the SETUP key.
2. Tap INSTRUMENT SETUP.

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



3. Under HARDWARE, select BNC 1.

A selection list is displayed.



4. Select the desired function for the BNC 1 connector.

The TRIGGER INPUT setting only configures the input. Utilization of the external trigger must be configured in the SWEEP menu ( SWEEP key, TRIGGER menu). 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.

# 10 Saving and Recalling Measurement Results and Settings

The R&S ETC can store measurement results and settings in the internal memory or on the internal SD memory card or optional USB stick.

Results and settings are always stored together, allowing them to be interpreted in context when recalled. The R&S ETC can store at least 100 data records with unique names in the internal memory.

Using the supplied R&S ETC View software, these data sets can also be saved to a PC from the R&S ETC or downloaded onto the R&S ETC from a PC.

## **Saving on the internal SD Memory Card**

An internal SD card can be used for memory expansion or for data transfer to a PC without a direct LAN or USB connection.

## **Saving on a USB Stick**

The R&S ETC can store measurement results and settings also on a removable USB stick.

- ▶ Connect the USB stick via the supplied USB adapter with the USB interface.

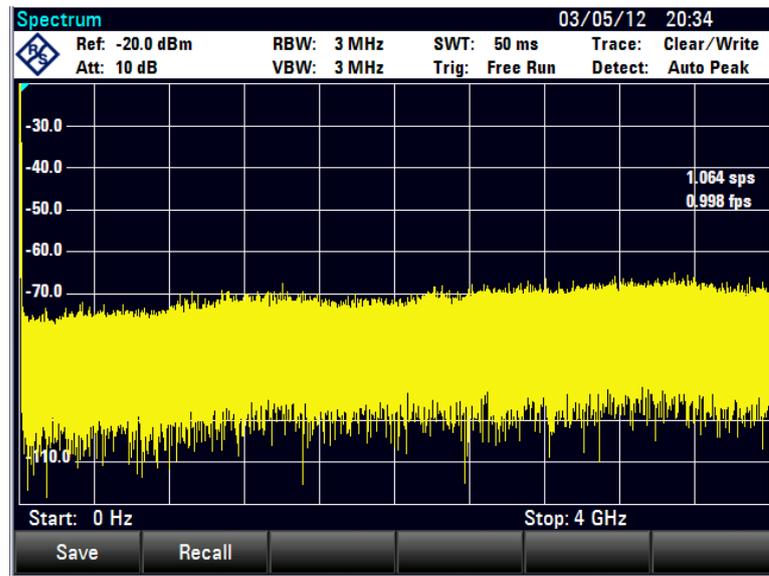
If cable models, channel tables, limit lines or transducer factors are stored simultaneously, the maximum number of data sets will be reduced. In addition, the size of the data sets can vary as a function of the selected measurement function. A complete data set uses approx 100 Kbyte of memory.

The R&S ETC provides a total internal storage space of approx 20 MB. In addition data sets, cable models, channel tables, limit lines and transducer factors can be stored on a SD card. Thus the amount of data sets that can be stored depends only on the size of the SD card in use.

## **Displaying the Save/Print Menu**

- ▶ Press the SAVE/RECALL key.

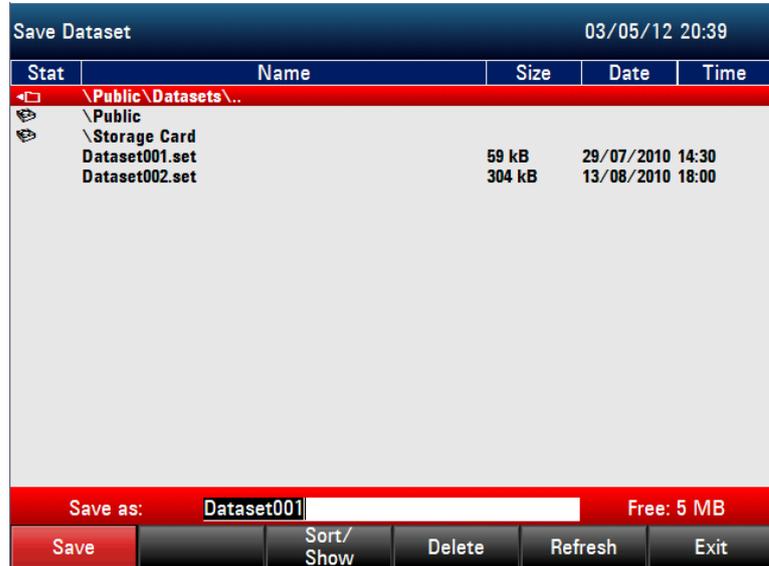
The R&S ETC opens the SAVE/PRINT menu with the functions for saving, clearing and loading data sets.



## 10.1 Saving Measurement Results and Settings

1. Tap SAVE.

The R&S ETC opens a text box and prompts the user to enter a name for the data set.



The entry field highlighted in red also suggests a name for the data set (DATASET.003)

2. To accept the suggested name, press the ENTER key or tap SAVE.
3. To enter a new name, use the alphanumeric keypad. For details see chapter "Operating Concepts".

The data set is saved to the R&S ETC's internal memory under the name that has been given. The remaining available storage capacity is displayed in the lower right-hand corner of the screen.

### Naming Data Sets

The data set name comprises a text section and a numeric extension, which are separated by a full stop. The data set name suggested by the R&S ETC is derived from the name of the data set last stored, the numeric extension being incremented by 1 in each case. This means that consecutive data set names can be assigned by simply saving with SAVE or ENTER.

The names of the data sets already stored can be displayed one after the other using the BACK key. This allows, for example, to store new results under the name of a previous data set (for example Antenna.000), but with a new extension. The R&S ETC displays the old name together with the first unassigned extension, e.g. Antenna.001. No new name has to be entered.

## 10.2 Recalling Measurement Results and Settings

Previously saved measurement results and settings can be recalled with the R&S ETC's recall function.

1. Press the SAVE/RECALL key.
2. Tap RECALL.

The R&S ETC opens the file browser.

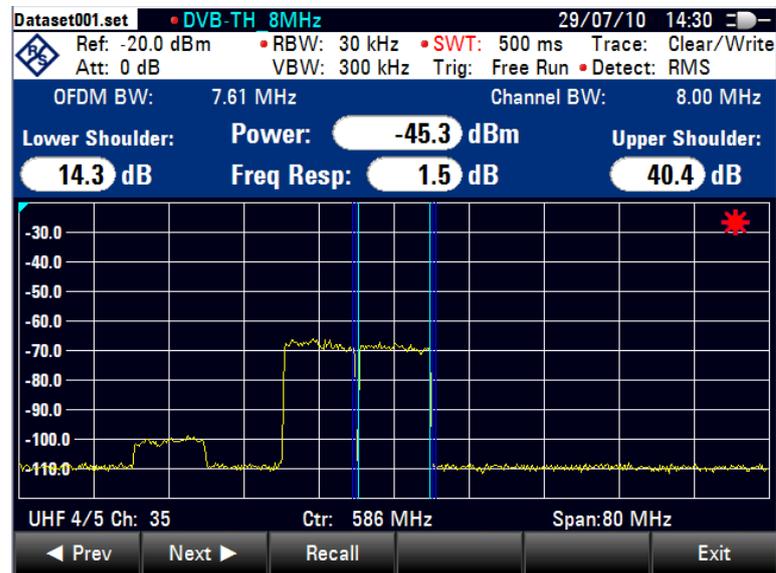
Stat	Name	Size	Date	Time
	\Public\			
	\Storage Card			
	Cable Models			
	Channel Tables			
	Datasets			
	Limit Lines			
	Screen Shots			
	Standards			
	Transducers			
	Dataset001.set	18 kB	29/04/2012	17:45
	Dataset002.set	759 kB	02/05/2012	14:49
	nab2012.set	750 kB	02/01/2000	14:02

Free: 7 MB

View   Recall   Sort / Show   Delete   Refresh   Exit

3. Select the required data record.
4. To load the data record, press the RECALL.  
The R&S ETC loads the data set and starts the measurement.
5. To view the measurement results, press the VIEW

The R&S ETC displays the measurement results of the selected data set. However, the settings of the selected data set are not yet activated.



The name of the data set is shown at the left upper corner of the display.

#### Further Actions

- ▶ To scroll through the current directory, press the PREV and NEXTs.
- ▶ To setup the and start the measurement, press the RECALL.
- ▶ To leave the viewer, press the EXIT.

The R&S ETC returns to the file manager (RECALL DATASET).

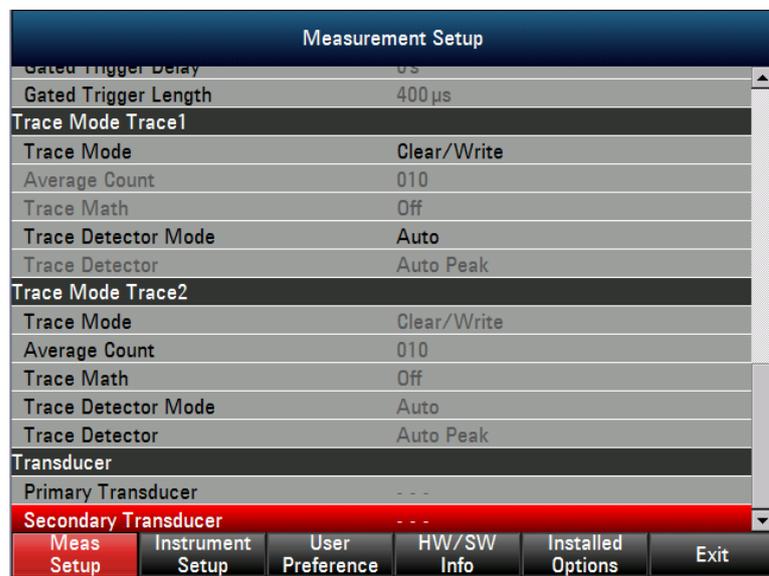
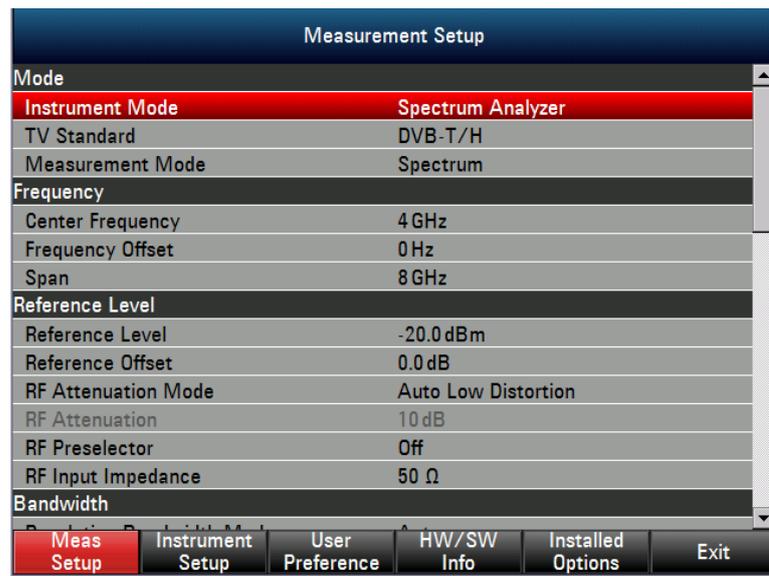
### 10.3 Measurement Setup Overview

The measurement setup provides an overview of all parameters that have just been set for the current operating mode. This means that all the measurement settings can be checked easily at a glance.



The measurement setup screen and its contents are customized for each operating mode of the R&S ETC. Therefore, the order and number of displayed settings is different in each mode.

1. Tap SETUP key.
2. Tap MEAS SETUP.



The R&S ETC displays the current measurement settings on the screen. To view all settings, you can scroll through the screen content. The scroll bar at the right screen edge indicates if there is additional information available before or after the displayed window. You can use the display to check the settings.

### Changing the Measurement Settings

In the MEASUREMENT SETUP dialog, you can change the settings, too.

1. Press the SETUP key.
2. Tap MEAS SETUP.
3. Select the setting parameter.  
The R&S ETC opens the entry field.
4. Set a new value for the setting parameter.

## 10.4 Making a Screenshot

- ▶ Press the  key.

The R&S ETC stores a screenshot in the "\Screen Shots\" directory. If the "\Screen Shots\" directory does not exist, it will be created.

The selected memory depends on the availability of the connected memories.

- At first, the R&S ETC tries to save the screenshot on the SD card ("Storage Card:\Screen Shots\\*").
- If no SD card is available, the R&S ETC tries to save the screenshot on the USB memory stick ("USB:\Screen Shots\\*").
- If neither a SD card nor an USB memory stick is available, the R&S ETC stores the screenshot on the internal flash memory ("Public\Screen Shots\\*"). From there it can be transferred to a PC using the R&S ETC View software.

### Setting the File Format

You can save screenshots in png format (default setting) or in jpg format.

1. Press the SETUP key.
2. Tap USER PREFERENCE.
3. Under SCREEN CAPTURE, select the screen capture format.

# 11 Remote Control Basics

You can operate your R&S ETC using remote control. This chapter describes how to set a remote control session and provides background information on remote control.

In chapter "Remote Command Reference", the remote commands for each instrument mode are described in detail.

## 11.1 Interfaces and Protocols

The R&S ETC supports two different interfaces for remote control.

- LAN Interface

The protocol is based on TCP/IP and supports the VXI-11 standard.

- USB Interface

The connectors are located at the rear panel and permit a connection to a controller for remote control via a local area network (LAN) or directly via USB.

### SCPI

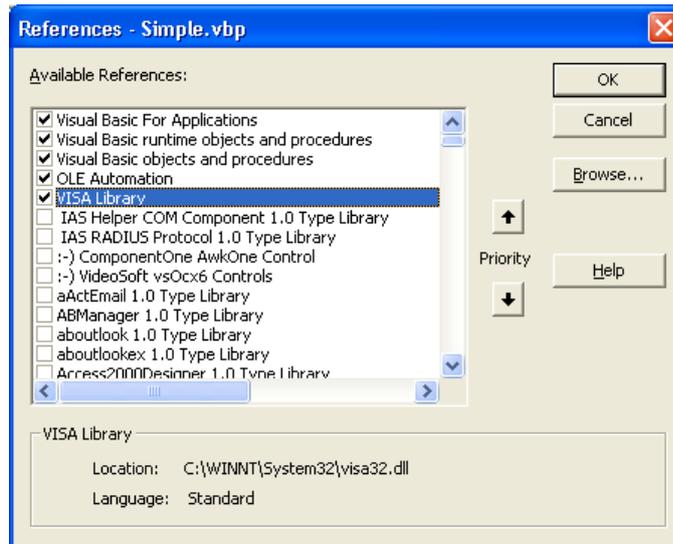
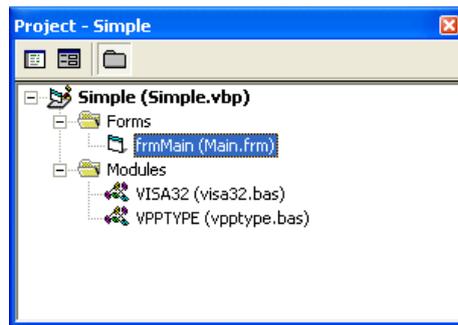
SCPI (Standard Commands for Programmable Instruments) commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

### VISA

VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel (LAN or USB) is selected at initialization time by means of a channel-specific resource string. For more information about VISA refer to its user documentation.

The programming examples for remote control are all written in Microsoft® VISUAL BASIC®. Access to the VISA functions require the declaration of the functions and constants prior to their use in the project. This can be accomplished either by adding the modules VISA32.BAS and VPPTYPE.BAS or a reference to the VISA32.DLL to the project.



The modules visa32.bas and vpptype.bas can be found in the <VXI|pnpPath>\WinNT\include (typically C:\VXI|pnp\WinNT\include).



Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the device status. Therefore, control programs should always define an initial device status (e.g. with the \*RST command) and then implement the required settings

## 11.2 LAN Interface

To be integrated in a LAN, the instrument is equipped with a standard LAN interface, consisting of a connector, a network interface and protocols (VXI-11).

Instrument access via VXI-11 is usually achieved from high level programming platforms by using VISA as an intermediate abstraction layer. VISA encapsulates the low level VXI-11 (LAN) or USB function calls and thus makes the transport interface transparent for the user. The necessary VISA library is available as a separate product. For details contact your local R&S sales representative.

## 11.3 USB Interface

For remote control via the USB connection, the PC and the instrument must be connected via the USB interface. A USB connection requires the VISA library to be installed. VISA detects and configures the instrument automatically when the USB connection is established. You do not have to enter an address string or install a separate driver.

## 11.4 Protocols - VXI-11 Basics

The VXI-11 standard is based on the ONC-RPC protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Remote control of an instrument via a network is based on standardized protocols which follow the OSI reference model (see Fig. 11-1).

Application	SCPI
Presentation	XDR (VXI-11)
Session	ONC-RPC
Transport	TCP / UDP
Network	IP
Data Link	Ethernet/802.3
Physical	802.3/10BASE-T

Fig. 11-1: Example for LAN remote control based on the OSI reference model

Based on TCP/UDP, messages between the controller and the instrument are exchanged via open network computing (ONC) - remote procedure calls (RPC). With XDR (VXI-11), legal RPC messages are known as VXI-11 standard. Based on this standard, messages are exchanged between the controller and the instrument. The messages are identical with SCPI commands. They can be organized in four groups:

- Program messages (control command to the instrument)
- Response messages (values returned by the instrument)
- Service request (spontaneous queries of the instrument)
- Low-level control messages (interface messages).

A VXI-11 link between a controller and an instrument uses three channels: core, abort and interrupt channel. Instrument control is mainly performed on the core channel (program, response and low-level control messages). The abort channel is used for immediate abort of the core channel; the interrupt channel transmits spontaneous service requests of the instrument. Link setup itself is very complex. For more details refer to the VXI-11 specification.

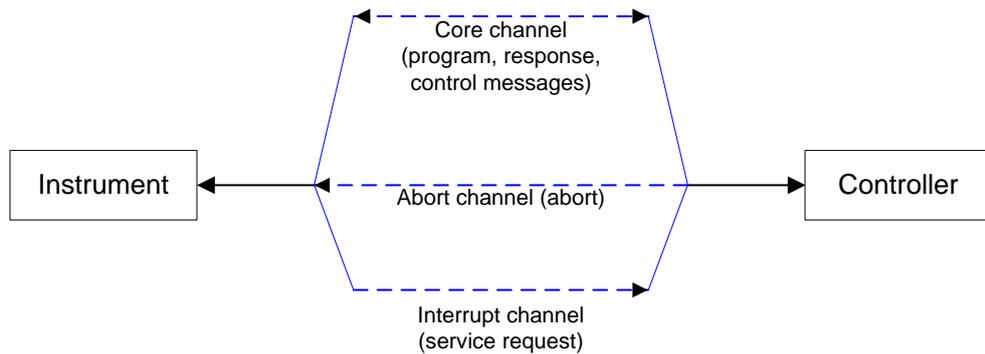


Fig. 11-2: VXI-11 channels between instrument and controller

The number of controllers that can address an instrument is practically unlimited in the network. In the instrument, the individual controllers are clearly distinguished. This distinction continues up to the application level in the controller, i.e. two applications on a computer are identified by the instrument as two different controllers.

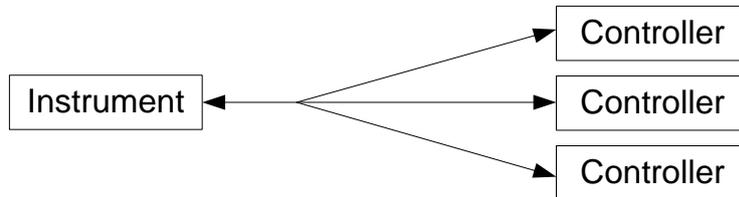


Fig. 11-3: Remote control via LAN from several controllers

The controllers can lock and unlock the instrument for exclusive access. This regulates access to the instrument of several controllers.

## 11.5 Setting Up the Remote Control Connection

### Preparing for Remote Control

The short and simple operating sequence below shows how to put the instrument into operation and quickly set its basic functions. The current IP address for LAN operation is shown in the SETUP – Instrument Setup Menu. For USB connection, the IP address is fixed to 172.16.10.10..

For instructions on how to change the IP address, refer to the getting started manual.

1. Connect the instrument to the LAN or directly to the controller via USB.
2. Switch on the instruments.
3. Write and start the following program on the controller:

```
status = viOpenDefaultRM(defaultRM)
```

'Opens default resource manager

```
status = viOpen(DefaultRM, "TCPIP::172.16.10.10", 0, 0, vi)
```

'For USB connection

```
Status = viopen(DefaultRM, "TCPIP::xxx.xxx.xxx.xxx", 0, 0, vi)
'For a LAN connection, with xxx.xxx.xxx.xxx = IP address
Cmd = "**RST;*CLS"
status = viWrite(vi, Cmd, Len(Cmd), retCount)
'Resets instrument and clear status registers
Cmd = "FREQ:CENT 100MHz"
status = viWrite(vi, Cmd, Len(Cmd), retCount)
'Sets center frequency to 100 MHz
Cmd = "FREQ:SPAN 10MHz"
status = viWrite(vi, Cmd, Len(Cmd), retCount)
'Sets span to 10 MHz
Cmd = "DISP:TRAC:Y:RLEV -10dBm"
status = viWrite(vi, Cmd, Len(Cmd), retCount)
'Sets reference level to -10 dBm
viclose vi
viclose default RM
```

The instrument now performs a sweep in the frequency range of 95 MHz to 105 MHz.

### Changing the IP Address

In order to operate the instrument via remote control, it must be accessed via LAN (IP address) or USB. If the factory-set remote control address does not fit in the network environment, it can be changed. For instructions on how to change the IP address, refer to the getting started manual.

## 11.6 Instrument Model and Command Processing

The block diagram in Fig. 11-4 shows how SCPI commands are serviced in the instrument. The individual components work independently and simultaneously. They communicate with each other by means of so-called "messages".

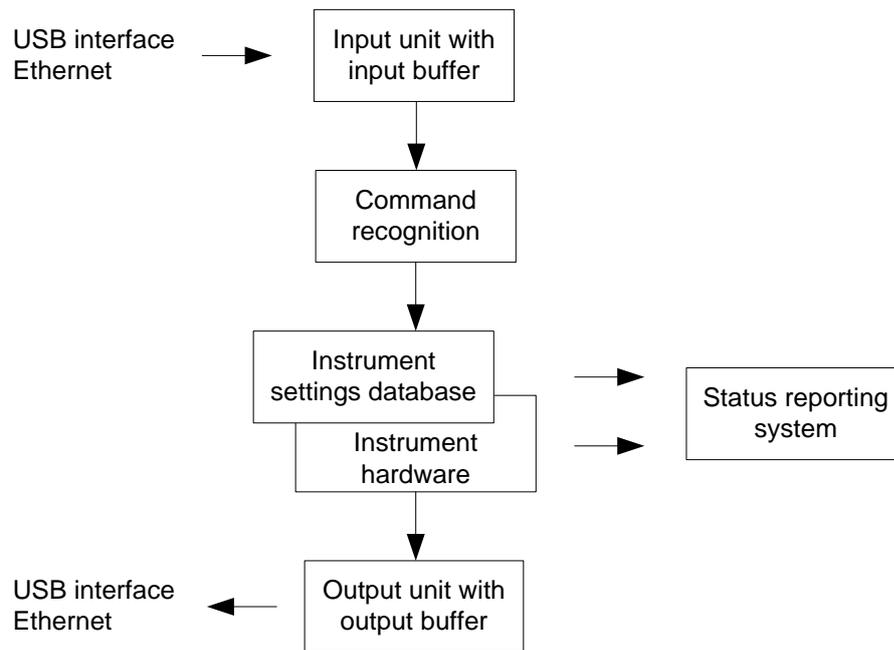


Fig. 11-4: Instrument model in the case of remote control

### Input Unit

The input unit receives commands character by character from the controller and collects them in the input buffer. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the traffic is stopped and the data received up to then are processed. Subsequently the traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of DCL clears the input buffer and immediately resets the command recognition.

### Command Recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only DCL is serviced with priority, for example GET (Group Execute Trigger) is only executed after the commands received before. Each recognized command is immediately transferred to the internal instrument settings data base but not executed immediately.

The command recognition detects syntax errors in the commands and transfers them to the status reporting system. The rest of a program message after a syntax error is analyzed further if possible and serviced. After the syntax test, the value range of the parameter is checked, if required.

If the command recognition detects a delimiter, it passes the command to an execution unit that performs the instrument settings. In the meantime, the command recognition is ready to process new commands (overlapping execution). A DCL command is processed in the same way.

### Data Base and Instrument Hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included. The term "data base" denotes a database that manages all the parameters and associated settings required for setting the instrument hardware.

Setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. This only takes place at the end of a program message.

The data are checked for compatibility with the current instrument settings before they are transmitted to the instrument hardware. If the execution is not possible, an "execution error" is signaled to the status reporting system. The corresponding settings are discarded.

Before passing on the data to the hardware, the settling bit in the STATUS:OPERation register is set (refer to section "STATUS:OPERation Register"). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

Queries induce the data set management to send the desired data to the output unit.

### Status Reporting System

For detailed information refer to chapter "Remote Command Reference", section "Status Reporting System".

### Output Unit

The output unit collects the information requested by the controller, which it receives from the data base management. It processes it according to the SCPI rules and makes it available in the output buffer.

If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data base management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent to the controller, the controller waits until it has reached its time limit. This behavior is defined by IEEE 488.2 and SCPI.

## 11.7 SCPI Command Structure and Syntax

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure.

SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see section "Responses to Queries").



Not all commands used in the following examples are implemented in the instrument.

### 11.7.1 Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

#### 11.7.1.1 Common commands

Common commands consist of a header preceded by an asterisk "\*" and one or several parameters, if any.

Example

\*RST

'RESET, resets the device

\*ESE 253

'EVENT STATUS ENABLE, sets the bits of the event status enable register

\*ESR?

'EVENT STATUS QUERY, queries the contents of the event status register.

#### 11.7.1.2 Device-Specific Commands

##### Hierarchy

Device-specific commands are of hierarchical structure (see Fig. 11-5). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

Example

SENSe

This key word denotes the SENSE command system.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example

SENSe:FREQuency:SPAN 10MHZ

This command lies in the third level of the SENSE system. It sets the frequency span.

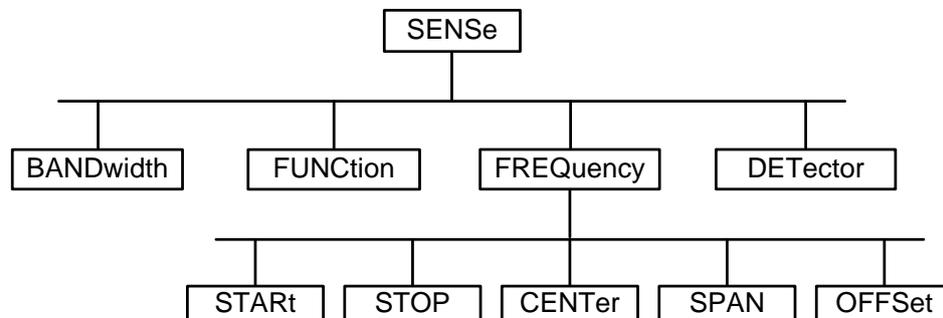


Fig. 11-5: Tree structure the SCPI command systems using the SENSE system as example

### Multiple Key Words

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, i.e. at which position in the header of a command they are inserted.

Example

SOURce:FM:POLarity NORMal

This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

Example

SOURce:FM:EXTernal:POLarity NORMal

This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

### Optional Key Words

Some command systems permit certain key words to be inserted into the header or omitted. These key words are marked by square brackets in the description. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example

[SENSe]:BANDwidth[:RESolution]:AUTO

This command couples the resolution bandwidth of the instrument to other parameters. The following command has the same effect:

BANDwidth:AUTO

### Optional keywords with numeric suffixes

Do not omit an optional keyword if it includes a numeric suffix that is relevant for the effect of the command.

Example



DISPlay[:WINDow<1...4>]:MAXimize <Boolean>

Command DISP:MAX ON refers to window 1.

In order to refer to a window other than 1, you must include the optional WINDow parameter with the suffix for the required window.

DISP:WIND2:MAX ON refers to window 2.

### Long and Short Form

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permitted.

Example

STATus:QUESTionable:ENABLE 1 is equivalent to STAT:QUES:ENAB 1



Upper-case and lower-case notation only serves to distinguish the two forms in the manual, the instrument itself does not distinguish upper-case and lower-case letters.

### Parameter

The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. Refer to "Parameters" for a detailed description of the various parameters.

Example

SENSe:FREQuency:STOP? MAXimum, Response: 3.5E9

This query requests the maximal value for the stop frequency.

### Special Characters

	<p>A vertical stroke in parameter definitions indicates alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.</p> <p>Example</p> <p>DISPlay:FORMat SINGLE   SPLit</p>
--	--

	<p>If parameter SINGLE is selected, full screen is displayed, in the case of SPLit, split screen is displayed.</p> <p>A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.</p> <p>Example</p> <pre>SENSe:BANDwidth BWIDth[:RESolution]</pre> <p>The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:</p> <pre>SENSe:BAND 1 SENSe:BWID 1</pre>
[ ]	<p>Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.</p> <p>Example</p> <pre>[SENSe:]BANDwidth BWIDth[:RESolution]</pre> <p>SENS:BAND:RES is equivalent to BAND</p> <p>Parameters in square brackets can be incorporated optionally in the command or omitted as well.</p> <p>Example</p> <pre>MMEMory:NETWork:MAP &lt;string&gt;,&lt;string&gt;[,string&gt;,&lt;string&gt;,&lt;boolean&gt;]</pre> <p>Entries in square brackets are optional or can be omitted.</p>
{ }	<p>Parameters in curly brackets are optional and can be inserted once or several times, or omitted.</p> <p>Example</p> <pre>SENSe:LIST:FREQuency &lt;numeric_value&gt;{,&lt;numeric_value&gt;}</pre> <p>The following are available commands:</p> <pre>SENS:LIST:FREQ 10 SENS:LIST:FREQ 10,20 SENS:LIST:FREQ 10,20,30,40</pre>

### Numeric Suffix

If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1. Optional keywords must be specified if they select a function with the suffix.

Example

SYSTem:COMMunicate:SERial2:BAUD 9600

This command sets the baud rate of a second serial interface.



In remote control, suffix counting may differ from the numbers of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.

Some standards define a fixed numbering, starting with 0. With GSM, for instance, slots are counted from 0 to 7. In the case of remote control, the slots are selected with the suffixes 1 to 8. If the numbering differs in manual operation and remote control, it is indicated with the respective command.

## 11.7.2 Overview of Syntax Elements

The following table offers an overview of the syntax elements.

:	The colon separates the key words of a command. In a program message the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands within a program message. It does not alter the path.
,	The comma separates several parameters of a command.
?	The question mark forms a query.
*	The asterisk marks a common command.
"	Quotation marks introduce a string and terminate it.
#	The hash symbol # introduces binary, octal, hexadecimal and block data. Binary: #B10110 Octal: #O7612 Hexa: #HF3A7 Block: #21312
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

## 11.7.3 Parameters

For most commands a parameter needs to be supplemented. The parameter has to be separated from the header by a "white space". Possible parameters are:

- Numeric values
- Special numeric values
- Boolean parameters
- Text
- Character strings
- Block data

The type of parameter required for each command and the allowed range of values are specified in the command description.

### 11.7.3.1 Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), (MOHM and MHZ are also possible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example

```
SENSe:FREQuency:STOP 1.5GHz = SENSe:FREQuency:STOP 1.5E9
```

Special Numeric Values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numeric values. For queries, the numeric value is returned.

- MIN/MAX

MINimum and MAXimum denote the minimum and maximum value.

- UP/DOWN

UP, DOWN increases or reduces the numerical value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.

- INF/NINF

INFINITY, Negative INFINITY (NINF) Negative INFINITY (NINF) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device responses.

- NAN

Not A Number (NAN) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Example:

```
Setting command: SENSe:FREQuency:STOP MAXimum
```

Query: SENSE:FREQUENCY:STOP?, Response: 3.6E9

### 11.7.3.2 Boolean Parameters

Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically untrue) is represented by OFF or the numerical value 0. The numerical values are provided as response for query.

Example

Setting command: DISPLAY:WINDOW:STATE ON

Query: DISPLAY:WINDOW:STATE?, Response: 1

### 11.7.3.3 Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example

Setting command: INPUT:COUPLING GROund

Query: INPUT:COUPLING?, Response: GRO

### 11.7.3.4 Strings

Strings must always be entered in quotation marks (' or ").

Example

SYSTEM:LANGUAGE "SCPI" or SYSTEM:LANGUAGE 'SCPI'

### 11.7.3.5 Block Data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example

HEADER:HEADER #45168xxxxxxxx

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted.

### 11.7.4 Structure of a Program Message

A program message may consist of one or several commands. It is terminated by the program message terminator which is the NL (New Line) character for LAN and USB connections.

Several commands in a program message must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQUency:CENTer 100MHz;:INPut:ATTenuation 10")
```

This program message contains two commands. The first one is part of the SENSe command system and is used to determine the center frequency of the instrument. The second one is part of the INPut command system and sets the input signal attenuation.

If the successive commands belong to the same system, having one or several levels in common, the program message can be abbreviated. For that purpose, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQUency:START 1E6;:SENSe:FREQUency:STOP 1E9")
```

This program message is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SENSe command system, subsystem FREQUency, i.e. they have two common levels.

When abbreviating the program message, the second command begins with the level below SENSe:FREQUency. The colon after the semicolon is omitted. The abbreviated form of the program message reads as follows:

```
CALL InstrWrite(analyzer, "SENSe:FREQUency:START 1E6;STOP 1E9")
```

However, a new program message always begins with the complete path.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQUency:START 1E6")
```

```
CALL InstrWrite(analyzer, "SENSe:FREQUency:STOP 1E9")
```

### 11.7.5 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

The requested parameter is transmitted without header.

Example

INPut:COUPling?, Response: DC

Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.

Example

SENSe:FREQUency:STOP? MAX, Response: 3.5E9

Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.

Example

SENSe:FREQUency:CENTer?, Response: 1E6 (for 1 MHz)

Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).

Example

SENSe:BANDwidth:AUTO?, Response: 1 (for ON)

Text (character data) is returned in a short form.

Example

SYSTem:COMMunicate:SERial:CONTrol:RTS?, Response STAN (for standard)

## 11.7.6 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. In order to prevent an overlapping execution of commands, one of the commands \*OPC, \*OPC? or \*WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the respective action to occur (refer to Table 11-1).

**Table 11-1: Synchronization using \*OPC, \*OPC? and \*WAI**

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	Setting bit 0 in the ESE Setting bit 5 in the SRE Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all	Sending *WAI directly after the command whose processing should

	commands sent before *WAI have been executed.	be terminated before other commands are executed.
--	---	---

For a couple of commands the synchronization to the end of command execution is mandatory in order to obtain the desired result. The affected commands require either more than one measurement in order to accomplish the desired instrument setting (e.g. auto range functions), or they require a longer period of time for execution. If a new command is received during execution of the corresponding function this may either lead to an aborted measurement or to incorrect measurement data.

The following table includes the commands, for which a synchronization via \*OPC, \*OPC? or \*WAI is mandatory:

**Table 11-2: Commands with mandatory synchronization (overlapping commands)**

Command	Purpose
INIT	Starts measurement (sweep).
INIT:CONT OFF	Sets to single sweep.
CALC:MARK:FUNC:xx?	Queries all marker functions.

## 12 Remote Command Reference

The following chapters provide a detailed description of all remote control commands currently available for the R&S ETC and its firmware options.

Each section describes the commands for one of the operating modes available in the R&S ETC, beginning with the description of common commands required to operate the instrument. The structure is based on that of the user manual.

- [Common Commands](#)
- [Remote Commands in Spectrum Mode](#)
- [Remote Commands in Network Analyzer Mode](#)
- [Remote Commands in Power Meter Mode](#)

Each section is subdivided into various tasks required to perform measurements with the R&S ETC, also based on the structure of the user manual. Some commands like those for controlling markers or configuring the frequency axis are available for all operating modes. In that case you will find a list of these commands in the corresponding section. However, a detailed description is provided only in the analyzer commands section.



The spectrum analysis and network analysis modes are implemented in the basic unit.

For the other modes, the corresponding options are required.

---

Following the remote control commands required to perform specific measurements, you will find a description of general commands used to set up and control basic instrument functions. These commands are independent of the operating mode. Therefore they are listed separately.

- [Saving and Restoring Instrument Settings and Measurement Results](#)
- [Configuring the Instrument](#)
- [Remote Commands of the Status Reporting System](#)

All chapters begin with a list of commands available in the context of that chapter. Following that list you will find a detailed description of all commands.

All individual descriptions contain:

- Complete notation and syntax of the command
- Description of the effects of the command
- List of all parameters available for that command
- Example of how a program message would look like
- \*RST value
- Information on SCPI conformity

## 12.1 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. A particular command has the same effect on different devices. The headers of these commands consist of an asterisk "\*" followed by three letters. Some of the common commands refer to the ["Status Reporting System"](#).

### List of common commands

- \*CLS
- \*ESE
- \*ESR?
- \*IDN?
- \*IST?
- \*OPC
- \*OPT?
- \*RST
- \*SRE
- \*STB?
- \*TRG
- \*TST?
- \*WAI

#### \*CLS

---

**CLEAR STATUS** sets the status byte (STB), the standard event register (ESR) and the EVENT part of the QUESTIONable and the OPERATION register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

#### \*ESE

---

**EVENT STATUS ENABLE** sets the event status enable register to the value indicated. The query form \*ESE? returns the contents of the event status enable register in decimal form

##### Parameters

0 to 255

#### \*ESR?

---

**STANDARD EVENT STATUS QUERY** returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero

##### Parameters

0 to 255

**\*IDN?**


---

IDENTIFICATION QUERY queries the instrument identification.

You can change the format of the return values with the **SYSTEM:FORMat:IDENT** command

**Return value**

Example for R&S ETC:

Rohde&Schwarz,ETC,100005/014,3.00

ETC	instrument name
100005/014	serial number/model index
3.00	firmware version

**\*IST?**


---

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll (see chapter "Remote Control Basics")

**Parameter**

0 | 1

**\*OPC**


---

OPERATION COMPLETE sets bit 0 in the event status register after all preceding commands have been executed. This bit can be used to initiate a service request (see chapter "Remote Control Basics")

**\*OPT?**


---

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas

**Parameter**

K<number> software options

For a list of all available options and their description refer to the CD-ROM

**Example**

K40, K41, K42, K45

**\*RST**

---

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the PRESET key. PRESET sets the R&S ETC to the default setup of the selected instrument mode. This allows you to enter a new configuration based on defined measurement parameters, without parameters from a previous setting still being inadvertently active.

**\*SRE**

---

SERVICE REQUEST ENABLE sets the service request enable register to the indicated value. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is generated. The query form \*SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

**Parameter**

0 to 255

**\*STB?**

---

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

**\*TRG**

---

TRIGGER initiates all actions in the currently active test screen expecting a trigger event. This command corresponds to the INITiate:IMMEDIATE command. For details refer to the [INITiate\[:IMMEDIATE\]](#).

**\*TST?**

---

SELF TEST QUERY initiates the self test of the instrument and outputs an error code in decimal form.

**Parameter**

0 = no error

**\*WAI**

---

WAIT-to-CONTINUE permits servicing of subsequent commands only after all preceding commands have been executed and all signals have settled (see chapter "Remote Control Basics").

## 12.2 Remote Commands in TV Analyzer Mode

This section provides a detailed description of all remote control commands required to configure and perform measurements in TV Analyzer mode.

- [Configuring the TV Analyzer Measurements](#)
- [Configuring the Constellation Diagram Measurement](#)
- [Configuring the Echo Pattern Measurement](#)
- [Configuring the MER\(k\) Measurement](#)
- [Configuring the Amplitude/Phase/Group Delay Measurement](#)
- [Configuring the Spectrum Measurement](#)
- [Configuring the Spectrum Emission Mask Measurement](#)
- [Setting the Frequency](#)
- [Setting Amplitude Parameters](#)
- [Configuring Limits](#)
- [Using Limit Functions](#)

### 12.2.1 Configuring the TV Analyzer Measurements

The following commands configure the measurement functions of the TV Analyzer.

#### List of Commands

- `INSTRument[:SElect]`
- `INSTRument[:SElect]?`
- `INSTRument:NSElect`
- `CONFigure:DTV:MEASurement`
- `DISPlay<1|2>[:WINDow]`
- `CALCulate<1|2>:DTV:PROFile:SElect`
- `CALCulate<1|2>:DTV:PROFile:SElect?`
- `CALCulate<1|2>:DTV:PROFile:CHECK?`
- `[SENSE:]DTV:BANDwidth:CHANnel`
- `[SENSE:]DTV:BANDwidth:OFDM`
- `[SENSE:]DTV:T2PRofile`
- `[SENSE:]DDEMod:FECSync`
- `[SENSE:]DDEMod:LOOPs:SYMBOL`
- `[SENSE:]DDEMod:T2SOutput`
- `[SENSE:]DDEMod:BITStream:PRiority`
- `[SENSE:]DDEMod:SOPTimation`
- `[SENSE:]DDEMod:CADaption`
- `[SENSE:]DDEMod:FFT:WPOSITIONing`
- `[SENSE:]DDEMod:FFT:WOFFset`
- `[SENSE:]DDEMod:DECPIpid:MODE`
- `[SENSE:]DDEMod:DECPIpid:MAN`
- `[SENSE:]DDEMod:SBPosition`
- `CALCulate<1|2>:AVERage:BERate:CLEar`

**INSTrument[:SElect]**


---

This command selects the instrument mode of the R&S ETC.

**Parameter**

DVB	Selects the TV Analyzer mode (equivalent to 'TV')
TV	Selects the TV Analyzer mode (equivalent to 'DVB')
SANalyzer	Selects the Spectrum Analysis mode
NANalyzer	Selects the Network Analysis mode
DTF	Selects the Distance to Fault mode (only available for R&S ETH)
PM	Selects the Power Meter mode

**Example**

INST DVB

Switches the instrument to TV Analyzer mode.

**Characteristics**

- \* RST value: DVB
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**INSTrument[:SElect]?**


---

This command selects the instrument mode of the R&S ETC.

**Return value**

DVB	TV Analyzer mode
SAN	Spectrum Analysis mode
NAN	Network Analysis mode
DTF	Distance to Fault mode (only available for R&S ETH)
PM	Power Meter mode

**Example**

INST?

DVB

The instrument is in the TV Analyzer mode.

**Characteristics**

- \* RST value: DVB
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**INSTrument:NSElect**

This command switches between the measurement modes by means of numbers.

**Parameter**

1	TV Analyzer
2	Spectrum Analyzer
3	Network Analyzer
4	Distance-to-Fault (only available for R&S ETH)
5	Power Meter

**Example**

INST:NSEL 1

Switches the instrument to TV Analyzer mode.

**Characteristics**

- \* RST value: 1
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**SETup:TV:STANdard**

This command selects the TV standard of the TV Analyzer. Prerequisite: the TV Analyzer instrument mode must be selected. The corresponding SW option key for the TV standard must be installed.

**Parameter**

DVBT	Selects the DVB-T/H TV standard
ISDBt	Selects ISDB-T the TV standard
DVBT2	Selects the DVB-T2 TV standard

**Example**

```
SET:TV:STAN ISDBT
```

Sets the TV Analyzer to TV standard ISDB-T.

**Characteristics**

- \* RST value: DVB-T
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CONFigure:DTV:MEASurement**

This command selects the measurement mode of the TV Analyzer. Prerequisite: the TV Analyzer instrument mode must be selected.

**Parameter**

LIST	Selects the Measurement List	
CONS	Selects the Constellation Diagram	

EPATtern	Selects the Echo Pattern measurement	
MERK	Selects the MER(k) measurement	equivalent to MERFrequency
MERFrequency	Selects the MER(k) measurement	equivalent to MERK
APGD	Select the Amplitude/Phase/Grp Delay measurement	
DSpectrum	Selects the corresponding Spectrum measurement	
SEM	Selects the Spectrum Emission Mask measurement	
L1Pre	Selects the L1-pre Signalling measurement (DVB-T2 only)	equivalent to DISPlay<1 2>[:WINDow]TPS
L1Post	Selects the L1-post Signalling measurement (DVB-T2 only)	
L1PLp	Selects the L1 PLP parameter measurement (DVB-T2 only)	
MDECoder	Selects the MPEG Decoder measurement	

**Example**

CONF:DTV:MEAS CONS

Sets the measurement mode to constellation diagram.

**Characteristics**

- \* RST value: LIST
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay<1|2>[:WINDow]**

This command defines the active viewer mode between Measurement List or Constellation Diagram and the TPS or TMCC screen. This command is available in the Measurement List and Constellation Diagram measurement modes.

Note : TPS command is also available for measurement mode MER(k) when DVB-T2 is activated. In DVB-T2 mode, TPS will switch the display to “L1-Pre Signalling” screen. To switch to other signaling information screen, see

**CONFigure:DTV:MEASurement** command**Parameter**

DVB	Selects the Measurement List or the Constellation Diagram screen.
TPS	Selects the TPS or TMCC or L1 PLP Signalling screen.

**Example**

DISPLAY TPS  
Sets the TPS screen.

**Characteristics**

- \* RST value: DVB
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate<1|2>:DTV:PROFile:SElect**

This command loads a measurement profile from a file with the name <file name> and applies its settings. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMemory:CDIRectory](#) command.

This command is available in all TV Analyzer measurement modes.

**Parameter**

<string> = <file name>

**Example**

CALC:DTV:PROF:SEL 'DVB-T 8MHz'  
Loads the measurement profile from the default directory with the name 'DVB-T 8MHz'.

CALC:DTV:PROF:SEL '\\Storage Card\\Public\\STANDARDS\\DVB-T 8MHz'  
Loads the measurement profile from the directory '\\SD card\\public\\standards\\' with the name 'DVB-T 8MHz'.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate<1|2>:DTV:PROFile:SElect?**


---

This command returns the file name and its description of the loaded measurement profile.

This command is an query and therefore has no \*RST value.

**Parameter**

<string1>,<string2>

string1: "measurement profile file name"

string2: "measurement profile description"

**Example**

CALC:DTV:PROFILE:SEL?

Reads the measurement profile file name and the measurement profile description.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate<1|2>:DTV:PROFile:CHECK?**


---

This command checks if the settings correspond to the loaded measurement profile. This command is available in all TV Analyzer measurement modes.

**Return value**

0	Settings do not correspond to the loaded measurement profile.
1	Settings correspond to the loaded measurement profile.

**Example**

CALCulate:DTV:PROFile:CHECK?

Checks the settings with the loaded measurement profile.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSE:]DTV:BANDwidth:CHANnel**

This command defines the channel bandwidth setting. The R&S ETC sets the correct OFDM bandwidth depending on the set channel bandwidth. Note : Only DVB-T2 support 1.7MHz bandwidth setting. 1.7MHz will be ignored in DVB-T.

**Return value**

1_7Mhz or 1.7e6	1.7 MHz channel bandwidth (DVB-T2 only)
5MHz or 5e6	5 MHz channel bandwidth
6MHz or 6e6	6 MHz channel bandwidth
7MHz or 7e6	7 MHz channel bandwidth
8MHz or 8e6	8 MHz channel bandwidth

**Example**

DTV:BAND:CHAN 7e6

Sets the channel bandwidth to 7 MHz.

**Characteristics**

- \* RST value: 8e6
- SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: -

**Mode**

-

**[SENSE:]DTV:BANDwidth:OFDM**

This command sets the OFDM bandwidth with a resolution of 0.1 Hz.

**Parameter**

1.0E06 to 8.0E06 (numeric value in exponential notation) or 1.0MHz to 8.0MHz

**Example**

SENSE:DTV:BANDWIDTH:OFDM 4.8E06  
Sets the OFDM bandwidth to 4.8000000 MHz.

**Characteristics**

- \* RST value: 7.6071429E06
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSE:]DTV:T2PProfile**

This command sets the OFDM bandwidth with a resolution of 0.1 Hz.

**Parameter**

T2Base	DVB-T2 Base profile
T2Lite	DVB-T2 Lite profile

**Example**

SENSE:DTV:T2PROFILE T2BASE  
Sets the DVB-T2 Profile to T2Base.

**Characteristics**

- \* RST value: T2Base
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: no
- Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:FECsSync**


---

This command defines if a locked FEC decoder is required for demodulator synchronization. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

**Parameter**

FEC	FEC decoder lock is required
NFEC	FEC decoder lock is not required

**Example**

DDEMod:FECs NFEC

Sets the OFDM demodulator lock condition to FEC decoder lock is not required.

**Characteristics**

- \* RST value: FEC
- SCPI: device-specific
- TV standard: DVB-T/H and ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:LOOPs:SYMBOL**


---

This command defines the symbol loop setting. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k)

---

measurement modes.

**Parameter**

HIGH | MEDium | LOW

**Example**

DDEMOD:LOOPS:SYMBOL HIGH

Sets the symbol loop bandwidth of the OFDM demodulator to high.

**Characteristics**

- \* RST value: MED
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:TOutput**

---

This command defines the bit stream priority setting for hierarchical modulation. Besides the BER measurement parameters also the TS output signal is controlled. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes. This command is equivalent to the [\[SENSE:\]DDEMod:BITStream:PRiority](#) command

**Parameter**

HIGH | LOW

**Example**

DDEM:TSO LOW

The low priority bit stream will be demodulated for hierarchical modulation.

**Characteristics**

- \* RST value: HIGH
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

### **[SENSE:]DDEMod:BITStream:PRiority**

This command defines the bit stream priority setting for hierarchical modulation. Besides the BER measurement parameters also the TS output signal is controlled. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes. This command is equivalent to the [\[SENSE:\]DDEMod:TSoOutput](#) command

#### **Parameter**

HIGH | LOW

#### **Example**

DDEM:TSo LOW

The low priority bit stream will be demodulated for hierarchical modulation.

#### **Characteristics**

- \* RST value: HIGH
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### **Mode**

-

### **[SENSE:]DDEMod:SOPTimation**

This command defines the channel adaptation setting. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

This command is equivalent to the [\[SENSE:\]DDEMod:CADaption](#) command.

#### **Parameter**

SLOW | MEDium | FAST

#### **Example**

DDEMOD:SOPT FAST

Sets the channel adaptation to fast adaptation.

#### **Characteristics**

- \* RST value: MED

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:CADaption**

This command defines the channel adaptation setting. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

This command is equivalent to the [\[SENSE:\]DDEMod:SOPTimation](#) command

**Parameter**

SLOW | MEDium | FAST

**Example**

DDEMOD:CAD FAST

Sets the channel adaptation to fast adaptation.

**Characteristics**

\* RST value: MED

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:FFT:WPOSITIONing**

This command activates or deactivates the manual setting of the FFT Window for demodulation. The shift offset can be set with the [\[SENSE:\]DDEMod:FFT:WOFFSET](#) command. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes

**Parameter**

AUTO | MANual

**Example**

DDEMOD:FFT:WPOS MAN

Sets the FFT window positioning to manual control.

**Characteristics**

- \* RST value: AUTO
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:FFT:WOffset**

This command shifts the FFT Window position for demodulation additionally as far as half the length of the guard interval in both directions. Prerequisite: manual setting is activated by the [\[SENSE:\]DDEMod:FFT:WPosItioning](#) command. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

**Parameter**

-50 to +50

**Example**

DDEMOD:FFT:WOff 10

Shifts the FFT window position by plus 10% with respect to the main pulse.

**Characteristics**

- \* RST value: 0
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**[SENSE:]DDEMod:DECPIpid:MODE**

This command activates or deactivates the manual setting of the PLP decoded ID for demodulation. The decoded PLP ID can be set with the

---

[\[SENSE:\]DDEMod:DECP:pid:MAN](#) command when MANual mode is activated.

This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

**Parameter**

AUTO | MANual

**Example**

DDEM:DECP:MODE MAN

Sets the Decoded PLP ID to manual control.

**Characteristics**

- \* RST value: AUTO
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: no
- Compatibility to R&S ETL: no

**Mode**

-

**[SENSE:]DDEMod:DECP:pid:MAN**

---

This command selects the PLP ID number to be used for decoding. Prerequisite: manual setting is activated by [\[SENSE:\]DDEMod:DECP:pid:MODE](#) command. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

**Parameter**

0 to 255

**Example**

DDEM:DECP:MAN 1

Sets the Decoded PLP ID to 1.

**Characteristics**

- \* RST value: 0
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: no
- Compatibility to R&S ETL: no

**Mode**

-

### **[SENSE:]DDEMod:SBPosition**

---

This command selects the sideband position for DVB-T2 during demodulation. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

#### **Parameter**

NORMal | INVerse

#### **Example**

DDEM:SBP NORM

Sets the sideband positioning to normal.

#### **Characteristics**

- \* RST value: 0
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: no
- Compatibility to R&S ETL: no

#### **Mode**

-

### **CALCulate<1|2>:AVERage:BERate:CLEar**

---

This command resets the BER measurements BER before Viterbi, BER before Reed Solomon and Packet Error Ratio. This command is available in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes.

#### **Parameter**

-

#### **Example**

CALC:AVER:BER:CLE

Resets all BER measurements.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

## 12.2.2 Configuring the Constellation Diagram Measurement

The following commands configure the Constellation Diagram measurement.

**List of Commands**

- [DISPlay\[:WINDow\]:TRACe:MODE](#)
- [DISPlay\[:WINDow\]:SElect:CONS:PCARriers](#)
- [CALCulate<1|2>:AVERAge:CELL:COUNt](#)
- [CALCulate<1|2>:AVERAge:SYMBol:COUNt](#)
- [CALCulate<1|2>:AVERAge:TRACe:REStart](#)

**DISPlay[:WINDow]:TRACe:MODE**

---

This command sets the trace mode of the constellation diagram.

**Parameter**

FREEze | INFinite | WRITe

**Example**

DISP:WIND:TRAC:MODE INF  
Freezes the constellation diagram screen.

**Characteristics**

- \* RST value: WRIT
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**DISPlay[:WINDow]:SElect:CONS:PCARriers**

---

This command configures the display of the pilot carriers in the Constellation Diagram measurement.

**Parameter**

ON | OFF

**Example**

DISP:SEL:CONS:PCAR OFF

Hides the display of pilots in the constellation diagram screen.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate<1|2>:AVERAge:CELL:COUNT**


---

This command defines the number of I/Q cells to be displayed in the Constellation measurement under trace mode Clear/Write. This command is only effective if any I/Q source is selected displaying the PLP cells.

**Parameter**

1 to 999 999 999 [I/Q cells]

**Example**

CALC:AVER:CELL:COUN 10000

Sets the number of I/Q cells to 10000.

**Characteristics**

- \* RST value: 200000
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: no
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate<1|2>:AVERAge:SYMBol:COUNT**

---

This command defines the number of symbols that are shown on display in the trace mode Clear/Write.

**Parameter**

1 to 999 999 999

**Example**

CALC:AVER:SYMB:COUN 100  
Sets the symbol counter to 100.

**Characteristics**

- \* RST value: 50
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate<1|2>:AVERage:TRACe:REStart**

---

This command clears all constellation samples from screen. It is only available in case the trace mode ([DISPlay\[:WINDow\]:TRACe:MODE](#)) is set to Clear/Write or Infinite.

**Parameter**

-

**Example**

CALCULATE:AVERAGE:TRACE:RESTART  
Restarts the Constellation Diagram measurement.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

### 12.2.3 Configuring the Echo Pattern Measurement

The following commands configure the Echo Pattern measurement.

#### List of Commands

- [SENSe]:DTV:EPATtern:ESPan
- DISPlay:DTV:EPATtern:ASPan
- DISPlay[:WINDow]:TRACe[<1|2>]:X[:SCALe]:AUTO
- DISPlay[:WINDow<1|2>]:TRACe:X[:SCALe]:DIVision
- DISPlay:DTV:EPATtern:SPAN
- CALCulate<1|2>:DTV:UNIT:POWER:EPATern
- UNIT:DTV:EPAT:SPAN
- DISPlay[:WINDow<1|2>]:TRACe:X[:SCALe]:CENTer
- DISPlay:DTV:EPATtern:CPOSition
- DISPlay:DTV:EPATtern:MLISt
- DISPlay:DTV:EPATtern:PLISt
- DISPlay:DTV:EPATtern:PLISt:FREeze
- DISPlay:DTV:EPATtern:PLISt:THReshold
- DISPlay:DTV:EPATtern:TRACe
- DISPlay:DTV:EPATtern:MEMory
- DISPlay[:WINDow<1|2>]:MEASurement:EPATtern:THReshold:LINE:STATe
- DISPlay:DTV:EPATtern:DLINe
- DISPlay:DTV:EPATtern:PLISt:TLINe
- DISPlay:DTV:EPATtern:MARKer:LIST
- DISPlay:DTV:EPATtern:MARKer:LIST?

#### [SENSe]:DTV:EPATtern:ESPan

---

This command sets the x-span to extended mode.

##### Parameter

ON | OFF

##### Example

DTV:EPAT:ESPAN ON

Sets the span mode to extended mode.

##### Characteristics

\* RST value: OFF

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: no

##### Mode

-

### DISPlay:DTV:EPATtern:ASPan

---

This command sets the span to Auto Span or to Manual Span. This command is equivalent to the [DISPlay:WINDow:TRACe\[<1|2>\]:X\[:SCALe\]:AUTO](#) command.

#### Parameter

ON | OFF

#### Example

DISPLAY:DTV:EPATTERN:ASPan OFF  
Sets the span to Manual Span.

#### Characteristics

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### Mode

-

### DISPlay[:WINDow]:TRACe[<1|2>]:X[:SCALe]:AUTO

---

This command sets the span to Auto Span or to Manual Span.  
This command is equivalent to the [DISPlay:DTV:EPATtern:ASPan](#) command.

#### Parameter

ON | OFF or 0 | 1

#### Example

DISPLAY:TRACE:X:AUTO OFF  
Sets the span to Manual Span.

#### Characteristics

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay[:WINDow<1|2>]:TRACe:X[:SCALe]:DIVision**

This command sets the x-scale per division. In total always 10 divisions (grids) are displayed. The Auto Span mode must be switched off before, see [DISPlay:DTV:EPATtern:ASPan](#). The value is referred to the selected span unit. This command is equivalent to the [DISPlay:DTV:EPATtern:SPAN](#) command.

**Parameter**

0.5e-6 to 200e-6	0.5 to 200 $\mu$ s/div if span unit ' $\mu$ s' is selected.
100 to 500e3	1 to 5000 km if span unit 'km' is selected.
1 to 2000	1 to 2000 miles if span unit 'miles' is selected.

**Example**

```
DISPLAY:TRACE:X:DIV 50
```

Sets the span to 500  $\mu$ s if the span unit ' $\mu$ s' is selected.

**Characteristics**

- \* RST value: SEC
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay:DTV:EPATtern:SPAN**

This command sets the span of the echo pattern measurement if manual span is selected. The span can be set in 1-2-5 steps. The Auto Span mode must be switched off before, see [DISPlay:DTV:EPATtern:ASPan](#). The value is referred to the selected span unit.

This command is equivalent to the [DISPlay\[:WINDow<1|2>\]:TRACe:X\[:SCALe\]:DIVision](#) command.

**Parameter**

5 to 10000	5 to 10000 $\mu$ s if span unit ' $\mu$ s' is selected.
1 to 5000	1 to 5000 km if span unit 'km' is selected.
1 to 2000	1 to 2000 miles if span unit 'miles' is selected.

**Example**

DISP:DTV:EPAT:SPAN 500

Sets the span to 500  $\mu$ s if the span unit ' $\mu$ s' is selected.

**Characteristics**

- \* RST value: - (Auto Span)
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**CALCulate<1|2>:DTV:UNIT:POWer:EPATern**

This command sets the x-span unit of the echo pattern measurement.  
This command is equivalent to the [UNIT:DTV:EPAT:SPAN](#) command.

**Parameter**

S | M | MILE

**Example**

CALC:DTV:UNIT:POW:EPAT M

Sets the span unit to meter.

**Characteristics**

- \* RST value: S
- SCPI: device-specific
- TV standard: DVB-T/H and ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**UNIT:DTV:EPAT:SPAN**

This command sets the x-span unit of the echo pattern measurement. This command is equivalent to the [CALCulate<1|2>:DTV:UNIT:POWer:EPATern](#) command.

**Parameter**

S | M | MILE

**Example**

UNIT:DTV:EPAT:SPAN M  
Sets the span unit to meter.

**Characteristics**

- \* RST value: S
- SCPI: device-specific
- TV standard: DVB-T/H and ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay[:WINDow<1|2>]:TRACe:X[:SCALE]:CENTer**

This command sets the center position of the x-scale. The span must be set to manual span before, see [DISPlay:DTV:EPATtern:ASPan](#) command. The value is referred to the selected span unit. This command is equivalent to the [DISPlay:DTV:EPATtern:CPOSition](#) command.

**Parameter**

-0.002 to 0.002	-0.002 to 0.002 s if span unit 'µs' is selected.
-600e3 to 600e3	-600000 to 600000 m if span unit 'km' is selected.
-372.823 to 372.823	-372.823 to 372.823 miles if span unit 'miles' is selected.

**Example**

DISPIAY:TRACE:X:CENTER 0  
Sets the center position to 0.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay:DTV:EPATtern:CPOsition**

This command sets the center position of the x-scale. The span must be set to manual span before, see [DISPlay:DTV:EPATtern:ASPan](#) command. The value is referred to the selected span unit.

This command is equivalent to the

[DISPlay\[:WINDow<1|2>\]:TRACe:X\[:SCALe\]:CENTer](#) command.

**Parameter**

-2000 to 2000	-2 to 2000 $\mu$ s if span unit ' $\mu$ s' is selected.
-600 to 600	-600000 to 600000 m if span unit 'km' is selected.
-372.823 to 372.823	-372.823 to 372.823 miles if span unit 'miles' is selected.

**Example**

DISPlay:DTV:EPATTERN:CPOSITION 0

Sets the center position to 0.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay:DTV:EPATtern:MLISt**

---

This command activates or deactivates the marker list in the echo pattern measurement.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT:MLIST ON  
Displays the marker list.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:PLISt**

---

This command selects the echo pattern peak list or the echo pattern diagram.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT:PLIST ON  
Displays the echo peak list.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:PLISt:FREeze**

This command freezes the echo pattern peak list. The Peak List is frozen independent from the measurement screen selection Echo Pattern Diagram or Echo Pattern Peak List.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT:PLIST:FREEZE ON  
Freezes the echo peak list.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:PLISt:THReshold**

This command defines the threshold value in dB for the echo pattern peak list.

**Parameter**

-50 to 0	Values are interpreted as dB values.
-50DB to 0DB	

**Example**

DISP:DTV:EPAT:PLIST:THRESHOLD -30DB  
Defines the echo peak list threshold value to -30 dB.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:TRACe**

---

This command switches the trace on or off.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT:TRACE ON

Displays the trace.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:MEMory**

---

This command switches the memory trace on or off.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT: MEMORY ON

Displays the memory trace.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**DISPlay[:WINDow<1|2>]:MEASurement:EPATtern:THReshold:LINE:STATe**

This command switches the Echo Detection Threshold Line on or off. Threshold Line on or off. This command is equivalent to the [DISPlay:DTV:EPATtern:DLINe](#) command.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:MEAS:EPAT:THR:LINE:STATE OFF  
Switches off the Echo Detection Threshold Line.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay:DTV:EPATtern:DLINe**

This command switches the Echo Detection Threshold Line on or off. This command is equivalent to the [DISPlay\[:WINDow<1|2>\]:MEASurement:EPATtern:THReshold:LINE:STATe](#) command.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:MEAS:EPAT:THR:LINE:STATE OFF  
Switches off the Echo Detection Threshold Line.

**Characteristics**

- \* RST value: ON

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**DISPlay:DTV:EPATtern:PLISt:TLINE**

This command displays the echo pattern peak list threshold line.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:EPAT:PLIST:TLINE ON

Displays the echo peak list threshold line.

**Characteristics**

\* RST value: OFF

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:MARKer:LIST**

This command shows or hides the marker list on the measurement screen.

**Parameter**

1 or ON	Shows the marker list.
0 or OFF	Hides the marker list.

**Example**

DISP:DTV:EPAT:MARK:LIST OFF  
Hides the marker list.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:EPATtern:MARKer:LIST?**

This command queries the display status of the marker list.

**Parameter**

1 or ON	The marker list is shown.
0 or OFF	The marker list is hidden.

**Example**

CALC:DTV:EPAT:MARK:LIST OFF  
Hides the marker list.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

## 12.2.4 Configuring the MER(k) Measurement

The following commands configure the MER(k) measurement.

### List of Commands

- DISPLAY:DTV:MERK:MLIST
- DISPLAY:DTV:MERK:RANGe
- DISPLAY:DTV:MERK:REFerence
- [SENSe:]DTV:MERK:DETEctor
- DISPLAY:DTV:MERK:TRACe:MODE
- DISPLAY:DTV:MERK:TRACe:VIEW
- DISPLAY:DTV:MERK:TRACe
- DISPLAY:DTV:MERK:MEMory
- DISPLAY:DTV:MERK:MARK:LIST
- DISPLAY:DTV:MERK:MARK:LIST?

### DISPLAY:DTV:MERK:MLIST

---

This command switches the marker list on or off.

#### Parameter

ON | OFF or 0 | 1

#### Example

DISP:DTV:MERK:MLIST ON  
Displays the marker list.

#### Characteristics

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### DISPLAY:DTV:MERK:RANGe

---

This command sets the MER range of the MER(k) diagram.

#### Parameter

10 | 20 | 50

#### Example

DISP:DTV:MERK:RANGE 50  
Sets the MER range to 50 dB.

**Characteristics**

- \* RST value: 50 dB
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:REference**

---

This command sets the MER reference which is the uppermost grid line of the MER(k) diagram.

**Parameter**

0 to 50

**Example**

DISP:DTV:MERK:REF 50  
Sets the MER reference to 50 dB.

**Characteristics**

- \* RST value: 50 dB
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]DTV:MERK:DETEctor**

---

This command sets the trace detector.

**Parameter**

APEak | NEGative | POSitive | RMS

**Example**

DTV:MERK:DETECTOR RMS  
Sets the trace detector to rms.

**Characteristics**

- \* RST value: RMS
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:TRACe:MODE**

---

This command sets the trace mode.

**Parameter**

WRITE | MAXHold | MINHold

**Example**

DISP:DTV:MERK:TRACE:MODE MINH  
Sets the trace mode to min hold.

**Characteristics**

- \* RST value: WRITE
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:TRACe:VIEW**

---

This command freezes the actual trace.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:MERK:TRACE:VIEW ON  
Freezes the actual trace.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:TRACe**

---

This command switches the trace on or off.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:MERK:TRACE ON  
Displays the trace.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:MEMOrY**

---

This command switches the memory trace on or off.

**Parameter**

ON | OFF or 0 | 1

**Example**

DISP:DTV:MERK:MEMORY ON  
Displays the memory trace.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:MARK:LIST**


---

This command shows or hides the marker list on the measurement screen.

**Parameter**

1 or ON	Shows the marker list.
0 or OFF	Hides the marker list.

**Example**

DISP:DTV:MERK:MEMORY ON  
Displays the memory trace.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:MERK:MARK:LIST?**


---

This command shows or hides the marker list on the measurement screen.

**Parameter**

1 or ON	The marker list is shown.
---------	---------------------------

0 or OFF	The marker list is hidden.
----------	----------------------------

**Example**

CALC:DTV:MERK:MARK:LIST OFF  
Hides the marker list.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

## 12.2.5 Configuring the Amplitude/Phase/Group Delay Measurement

The following commands configure the Amplitude/Phase/Group Delay measurement.

**List of Commands**

- CONFigure:DTV:APGD:FORMat
- DISPlay:DTV:APGD:MLISt
- [SENSe:]DTV:APGD:TRACe[<1|2>]:DETector
- DISPlay:DTV:APGD:TRACe[<1|2>]:MODE
- DISPlay:DTV:APGD:MARKer:LIST
- DISPlay:DTV:APGD:MARKer:LIST?
- [SENSe:]DTV:APGD:AVERage:TRACe[<1|2>]:COUNT
- DISPlay:DTV:APGD:TRACe:Y[:RANGe]:AUTO
- DISPlay:DTV:APGD:TRACe[<1|2>]:Y[:RANGe]
- CALCulate:DTV:APGD:MARKer:NUM<1...6>:STATe
- CALCulate:DTV:APGD:MARKer:NUM<1...6>:STATe?
- CALCulate:DTV:APGD:MARKer:NUM<1...6>:SEL
- CALCulate:DTV:APGD:MARKer:NUM<1...6>:SEL?
- CALCulate:DTV:APGD:MARKer:SElect
- CALCulate:DTV:APGD:MARKer:SElect?
- CALCulate:DTV:APGD:MARKer:TYPE
- CALCulate:DTV:APGD:MARKer:TYPE?
- CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK
- CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK:ALL
- CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK:NEXT
- CALCulate:DTV:APGD:MARKer:X
- CALCulate:DTV:APGD:MARKer:X?

- [CALCulate:DTV:APGD:MARKer:TRACe\[<1|2>\]:Y?](#)
- [CALCulate:DTV:APGD:TRACe\[<1|2>\]:DATA?](#)

### CONFigure:DTV:APGD:FORMat

This command selects the channel analysis format type measurement mode of the TV Analyzer. Prerequisite: the TV Analyzer channel analysis measurement mode must be selected. See [CONFigure:DTV:MEASurement](#) command for switching to Amplitude/Phase/GrpDelay measurement mode.

#### Parameter

APHase	Selects the Amplitude/Phase measurement
AGDelay	Selects the Amplitude/Group Delay measurement

#### Example

CONF:DTV:APGD:FORM APH  
Sets the Amplitude-Phase format.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### DISPlay:DTV:APGD:MLISt

This command switches the marker list on or off.

#### Parameter

ON | OFF or 0 | 1

#### Example

CONF:DTV:APGD:FORM APH  
Sets the Amplitude-Phase format.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]DTV:APGD:TRACe[<1|2>]:DETECTOR**


---

This command sets the trace detector.

Note : In Amplitude-Phase format, trace 1 is Amplitdue and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitdue and trace 2 is GroupDelay.

**Parameter**

APEak | RMS

**Example**

DTV:APGD:TRACE:DETECTOR RMS  
 Sets the trace detector to rms for Amplitude trace (TRACE1).

**Characteristics**

- \* RST value: RMS
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:APGD:TRACe[<1|2>]:MODE**


---

This command sets the trace mode.

Note : In Amplitude-Phase format, trace 1 is Amplitdue and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitdue and trace 2 is GroupDelay.

**Parameter**

VIEW | WRITe | AVERAge | BLANk

### Example

DISP:DTV:APGD:TRACE:MODE WRITE  
Sets the trace mode to clear / write.

### Characteristics

- \* RST value: WRITe
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

### Mode

-

## DISPlay:DTV:APGD:MARKer:LIST

---

This command shows or hides the marker list on the measurement screen.

### Parameter

1 or ON	Shows the marker list.
0 or OFF	Hides the marker list.

### Example

DISP:DTV:APGD:MARK:LIST OFF  
Hides the marker list.

### Characteristics

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

### Mode

-

## DISPlay:DTV:APGD:MARKer:LIST?

---

---

This command queries the display status of the marker list.

### Return value

1 or ON	The marker list is shown.
0 or OFF	The marker list is hidden.

### Example

DISP:DTV:APGD:MARK:LIST?  
Return the display status of marker list.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

### Mode

-

## [SENSe:]DTV:APGD:AVERAge:TRACe[<1|2>]:COUNT

---

This command set average count for the trace.

Note : In Amplitude-Phase format, trace 1 is Amplitdue and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitdue and trace 2 is GroupDelay.

### Parameter

1 to 999

### Example

DTV:APGD:AVER:TRAC:COUN 5  
Set the average count of Amplitude trace to 5.

### Characteristics

- \* RST value: 1
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

#### Mode

-

### DISPlay:DTV:APGD:TRACe:Y[:RANGe]:AUTO

This command auto scale the Y-axis to fit to the Amplitude/Phase/Group Delay measurement.

#### Parameter

1 or ON	The Y-axis is auto-range.
0 or OFF	The Y-axis auto-range is turned off.

#### Example

DISP:DTV:APGD:TRAC:Y:AUTO ON  
Auto scale the y-axis for the measurement.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### DISPlay:DTV:APGD:TRACe[<1|2>]:Y[:RANGe]

This command set the Y-axis range scale the Y-axis to fit to the Amplitude/Phase/Group Delay measurement.

Note : In Amplitude-Phase format, trace 1 is Amplitdue and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitdue and trace 2 is GroupDelay.

#### Parameter

10, 20, 50 and 100dB for Amplitude trace.  
 10, 20, 45, 90, 180 and 360dB for Phase trace.  
 50, 100, 200, 500ns, 1, 2, 5, 10, 20, 50 and 100us for Group Delay trace

#### Example

DISP:DTV:APGD:TRAC:Y 10

Set the Y-axis scale to +/- 10dB for the Amplitude trace.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:MARKer:NUM<1...6>:STATe

This command activates or deactivates the specified marker.

#### Parameter

1 or ON	Activates the specified marker.
0 or OFF	Deactivates the specified marker.

#### Example

CALC:DTV:APGD:MARK:NUM1:STAT ON

Enables marker 1.

#### Characteristics

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

**CALCulate:DTV:APGD:MARKer:NUM<1...6>:STATe?**


---

This command activates or deactivates the specified marker.

**Parameter**

1 or ON	Specified marker is enabled.
0 or OFF	Specified marker is disabled.

**Example**

CALC:DTV:APGD:MARK:NUM1:STAT?

1

Marker 1 is enabled.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:NUM<1...6>:SEL**


---

This command selects the specified marker. If this marker is not yet activated, it will be switched on.

**Parameter**

-

**Example**

CALC:DTV:APGD:MARK:NUM4:SEL

Selects marker 4.

**Characteristics**

- \* RST value: all markers will be switched off
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:NUM<1...6>:SEL?**

This command queries the status of the specified marker.

**Return value**

0	Specified marker is not selected.
1	Specified marker is selected.

**Example**

CALC:DTV:APGD:MARK:NUM4:SEL?

1

Marker 4 is selected.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:SElect**

This command selects the specified marker. If this marker is not yet activated, it will be switched on.

**Parameter**

-

**Example**

CALC:DTV:APGD:MARK:SEL 4

Selects marker 4.

**Characteristics**

- \* RST value: all markers will be switched off
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:SElect?**


---

This command queries which marker is selected.

**Return value**

0	No marker is selected.
1	Marker 1 is selected.
2	Marker 2 is selected.
3	Marker 3 is selected.
4	Marker 4 is selected.
5	Marker 5 is selected.
6	Marker 6 is selected.

**Example**

```
CALC:DTV:APGD:MARK:SEL?
```

```
4
```

```
Marker 4 is selected.
```

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:TYPE**


---

This command sets the marker type of the selected marker.

**Parameter**

CARRier	Relates the marker position to the carrier number.
RELative	Relates the marker frequency to the set RF.
ABSolute	Sets the absolute marker frequency.

**Example**

CALC:DTV:APGD:MARK:TYPE ABS

Sets the marker type of the selected marker to absolute marker frequency.

**Characteristics**

- \* RST value: carrier
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:TYPE?**


---

This command queries the marker type of the selected marker.

**Return value**

CARRier	Relates the marker position to the carrier number.
RELative	Relates the marker frequency to the set RF.
ABSolute	Sets the absolute marker frequency.

**Example**

CALC:DTV:APGD:MARK:TYPE?

REL

The marker frequency is related to the set RF.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK

---

This command sets the selected marker to the peak of the intended trace.

Note : In Amplitude-Phase format, trace 1 is Amplitdue and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitdue and trace 2 is GroupDelay

#### Parameter

-

#### Example

CALC:DTV:APGD:MARK:TRAC:PEAK

Sets the selected marker to peak of the Amplitude trace.

CALC:DTV:APGD:MARK:TRACE2:PEAK

Sets the selected marker to peak of the Phase(or Group Delay) trace.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK:ALL

---

---

This command sets all activated markers to the peak of the intended trace. M1 to the 1st amplitude peak, M2 to the 2nd amplitude peak and so on.

Note : In Amplitude-Phase format, trace 1 is Amplitude and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitude and trace 2 is GroupDelay.

#### Parameter

-

#### Example

CALC:DTV:APGD:MARK:TRAC:PEAK:ALL

Sets all activated marker(s) to peak of the Amplitude trace.

CALC:DTV:APGD:MARK:TRACE2:PEAK:ALL

Sets all activated marker(s) to peak of the Phase(or Group Delay) trace.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:PEAK:NEXT

---

This command sets the selected marker to the next peak of the intended trace.

Note : In Amplitude-Phase format, trace 1 is Amplitude and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitude and trace 2 is GroupDelay.

#### Parameter

-

#### Example

CALC:DTV:APGD:MARK:TRAC:PEAK:NEXT

Sets the selected marker to next peak of the Amplitude trace.

CALC:DTV:APGD:MARK:TRACE2:PEAK:NEXT

Sets the selected marker to next peak of the Phase(or Group Delay) trace.

#### Characteristics

- \* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:X**

This command sets the position of the selected marker according to the selected marker type.

**Parameter**

<numeric value>, UP, DOWN, MIN, MAX

UP and DOWN move the marker position by 1 grid

**Example**

CALC:DTV:APGD:MARK:X 3457

Sets the selected marker to OFDM carrier 3457 if the 'carrier' marker type is selected.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:APGD:MARKer:X?**

This command sets the position of the selected marker according to the selected marker type.

**Return value**

<numeric value>

**Example**

CALC:DTV:APGD:MARK:X?

2345

The x-position of the selected marker is the OFDM carrier 2345 if the 'carrier' marker type is selected.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:MARKer:TRACe[<1|2>]:Y?

This command queries the value of the selected marker for the intended trace. The return value corresponds to the selected marker type and to the selected unit if it is an absolute marker type.

Note : In Amplitude-Phase format, trace 1 is Amplitude and trace 2 is Phase. In Amplitude-GroupDelay format, trace 1 is Amplitude and trace 2 is GroupDelay.

#### Return value

<numeric value>

#### Example

```
CALC:DTV:APGD:MARK:TRAC:Y?
```

```
30.000
```

The amplitude value of the selected marker is 30 dB.

```
CALC:DTV:APGD:MARK:TRACE2:Y?
```

```
20.000
```

The phase(or group delay) value of the selected marker is 20deg(or nsec).

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:APGD:TRACe[<1|2>]:DATA?

This command reads the trace peak-peak data of the Amplitude/Phase or Amplitude/Group Delay measurement. The trace data are only available in Amplitude/Phase/Group Delay measurement. At first, the start and stop carrier of the span are returned. The span setting data is followed by 631 trace data of the Amplitude, Phase or Group Delay measurement. The trace values correspond to the measurement value of the pixel column in dB. If the Auto Peak trace detector is set, 631 value pairs are returned (min peak value, max peak value). If the OFDM demodulator is not synchronized, just '{}' is returned. This command is a query and therefore has no \*RST value.

#### Return value

start carrier, stop carrier, { Amplitude1, Amplitude2,...Amplitude631}  
 start carrier, stop carrier, { Phase1, Phase2,...Phase631}  
 start carrier, stop carrier, { GDelay1, GDelay2,...GDelay631}

#### Example

CALC:DTV:APGD:TRAC:DATA?

Queries the Amplitude trace data for Amplitude/Phase/GpDelay measurement screen.

CALC:DTV:APGD:TRAC2:DATA?

Queries the Phase (or Group Delay) trace data for Amplitude/Phase/GpDelay measurement screen.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

#### Mode

-

## 12.2.6 Configuring the Spectrum Measurement

Besides the frequency and channel bandwidth settings the same commands are available as described in chapter "[Remote Commands in Spectrum Mode](#)".

For setting the frequency parameters, see chapter "[Setting the Frequency](#)".

For setting the channel bandwidth, see [\[SENSE:\]DTV:BANDwidth:CHANnel](#) command.

For setting the OFDM bandwidth, see [\[SENSE:\]DTV:BANDwidth:OFDM](#) command.

### List of Commands

- UNIT:DTV:SPECTrum:SCALE
- UNIT:DTV:SPECTrum:SCALE?
- CONFigure:DTV:MEASurement:CN:STATe
- CONFigure:DTV:MEASurement:CN:FREQuency:AUTO
- CONFigure:DTV:MEASurement:CN:FREQuency
- CONFigure:DTV:MEASurement:CN:FREQuency:BANDwidth
- CONFigure:DTV:MEASurement:SATTenuation:STATe
- CONFigure:DTV:MEASurement:AFResponse:STATe
- CONFigure:DTV:MEASurement:OBANDwidth:STATe

### UNIT:DTV:SPECTrum:SCALE

This command configures the scaling unit. The setting influences the measurement screen, the markers and the lines.

#### Parameter

DB	The scale is set to relative unit 'dB'.
DB10	The scale is set to relative unit 'dBc/10kHz'. The RBW is automatically set to 10 kHz.
ABSolute	The scale is set to absolute unit. The unit is determined by the <b>UNIT:POWer</b> command

#### Example

UNIT:DTV:SPECTrum:SCALE DB10

Sets the scale unit to dBc/10kHz.

#### Characteristics

- \* RST value: ABSolute
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### UNIT:DTV:SPECTrum:SCALE?

This command configures the scaling unit. The setting influences the measurement screen, the markers and the lines.

**Return value**

DB	The scale is set to relative unit 'dB'.
DB10	The scale is set to relative unit 'dBc/10kHz'.
ABSolute	The scale is set to absolute unit.

**Example**

UNIT:DTV:SPECTrum:SCALE?

Return value: DB

The scale unit is set to 'dB'.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CONFigure:DTV:MEASurement:CN:STATE**

This command activates or deactivates the carrier-to-noise measurement.

**Parameter**

ON | OFF or 1 | 0

**Example**

CONF:DTV:MEAS:CN:STAT ON

Activates the C/N measurement.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CONFigure:DTV:MEASurement:CN:FREQUENCY:AUTO**

This command activates or deactivates the auto frequency offset setting. If deactivated, you can manually set the frequency offset for the noise power measurement, see [CONFigure:DTV:MEASurement:CN:FREQUENCY](#) command. If activated, the offset frequency is set to channel bandwidth + 0.5 MHz.

**Parameter**

ON | OFF or 1 | 0

**Example**

CONF:DTV:MEAS:CN:FREQ:AUTO OFF  
Deactivates the auto frequency offset setting.

**Characteristics**

- \* RST value: ON
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CONFigure:DTV:MEASurement:CN:FREQUENCY**

This command defines the frequency offset with respect to the set RF for the noise power measurement. Only effective if the frequency offset setting is set to manual control, see [CONFigure:DTV:MEASurement:CN:FREQUENCY:AUTO](#) command.

**Parameter**

<numeric\_value> in Hz, within the range  $\pm 5$ -channel bandwidth

**Example**

CONF:DTV:MEAS:CN:FREQ -4.5e6  
Sets the frequency offset to -4.5 MHz.

**Characteristics**

- \* RST value: channel bandwidth + 0.5 MHz (AUTO is set to ON)
- SCPI: conform
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: no

**Mode**

-

**CONFigure:DTV:MEASurement:CN:FREQuency:BANDwidth**

This command defines the noise channel bandwidth regarding the noise power measurement.

**Parameter**

1 to 10e6 <Hz>, MIN , MAX, DOWN, UP

**Example**

CONF:DTV:MEAS:CN:FREQ:BAND 10e3  
Sets the noise channel bandwidth to 10 kHz.

**Characteristics**

- \* RST value: 100e3
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CONFigure:DTV:MEASurement:SATTenuation:STATe**

This command activates or deactivates the shoulder attenuation measurement.

**Parameter**

ON | OFF or 1 | 0

**Example**

CONF:DTV:MEAS:SATT:STAT ON  
Activates the shoulder attenuation measurement.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: no

**Mode**

-

**CONFigure:DTV:MEASurement:AFResponse:STATe**

---

This command activates or deactivates the amplitude frequency response measurement.

**Parameter**

ON | OFF or 1 | 0

**Example**

CONF:DTV:MEAS:AFR:STAT ON

Activates the amplitude frequency response measurement.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CONFigure:DTV:MEASurement:OBANdwidth:STATe**

---

This command activates or deactivates the occupied bandwidth measurement.

**Parameter**

ON | OFF or 1 | 0

**Example**

CONF:DTV:MEAS:OBAN:STAT ON

Activates the occupied bandwidth measurement.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

#### Mode

-

## 12.2.7 Configuring the Spectrum Emission Mask Measurement

These commands are available in the TV Analyzer mode 'Spectrum Emission Mask'.

Besides the frequency and channel bandwidth settings the same commands are available as described in chapter "[Remote Commands in Spectrum Mode](#)".

For setting the frequency parameters, see chapter "[Setting the Frequency](#)".

For setting the channel bandwidth, see [\[SENSE:\]DTV:BANDwidth:CHANnel](#) command.

For setting the OFDM bandwidth, see [\[SENSE:\]DTV:BANDwidth:OFDM](#) command.

For setting the scale unit, see [UNIT:DTV:SPECTrum:SCALE](#).

#### List of Commands

- [DISPlay:DTV:SEM:MASK:VIEW](#)
- [DISPlay:DTV:SEM:MASK:VIEW?](#)
- [DISPlay:DTV:SEM:MASK:SElect](#)
- [DISPlay:DTV:SEM:MASK:SElect?](#)
- [DISPlay:DTV:SEM:MASK:UNSelect](#)
- [DISPlay:DTV:SEM:CHECK?](#)

#### DISPlay:DTV:SEM:MASK:VIEW

This command activates or deactivates the spectrum emission mask list.

#### Parameter

ON or 1	Enables the spectrum emission mask list.
OFF or 0	Disables the spectrum emission mask list.

#### Example

```
DISP:DTV:SEM:MASK:VIEW OFF
Disables the spectrum emission mask list.
```

#### Characteristics

- \* RST value: On
- SCPI: conform

TV standard: all  
 Compatibility to R&S ETH: yes  
 Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:SEM:MASK:VIEW?**


---

This command activates or deactivates the spectrum emission mask list.

**Return value**

1	The spectrum emission mask list is enabled
0	The spectrum emission mask list is disabled.

**Example**

DISP:DTV:SEM:MASK:VIEW?  
 Return value: 1.  
 The spectrum emission mask list is enabled.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:SEM:MASK:SElect**


---

This command loads the spectrum emission mask from a file with the name <file name>. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMory:CDIRectory](#) command.

**Parameter**

<string> = <file name>

**Example**

CALC:DTV:SEM:MASK:SEL "\Public\Standards\DVB-T 8MHz critical.tvsem"

Loads the spectrum emission mask 'DVB-T 8MHz critical.tvsem' from the directory '\Public\Standards\'.  
 \Public\Standards\.

CALC:DTV:SEM:MASK:SEL "\Storage Card\SEM\ARIB STD-B31 more than 2.5W.tvsem"

Loads the spectrum emission mask 'ARIB STD-B31 more than 2.5W' from the directory \SD card\SEM\.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

#### DISPlay:DTV:SEM:MASK:SElect?

This command returns the file name and its description of the loaded spectrum emission mask.

#### Parameter

<string1>,<string2>

string1: "spectrum emission mask file name"

string2: "spectrum emission mask description"

#### Example

CALC:DTV:SEM:MASK:SElect?

Reads the spectrum emission mask file name and its description.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

**DISPlay:DTV:SEM:MASK:UNSeLect**

This command unselects the spectrum emission mask.

**Parameter**

-

**Example**

CALC:DTV:SEM:MASK:UNS  
No spectrum emission mask is loaded.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:DTV:SEM:CHECK?**

This command checks if the frequency span setting corresponds to the loaded spectrum emission mask. This command is available in the Spectrum Emission Mask measurement mode of the TV Analyzer.

**Return value**

0	Setting does not correspond to the loaded spectrum emission mask
1	Setting corresponds to the loaded spectrum emission mask.

**Example**

CALCulate:DTV:SEM:CHECK?  
Checks the frequency span setting of the loaded spectrum emission mask.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**12.2.8 Using Measurement Functions**

The following commands describe the using of the measurement functions of the DVB-T/H Receiver mode.

**List of Commands**

- CALCulate:DTV:RESult:DEMod:SYNC?
- CALCulate:DTV:RESult:DMOD:SYNC?
- CALCulate:DTV:RESult:MPEG:SYNC?
- CALCulate:DTV:RESult:FEC:SYNC?
- CALCulate:DTV:RESult?
- CALCulate:DTV:RESult:APGD?
- CALCulate<1|2>:DTV:RESult:A|B|C?
- CALCulate:DTV:RESult:TPS?
- CALCulate:DTV:RESult:TMCC?
- CALCulate:DTV:RESult:TMCC:A|B|C?
- CALCulate:DTV:RESult:L1Pre?
- CALCulate:DTV:RESult:L1Post? APLP
- CALCulate:DTV:RESult:L1Post? DPLP
- CALCulate:DTV:RESult:L1Post? COMMon
- CALCulate:DTV:RESult:PLP:SYNC?
- CALCulate<1|2>:DTV:EPATtern:PLISt:DATA?
- CALCulate:DTV:EPATtern:TRACe:DATA?
- CALCulate:DTV: EPAT:MARK:NUM<1...6>:STATe
- CALCulate:DTV: EPAT:MARK:NUM<1...6>:STATe?
- CALCulate:DTV: EPAT:MARK:NUM<1...6>:SELEct
- CALCulate:DTV: EPATtern:MARKer:NUM<1...6>:SELEct?
- CALCulate:DTV: EPATtern:MARKer:SELEct <1...6>
- CALCulate:DTV: EPATtern:MARKer:SELEct?
- CALCulate:DTV: EPATtern:MARKer:TYPE
- CALCulate:DTV: EPATtern:MARKer:TYPE?
- CALCulate:DTV: EPATtern:MARKer:PEAK
- CALCulate:DTV: EPATtern:MARKer:PEAK:ALL
- CALCulate:DTV:EPATtern:MARKer:PEAK:NEXT
- CALCulate:DTV:EPATtern:MARKer:CENTer
- CALCulate:DTV:EPATtern:MARKer:X
- CALCulate:DTV:EPATtern:MARKer:X?
- CALCulate:DTV:EPATtern:MARKer:Y?
- CALCulate:DTV:MERK:MARKer:NUM<1...6>:STATe
- CALCulate:DTV:MERK:MARKer:NUM<1...6>:STATe?
- CALCulate:DTV:MERK:MARKer:NUM<1...6>:SELEct
- CALCulate:DTV:MERK:MARKer:NUM<1...6>:SELEct?
- CALCulate:DTV:MERK:MARKer:SELEct <1...6>
- CALCulate:DTV:MERK:MARKer:SELEct?

- [CALCulate:DTV:MERK:MARKer:TYPE](#)
- [CALCulate:DTV:MERK:MARKer:TYPE?](#)
- [CALCulate:DTV:MERK:MARKer:PEAK](#)
- [CALCulate:DTV:MERK:MARKer:PEAK:ALL](#)
- [CALCulate:DTV:MERK:MARKer:PEAK:NEXT](#)
- [CALCulate:DTV:MERK:MARKer:X](#)
- [CALCulate:DTV:MERK:MARKer:X?](#)
- [CALCulate:DTV:MERK:MARKer:Y?](#)
- [CALCulate:DTV:MERK:TRACe:DATA?](#)
- [CALCulate:DTV:RESult:DSpectrum?](#)
- [CALCulate:DTV:SEM:RESult?](#)
- [CALCulate:DTV:SEM:DATA?](#)

### **CALCulate:DTV:RESult:DEMod:SYNC?**

This command reads the status of the OFDM demodulator of the DVB-T/H Receiver.

This command is a query and therefore has no \*RST value.

This command is equivalent to the [CALCulate:DTV:RESult:DMOD:SYNC?](#) command.

#### **Return value**

SYNC	The OFDM demodulator is locked.
NSYN	The OFDM demodulator is unlocked.

#### **Example**

CALC:DTV:RESULT:DEMOD:SYNC?  
Queries the OFDM demodulator status.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### **Mode**

-

### **CALCulate:DTV:RESult:DMOD:SYNC?**

This command reads the status of the OFDM demodulator of the DVB-T/H Receiver.

This command is a query and therefore has no \*RST value.

This command is equivalent to the [CALCulate:DTV:RESult:DEMod:SYNC?](#) command.

#### Return value

SYNC	The OFDM demodulator is locked.
NSYN	The OFDM demodulator is unlocked.

#### Example

CALC:DTV:RESULT:DMOD:SYNC?

Queries the OFDM demodulator status.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### Mode

-

#### CALCulate:DTV:RESult:MPEG:SYNC?

This command reads the status of the FEC decoder of the DVB-T/H Receiver.

This command is a query and therefore has no \*RST value.

This command is equivalent to the [CALCulate:DTV:RESult:FEC:SYNC?](#) command.

#### Return value

1	The FEC decoder is locked.
0	The FEC decoder is unlocked.

#### Example

CALC:DTV:RESULT:MPEG:SYNC?  
Queries the MPEG decoder status.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### Mode

-

### CALCulate:DTV:RESult:FEC:SYNC?

---

This command reads the status of the FEC decoder of the DVB-T/H Receiver. This command is a query and therefore has no \*RST value. This command is equivalent to the [CALCulate:DTV:RESult:MPEG:SYNC?](#) command.

#### Return value

1	The FEC decoder is locked.
0	The FEC decoder is unlocked.

#### Example

CALC:DTV:RESULT:FEC:SYNC?  
Queries the FEC decoder status.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### Mode

-

### CALCulate:DTV:RESult?

---

---

This command reads the measurement values for the TV Analyzer measurements.

The following table shows in which measurement modes the measurement parameters are available and the compatibility to R&S ETL. This command is a query and therefore has no \*RST value.

**Parameter**

		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
LEVel	Level respectively power of the input signal	√	√	√	√	-	√
CFACTOR	Ccrest factor of the input signal	√	√	√	√	-	new
SBPosition	Sideband position	√	√	√	√	-	√
CONS	Constellation This parameter is only available in DVB-T/H.	√	√	√	√	-	√
TMODE	Transmission mode This parameter is only available in ISDB-T.	√	√	√	√	-	√
CFOffset	Carrier frequency offset	√	√	√	√	-	√
SROffset	Symbol rate offset This parameter is equivalent to 'BROffset'.	√	√	√	√	-	new
BROffset	Bit rate offset This parameter is equivalent to 'SROffset'.	√	√	√	√	-	√
MERRms	Root mean square of the modulation error ratio This parameter corresponds to MER (total,rms) in ISDB-T.	√	√	√	√	-	√

	This parameter corresponds to MER (L1,rms) in DVB-T2.						
MERPeak	Peak of the modulation error ratio  In ISDB-T, the parameter corresponds to MER (total,peak).  In DVB-T2, the parameter corresponds to MER (L1,peak).	√	√	√	√	-	√
MTRMs	Modulation error ratio of the TMCC carriers  This parameter is only available in ISDB-T.	√	√	√	√	-	√
MARMs	Modulation error ratio of the AC carriers  This parameter is only available in ISDB-T.	√	√	√	√	-	√
EVMRms	Root mean square of the error vector magnitude  This parameter is only available in DVB-T/H and DVB-T2.  In DVB-T2, the parameter corresponds to EVM (PLP,rms).	√	√	√	√	-	√
EVMPeak	Peak of the error vector magnitude.  This parameter is only available in	√	√	√	√	-	√

	DVB-T/H and DVB-T2. In DVB-T2, the parameter corresponds to EVM (PLP,peak)						
BBViterbi	Bit error ratio before Viterbi decoder  This parameter is only available in DVB-T/H.	√	√	√	√	-	√
BBRS	Bit error ratio before Reed Solomon decoder  This parameter is only available in DVB-T/H.	√	√	√	√	-	√
PERatio	Packet error ratio  This parameter is only available in DVB-T/H.	√	√	√	√	-	√
PERRor	Packet errors  This parameter is only available in DVB-T/H.	√	√	√	√	-	√
MTBitrate	MPEG TS bit rate  This parameter is only available in DVB-T/H.	√	√	√	√	-	√
SPRocessed	Symbols processed in constellation diagram	-	√	-	-	-	√
MPRMs	Modulation error ration for PLP in rms.  This parameter is only available in DVB-T2.	√	√	√	√	-	√
MPPeak	Modulation error ration for PLP in peak.	√	√	√	√	-	√

	This parameter is only available in DVB-T2.						
BLDPc	Bit error rate ratio before LDPC.  This parameter is only available in DVB-T2.	√	√	√	√	-	√
BBCH	Bit error rate ratio before BCH.  This parameter is only available in DVB-T2.	√	√	√	√	-	√
BBFRame	Bit error rate ratio for Baseband Frame.  This parameter is only available in DVB-T2.	√	√	√	√	-	-
ILDPC	Number of iterations for LDPC.  This parameter is only available in DVB-T2.	√	√	√	√	-	√
FFTMode	FFT mode for DVB-T2.  This parameter is only available in DVB-T2	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
LEVel	<numeric value>	Level respectively power of the input signal. The value corresponds according to the selected power unit.
CFACtor	<numeric value>	Crest factor of the input signal in dB
SBPosition	NORM INV	Sideband position of the input signal: Normal sideband position

		Inverted sideband position
CONS	<QAM> <hierarchy>	Constellation of the data carriers
TMODe	1 2 3	1: Mode 1 (2K) 2: Mode 2 (4K) 3: Mode 3 (8K)
CFOffset	<numeric value>	Carrier offset frequency in 'Hz'
SROffset	<numeric value>	Symbol rate offset respectively bit rate offset in 'ppm' This parameter is equivalent to 'BROffset'.
BROffset	<numeric value>	Bit rate offset respectively symbol rate offset in ppm This parameter is equivalent to 'SROffset'.
MERRms	<numeric value>	MER rms respectively MER (total, rms) in 'dB'
MERPeak	<numeric value>	MER peak respectively MER (total, peak) in 'dB'
MTRMs	<numeric value>	MER rms of TMCC carriers in 'dB'
MARMs	<numeric value>	MER rms of AC carriers in 'dB'
EVMRms	<numeric value>	EVM rms in '%'
EVMPeak	<numeric value>	EVM peak in '%'
BBViterbi	<numeric value>	BER before Viterbi decoder in scientific notation
BBRS	<numeric value>	BER before Reed Solomon decoder in scientific notation
PERatio	<numeric value>	Packet Error Ratio in scientific notation
PERRor	<numeric value>	Packet Errors per second
MTBitrate	<numeric value>	MPEG TS Bitrate in 'MBit/s'
SPRocessed	<numeric value>	processed symbols in constellation diagram
MPRMs	<numeric value>	MER rms for PLP in 'dB'
MPPeak	<numeric value>	MER peak for PLP in 'dB'
BLDpc	<numeric value>	BER before LDPC in scientific notation

BBCH	<numeric value>	BER before BCH in scientific notation
BBFRame	<numeric value>	BER before BaseBand frames in scientific notation
ILDPC	<numeric value>	Number of iteration of LDPC
FFTMMode	F2K F4K F8K F1K F8KE F16K F16E F32K F32E	2K FFT 4K FFT 8K FFT 1K FFT 8K FFT Extension 16K FFT 16K FFT Extension 32K FFT 32K FFT Extension

**Example**

CALCULATE:DTV:RESULT? LEVEL

Queries the signal level.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: see table above.

**Mode**

-

**CALCulate:DTV:RESult:APGD?**

This command reads the measurement peak-to-peak values for the TV Analyzer Amplitude/Phase/Group Delay measurement. The following table shows which the measurement parameters are available and the compatibility to R&S ETL. This command is a query and therefore has no \*RST value.

**Parameter**

Parameter	Description
AMPLitude	Peak-to-peak result for amplitdue

PHASe	Peak-to-peak result for Phase
GDELay	Peak-to-peak result for Group Delay

### Return value

Parameter	Return value	Description
AMPLitude	<numeric value>	Peak-to-peak result for Amplitude in dB
PHASe	<numeric value>	Peak-to-peak result for Phase in degree
GDELay	<numeric value>	Peak-to-peak result for Group Delay in nsec

### Example

CALC:DTV:RES:APGD? AMPL

Queries the peak-to-peak result for amplitude.

### Characteristics

RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

### Mode

-

### CALCulate<1|2>:DTV:RESult:A|B|C?

This command reads the layer specific measurement values of the ISDB-T Analyzer. The following table shows in which measurement modes the measurement parameters are available and the compatibility to R&S ETL. This command is a query and therefore has no \*RST value.

### Parameter

		Measurement list	Constellation	Echo Pattern	MER(k)	ISDB-T Spectrum	Compatibility to R&S ETL
MERRms	Root mean square of the modulation error ratio of the specific layer	√	√	√	√	-	√
BBViterbi	Bit error ratio before Viterbi decoder	√	√	√	√	-	√
BBRS	Bit error ratio before Reed Solomon decoder	√	√	√	√	-	√
BARS	Bit error ratio after Reed Solomon decoder	√	√	√	√	-	√
PERRor	Packet errors	√	√	√	√	-	√
MTBR	MPEG TS bit rate	√	√	√	√	-	-

### Return value

Parameter	Return value	Description
MERRms	<numeric value>	MER rms in 'dB'
BBViterbi	<numeric value>	BER before Viterbi decoder in scientific notation
BBRS	<numeric value>	BER before Reed Solomon decoder in scientific notation
BARS	<numeric value>	BER after Reed Solomon decoder in scientific notation
PERRor	<numeric value>	Packet Errors per second
MTBR	<numeric value>	MPEG TS Bitrate in 'Mbit/s'

**Example**

CALCULATE:DTV:RESULT:A? MERR

Queries the rms value of the modulation error ratio of layer A.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: ISDB-T

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:TPS?**

---

This command reads the transmission parameter signaling (TPS) values of the received signal. In DVB Spectrum measurement mode, the TPS parameters are not available. This command is a query and therefore has no \*RST value.

**Parameter**

		Measurement list	Constellation	Echo Pattern	MER(k)	DVB Spectrum
CONS	Constellation	√	√	√	√	-
FFTMode	FFT mode	√	√	√	√	-
GINTerval	Guard interval	√	√	√	√	-
CRHPriority	Code rate high priority	√	√	√	√	-
CRLPriority	Code rate low priority	√	√	√	√	-
CID	Cell ID	√	√	√	√	-
RESFrames	Reserved frames	√	√	√	√	-
INTerleaver	Interleaver	√	√	√	√	-
FECHigh	Forward error correction high	√	√	√	√	-
FECLow	Forward error correction low	√	√	√	√	-
TSHigh	Time slicing high priority	√	√	√	√	-
TSLow	Time slicing low priority	√	√	√	√	-
LINDicator	Length indicator	√	√	√	√	-

## Return value

Parameter	Return value	Description
CONS	<QAM>-<hierarchy>	Constellation, QAM: QPSK   QAM16   QAM64 hierarchy: NH   H1   H2   H4 examples: 'QAM64NH', 'QAM16H2'
FFTMMode	F2K F4K F8K	2k FFT mode 4k FFT mode 8k FFT mode
GINterval	G1_4 G1_8 G1_16 G1_32	Guard interval 1/4 Guard interval 1/8 Guard interval 1/16 Guard interval 1/32
CRHPriority	R1_2 R2_3 R3_4 R5_6 R7_8	Code rate 1/2 Code rate 2/3 Code rate 3/4 Code rate 5/6 Code rate 7/8
CRLPriority	R1_2 R2_3 R3_4 R5_6 R7_8	Code rate 1/2 Code rate 2/3 Code rate 3/4 Code rate 5/6 Code rate 7/8
CID	<numeric value>	Cell ID in 'hexadecimal'
RESFrames	<value>,<value>,<value>,<value>	TPS reserved comma separated in 'hexadecimal'
INTerleaver	NAT IND	native interleaver mode in-depth interleaver mode
FECHigh	0 1	MPE FEC high priority off on
FECLow	0 1	MPE FEC low priority off on
TSHigh	0 1	Time slicing high priority off on
TSLow	0	Time slicing low priority off

	1	on
LINDicator	<numeric value>	Length indicator in 'hexadecimal'
SBPos	Sideband position	
LINDicator	<numeric value>	Length indicator in 'hexadecimal'

**Example**

CALCULATE:DTV:RESULT:TPS? CID  
 Queries the Cell ID.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: DVB-T/H

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:TMCC?**

This command reads the layer specific measurement values of the ISDB-T Analyzer. The following table shows in which measurement modes the measurement parameters are available and the compatibility to R&S ETL. This command is a query and therefore has no \*RST value.

**Parameter**

		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
SIDent	System identification	√	√	√	√	-	√
GINterval	Guard interval	√	√	√	√	-	-
PSINdicator	Parameter switching indicator	√	√	√	√	-	-
EMERgency	Emergency alarm broadcasting	√	√	√	√	-	√
PRECeption	Current partial reception	√	√	√	√	-	√
PSHiftcorr	Phase shift reception	√	√	√	√	-	√
REServed	Reserved bits	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
SIDent	ISDB-T	
GINterval	G1_4 G1_8 G1_16 G1_32	Guard interval 1/4 Guard interval 1/8 Guard interval 1/16 Guard interval 1/32
PSINdicator	NORMAL FR_1 FR_2 FR_3 ... FR_15	B22 – B25 bit of TMCC carriers
EMERgency	0	0: Off

	1	1: On
PREception	0 1	B27 bit of TMCC carriers 0: off 1: on
PSHiftcorr	<hexadecimal value>	B107 – B109 bit of TMCC carriers
REServed	<hexadecimal value>	B110 – B121 bit of TMCC carriers

**Example**

CALC:DTV:RES:TMCC? SID  
 Queries the system identification.  
 ISDB-T  
 The system ISDB-T is identified.

**Characteristics**

RST value: -  
 SCPI: device-specific  
 TV standard: ISDB-T  
 Compatibility to R&S ETH: yes  
 Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:TMCC:A|B|C?**

This command reads the current TMCC values for the specified layer of the received signal. In ISDB-T Spectrum measurement mode, the TMCC parameter are not available. This command is a query and therefore has no \*RST value.

**Parameter**

		Measurement list	Constellation	Echo Pattern	MER(k)	ISDB-T Spectrum
CONS	Modulation scheme of the corresponding layer	√	√	√	√	-
CRATe	Convolutional coding rate of the corresponding layer	√	√	√	√	-
TDEeinterleav	Time interleaving length of the corresponding layer	√	√	√	√	-
SEGMents	Number of occupied segments of the corresponding layer	√	√	√	√	-

**Return value**

Parameter	Return value	Description
CONS	DQPSK   QPSK   QAM16   QAM64	Transmission bits: B28 – B30 / B41 - B43 / B54 - B56
CRATe	R1_2 R2_3 R3_4 R5_6 R7_8	Transmission bits: B31 – B33 / B44 - B46 / B57 - B59
TDEeinterleav	0 1 2 4 8 16	Transmission bits: B34 – B36 / B47 - B49 / B60 - B62

	32	
SEGMents	1 to 13	

**Example**

CALC:DTV:RES:TMCC:A? CONS  
 Queries the modulation scheme of layer A.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: ISDB-T

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate<1|2>:DTV:EPATtern:PLISt:DATA?**

This command reads the echo pattern list. The measurement parameters are only available in the Echo Pattern measurement mode, Echo Pattern Peak List. The echoes are level sorted. Up to 200 echoes are output. The output data can be limited by using the echo peak list threshold. This command is a query and therefore has no \*RST value.

**Parameter**

{(relative level1,absolute level1,time|distance1),(relative level2,absolute level2,time|distance2),(relative level3,absolute level3,time|distance3), ... ,(relative level200,absolute level200,time|distance200)}

**Example**

CALCulate:DTV:EPATtern:PLISt:DATA?  
 Queries the echo pattern peak list.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: no

**Mode**

-

### **CALCulate:DTV:RESult:L1Pre?**

---

This command reads the specified measurement value for the L1-pre Signalling measurement.

This command is a query and therefore has no \*RST value.

### **Parameter**

		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
T2Version	T2 Version	√	√	√	√	-	√
TSYSstem	Transmission System	√	√	√	√	-	√
GINTerval	Guard Interval	√	√	√	√	-	√
PPATtern	Pilot Pattern	√	√	√	√	-	√
BWEXt	Bandwidth Extension	√	√	√	√	-	√
LDATa	Data Symbols per Frame	√	√	√	√	-	√
NT2	Number of Frames per SuperFrames	√	√	√	√	-	√
PAPR	Peak to Average Power Ratio	√	√	√	√	-	√
SID	System ID	√	√	√	√	-	√
CID	Cell ID	√	√	√	√	-	√
NID	Network ID	√	√	√	√	-	√
S1	S1 (binary)	√	√	√	√	-	√
S2	S2 (binary)	√	√	√	√	-	√
CRC	CRC 32	√	√	√	√	-	√
CONS	L1-post Constellation	√	√	√	√	-	√

LPCRate	L1-post Code Rate	√	√	√	√	-	√
LPFec	L1-post FEC Type	√	√	√	√	-	√
LPEXt	L1-post Extension	√	√	√	√	-	√
LPSize	L1-post Size	√	√	√	√	-	√
LPISize	L1-post Info Siuze	√	√	√	√	-	√
LREP	L1 Repetition	√	√	√	√	-	√
STYPe	Stream Type	√	√	√	√	-	√
TIDavailable	Tx ID Availability (hex)	√	√	√	√	-	√
RFLag	Regeneration Flag	√	√	√	√	-	√
FREQ	Frequencies	√	√	√	√	-	√
RFIndex	RF Index	√	√	√	√	-	√
REServed	Reserved (hex)	√	√	√	√	-	√
T2BLite	L1-base Lite	√	√	√	√	-	√
LPSCrambled	L1-post Scrambled	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
T2Version	1_1_1 1_2_1 NA	T2 Version 1.1.1 T2 Version 1.2.1 Not Used
TSYSstem	SISO MISO NOT2	Single Input Single Ouput Multiple Input Single Output Non-T2 system

GINterval	G1_4 G19_128 G1_8 G19_256 G1_16 G1_32 G1_128 REServed	Guard interval 1/4 Guard interval 19/128 Guard interval 1/8 Guard interval 19/256 Guard interval 1/16 Guard interval 1/32 Guard interval 1/128 Reserved / Not Used
PPATtern	PP1 PP2 PP3 PP4 PP5 PP6 PP7 PP8 REServed	Pilot Pattern 1 Pilot Pattern 2 Pilot Pattern 3 Pilot Pattern 4 Pilot Pattern 5 Pilot Pattern 6 Pilot Pattern 7 Pilot Pattern 8 Reserved
BWEXt	1 (ON) 0 (OFF)	Bandwidth extension ON Bandwidth extension OFF
LDATa	< numeric_value : 1 to 4095>	Number of Data Symbols per T2 Frame
NT2	< numeric_value : 2 to 255>	Number of Frames per Superframe
PAPR	None ACE TR ACTR LAPT LAAC LATR LAAT REServed	Peak to Average Power Ratio No PAPR reduction is used Active constellation extension Tone reservation Active constellation extension and tone reservation L1-ACE use used and TR is used on P2 symbols only Active constellation extension only is used (L1 and data) L1-ACE and tone reservation only are used Active constellation extension (L1 and data) and tone reservation is used Reserved
SID	< hex : 0x0000 to 0xFFFF>	System ID (4 digit hex value)
CID	< hex : 0x0000 to 0xFFFF>	Cell ID (4 digit hex value)

NID	< hex : 0x0000 to 0xFFFF >	Network ID (4 digit hex value)
S1	< binary >	S1 bits also transmitted in P1 symbol (3 digit binary value)
S2	< binary >	S2 bits also transmitted in P1 symbol (4 digit binary value)
CRC	< hex : 0x12345678 >	CRC32 value (8 digit hex value)
CONS	BPSK QPSK QAM16 QAM64 RESERVED	L1-post constellation
LPCRate	R1_2 RESERVED	L1-post Code Rate 1/2
LPFec	SHORT RESERVED	L1-post FEC Type
LPEXt	1 (ON) 0 (OFF)	L1-post Extension ON L1-post Extension OFF
LPSize	< numeric_value : 0 to 262143 >	L1-post Size
LPISize	< numeric_value : 0 to 262143 >	L1-post Info Size
LREP	1 (ON) 0 (OFF)	L1 repetition ON L1 repetition OFF
STYPe	TSONly GENERIC TSGENERIC RESERVED	Stream Type TS only Generic Stream TS and Generic Stream reserved
TIDavailable	< hex : 0x00 to 0xFF >	Tx ID availability (2 digit hex value)
RFLag	< numeric_value : 0 to 7 >	Regeneration Flag
FREQ	< numeric_value : 0 to 7 >	Frequencies
RFIndex	< numeric_value : 0 to 7 >	RF index
RESERVED	< hex : 0x0 to 0xF >	Reserved (1 digit hex value)
T2BLite	ON OFF	L1-base Lite ON L1-base Lite OFF

	REServed	reserved
LPSCrambled	ON OFF REServed	L1-post scrambled ON L1-post scrambled OFF reserved

**Example**

CALC:DTV:RES:L1PR? SID  
 Queries the system identification.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: no

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:L1Post? APLP**

This command reads a list of L1-post signaling parameters of all physical layer pipes (PLP) available in the received signal. The return value is in the order of the list shown below. This command is a query and therefore has no \*RST value.

**Parameter**



		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
NPLP	Number of PLP	√	√	√	√	-	√
PGID	PLP Group ID	√	√	√	√	-	√
PLPid	PLP ID	√	√	√	√	-	√
PTYPE	PLP ID Type	√	√	√	√	-	√
PCONstellation	PLP Constellation	√	√	√	√	-	√
PROtation	PLP Rotation	√	√	√	√	-	√
PFECtype	PLP FEC Type	√	√	√	√	-	√
PCRate	PLP Code Rate	√	√	√	√	-	√
PPAYload	PLP Payload Type	√	√	√	√	-	√
TITYPE	Time Interleave Type	√	√	√	√	-	√
TILength	Time Interleave Length	√	√	√	√	-	√
NBMAx	Number Blocks Maximum	√	√	√	√	-	√
PMODE	PLP Mode	√	√	√	√	-	√
STFLag	Static Flag Status	√	√	√	√	-	√
SPADding	Static Padding Flag	√	√	√	√	-	√

FFRFlag	Fixed Frequency Flag	√	√	√	√	-	√
FRFindex	First RF Index	√	√	√	√	-	√
IBSa	InBand Singalling A	√	√	√	√	-	√
IBSB	InBand Signalling B	√	√	√	√	-	√
RES1	Reserved 1	√	√	√	√	-	√
FFAindex	First Frame Index	√	√	√	√	-	√
FINterval	Frame Interval	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
Number of PLP (NPLP)	< numeric value : 1 to 255 >	
PLP Group ID (PGID)	< numeric value : 0 to 255 >	
PLP ID (PLPid)	< numeric value : 0 to 255 >	
PLP Type (PTYPE)	COMM TYP1 TYP2 REServed	Common Type 1 Type 2 Reserved
PLP Constellation (PCONstellation)	QPSK QAM16 QAM64 QAM256 REServed	QPSK 16 QAM 64 QAM 256 QAM Reserved
PLP Rotation (PROtation)	1 (ON) 0 (OFF)	PLP rotation ON PLP rotation OFF
PLP FEC Type (PFECtype)	SHOR NORM REServed	Short Normal Reserved

PLP Code Rate (PCRate)	R1_2 R3_5 R2_3 R3_4 R4_5 R5_6 REServed	Coderate 1/2 Coderate 3/5 Coderate 2/3 Coderate 3/4 Coderate 4/5 Coderate 5/6 Reserved
PLP Payload Type (PPAYload)	GFPS GCS GSE TS REServed	Generic Fixed-length Packetized Stream Generic Continuous Stream Generic Encapsulated Stream Transport Stream Reserved
Time Interleave Type (TIType)	SING MULT	Single Multi
Time Interleave Length (TILength)	< numeric value : 0 to 255 >	Time Interleave Length
Number Blocks Maximum (NBMAx)	< numeric value : 0 to 1023 >	Number Blocks Maximum
PLP Mode (PMODE)	NTSP NORM HIEF	Not specified Normal Mode High Efficiency Mode
Static Flag (STFLag)	1 (ON) 0 (OFF)	Static Flag ON Static Flag OFF
Static Padding Flag (SPADding)	1 (ON) 0 (OFF)	Static Padding Flag ON Static Padding Flag OFF
Fixed Frequency Flag (FFRFlag)	1 (ON) 0 (OFF)	Fixed Frequency Flag ON Fixed Frequency Flag OFF
First RF Index (FRFindex)	< numeric value : 0 to 7 >	First RF Index
In Band Signalling A (IBSA)	1 (ON) 0 (OFF)	InBand A signalling ON InBand A signalling OFF
In Band Signalling B (IBSB)	1 (ON) 0 (OFF)	InBand B signalling ON InBand B signalling OFF
Reserved_1 (RES1)	< hex : 0x000 to 0xFFFF >	Reserved (3 digits hex value)
First Frame Index (FFAindex)	< numeric_value : 0 to 255 >	First Frame Index
Frame Interval (FINTerval)	< numeric value : 0 to 255 >	Frame Interval

**Example**

CALC:DTV:RES:L1P? APLP

Queries the list of available PLP parameter information.

<Number of PLP>, <PLP1>, <PLP2>, ....

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: no

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:L1Post? DPLP**

---

This command reads a list of L1-post signaling parameters of all physical layer pipes(PLP) available in the received signal. The return value is in the order of the list shown below. This command is a query and therefore has no \*RST value.

**Parameter**



		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
PGID	PLP Group ID	√	√	√	√	-	√
PLPid	PLP ID	√	√	√	√	-	√
PTYPE	PLP ID Type	√	√	√	√	-	√
PCONstellation	PLP Constellation	√	√	√	√	-	√
PROtation	PLP Rotation	√	√	√	√	-	√
PFECtype	PLP FEC Type	√	√	√	√	-	√
PCRate	PLP Code Rate	√	√	√	√	-	√
PPAYload	PLP Payload Type	√	√	√	√	-	√
TITYPE	Time Interleave Type	√	√	√	√	-	√
TILength	Time Interleave Length	√	√	√	√	-	√
NBMax	Number Blocks Maximum	√	√	√	√	-	√
PMODE	PLP Mode	√	√	√	√	-	√
STFLag	Static Flag Status	√	√	√	√	-	√
SPADding	Static Padding Flag	√	√	√	√	-	√
FFRFlag	Fixed Frequency Flag	√	√	√	√	-	√

FRFindex	First RF Index	√	√	√	√	-	√
IBSA	InBand Singalling A	√	√	√	√	-	√
IBSB	InBand Signalling B	√	√	√	√	-	√
RES1	Reserved 1	√	√	√	√	-	√
FFAindex	First Frame Index	√	√	√	√	-	√
FINTerval	Frame Interval	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
Current Decoded PLP Group ID (PGID)	< numeric value : 0 to 255 >	
Current Decoded PLP ID (PLPid)	< numeric value : 0 to 255 >	
Current Decoded PLP Type (PTYPE)	COMM TYP1 TYP2 REServed	Common Type 1 Type 2 Reserved
Current Decoded PLP Constellation (PCONstellation)	QPSK QAM16 QAM64 QAM256 REServed	QPSK 16 QAM 64 QAM 256 QAM Reserved
Current Decoded PLP Rotation (PROTation)	1 (ON) 0 (OFF)	PLP rotation ON PLP rotation OFF
Current Decoded PLP FEC Type (PFECtype)	SHOR NORM REServed	Short Normal Reserved
Current Decoded PLP Code Rate (PCRate)	R1_2 R3_5 R2_3	Coderate 1/2 Coderate 3/5 Coderate 2/3

	R3_4 R4_5 R5_6 RES	Coderate 3/4 Coderate 4/5 Coderate 5/6 Reserved
Current Decoded PLP Payload Type (PPAYload)	GFPS GCS GSE TS REServed	Generic Fixed-length Packetized Stream Generic Continuous Stream Generic Encapsulated Stream Transport Stream Reserved
Current Decoded PLP Time Interleave Type (TIType)	SING MULT	Single Multi
Current Decoded PLP Time Interleave Length (TILength)	< numeric value : 0 to 255>	Time Interleave Length
Number Blocks Maximum (NBMAx)	< numeric value : 0 to 1023>	Number Blocks Maximum
PLP Mode (PMODE)	NTSP NORM HIEF	Not specified Normal Mode High Efficiency Mode
Static Flag (STFLag)	1 (ON) 0 (OFF)	Static Flag ON Static Flag OFF
Static Padding Flag (SPADding)	1 (ON) 0 (OFF)	Static Padding Flag ON Static Padding Flag OFF
Fixed Frequency Flag (FFRFlag)	1 (ON) 0 (OFF)	Fixed Frequency Flag ON Fixed Frequency Flag OFF
First RF Index (FRFindex)	< numeric value : 0 to 7 >	First RF Index
In Band Signalling A (IBSA)	1 (ON) 0 (OFF)	InBand A signalling ON InBand A signalling OFF
In Band Signalling B (IBSB)	1 (ON) 0 (OFF)	InBand B signalling ON InBand B signalling OFF
Reserved_1 (RES1)	< hex : 0x000 to 0xFFFF>	Reserved (3 digits hex value)
First Frame Index (FFAindex)	< numeric_value : 0 to 255>	First Frame Index
Frame Interval (FINterval)	< numeric value : 0 to 255>	Frame Interval

**Example**

CALC:DTV:RES:L1P? DPLP

Queries the current decoded PLP ID parameter information.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: no

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:L1Post? COMMON**

---

This command reads a list of L1-post signaling parameters of all physical layer pipes (PLP) available in the received signal. The return value is in the order of the list shown below. This command is a query and therefore has no \*RST value.

**Parameter**



		Measurement list	Constellation	Echo Pattern	MER(k)	TV Spectrum	Compatibility to R&S ETL
SSFR	Sub-Slices per Frame	√	√	√	√	-	-
AUXC	AUX Configuration RFU	√	√	√	√	-	√
FEFType	FEF Type	√	√	√	√	-	√
FEFLength	FEF Length	√	√	√	√	-	√
FEFinterval	FEF Interval	√	√	√	√	-	√
RES2	Reserved 2	√	√	√	√	-	√
NFfrequency	Number of Frequency	√	√	√	√	-	√
RID0	RF_IDX #0 Frequency	√	√	√	√	-	√
RID1	RF_IDX #1 Frequency	√	√	√	√	-	√
RID2	RF_IDX #2 Frequency	√	√	√	√	-	√
RID3	RF_IDX #3 Frequency	√	√	√	√	-	√
RID4	RF_IDX #4 Frequency	√	√	√	√	-	√
RID5	RF_IDX #5 Frequency	√	√	√	√	-	√
RID6	RF_IDX #6 Frequency	√	√	√	√	-	√

RID7	RF_IDX #7 Frequency	√	√	√	√	-	√
NAUXstream	Number of AUX Streams	√	√	√	√	-	√
ATY1	Stream Type of AUX Stream #1	√	√	√	√	-	√
APR1	Private Conf of AUX Stream #1	√	√	√	√	-	√
ATY2	Stream Type of AUX Stream #2	√	√	√	√	-	√
APR2	Private Conf of AUX Stream #2	√	√	√	√	-	√
...							
ATY15	Stream Type of AUX Stream #15	√	√	√	√	-	√
APR15	Private Conf of AUX Stream #15	√	√	√	√	-	√

### Return value

Parameter	Return value	Description
Sub-Slices per Frame (SSFR)	< numeric value : 0 to 32767 >	
AUX Configuration RFU (AUXC)	< numeric value : 0 to 255 >	
FEF Type (4 digit binary value) (FEFType)	< binary : 0x0000 to 0x1111 >	
FEF Length (FEFLength)	< numeric value : 0 to 4194303 >	
FEF Interval (FEFinterval)	< numeric value : 0 to 255 >	
Reserved 2 ( 8 digit hex value) (RES2)	< hex : 0x00000000 to 0xFFFFFFFF >	
Number of Frequency (NFRequency)	< numeric value : 0 to 8 >	
RF_IDX #0 Frequency [Hz] (RID0)	< numeric value >	

RF_IDX #1 Frequency [Hz] (RID1)	< numeric value >	
RF_IDX #2 Frequency [Hz] (RID2)	< numeric value >	
RF_IDX #3 Frequency [Hz] (RID3)	< numeric value >	
RF_IDX #4 Frequency [Hz] (RID4)	< numeric value >	
RF_IDX #5 Frequency [Hz] (RID5)	< numeric value >	
RF_IDX #6 Frequency [Hz] (RID6)	< numeric value >	
RF_IDX #7 Frequency [Hz] (RID7)	< numeric value >	
Number of AUX Streams (NAUXstream)	< numeric value : 0 to 15 >	
Stream Type of AUX Stream (ATY1)	TXSI RESERVED	TS-SIG Reserved
Private Conf of AUX Stream #1 (8 digit hex value) (APR1)	< hex : 0x00000000 to 0xFFFFFFFF >	
Stream Type of AUX Stream (ATY2)	TXSI RESERVED	TS-SIG Reserved
Private Conf of AUX Stream #2 (8 digit hex value) (APR2)	< hex : 0x00000000 to 0xFFFFFFFF >	
Stream Type of AUX Stream (ATY15)	TXSI RESERVED	TS-SIG Reserved
Private Conf of AUX Stream #15 (8 digit hex value) (APR15)	< hex : 0x00000000 to 0xFFFFFFFF >	

**Example**

CALC:DTV:RES:L1P? COMM

Queries the auxiliary L1-post signalling information as listed above.

**Characteristics**

RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: no

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:RESult:PLP:SYNC?**

This command reads the status of the decoded physical layer pipe (PLP) of the DVB-T2 Receiver.

This command is a query and therefore has no \*RST value.

**Return value**

SYNC	The decoded PLP is synchronized and locked.
NSYNC	The decoded PLP is not synchronized and unlocked.

**Example**

CALC:DTV:RES:PLP:SYNC?

Queries the decoded PLP status.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: no

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:EPATtern:TRACe:DATA?**

This command reads the trace data of the Echo Pattern measurement screen.

The trace data are only available in the Echo Pattern measurement mode. At first, the start and stop values of the span are returned. The span data corresponds to the set span unit. The span setting data is followed by 631 trace data of the Echo Pattern measurement screen. The trace values correspond to the relative level in dB.

Trace data without the measurement range are presented by '---'.

If the OFDM demodulator is not synchronized, just '{ }' is returned.

---

This command is a query and therefore has no \*RST value.

### Return value

start,stop,{relative level1,relative level2,relative level3, ... ,relative level631}

### Example

CALCulate:DTV:EPATtern:TRACe:DATA?

Queries the trace data of the Echo Pattern measurement screen.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

### Mode

-

## CALCulate:DTV: EPAT:MARK:NUM<1...6>:STATe

---

This command activates or deactivates the specified marker.

### Parameter

1 or ON	enables the specified marker
0 or OFF	disables the specified marker

### Example

CALC:DTV:EPAT:MARK:NUM1:STATE ON

Enables marker 1.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

### Mode

-

**CALCulate:DTV: EPAT:MARK:NUM<1...6>:STATE?**


---

This command queries the status of the specified marker.

**Parameter**

1	The specified marker is enabled.
0	The specified marker is disabled.

**Example**

CALC:DTV:EPAT:MARK:NUM1:STATE?

Return value: 1

Marker 1 is enabled.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPAT:MARK:NUM<1...6>:SElect**


---

This command selects the specified marker. If this marker is not yet activated, it will be switched on.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:NUM4:SEL

Selects marker 4.

**Characteristics**

- \* RST value: all markers will be switched off
- SCPI: device-specific

TV standard: all  
 Compatibility to R&S ETH: yes  
 Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:NUM<1...6>:SElect?**


---

This command queries the status of the specified marker.

**Parameter**

0	Specified marker is not selected.
1	Specified marker is selected.

**Example**

CALC:DTV:EPAT:MARK:NUM4:SEL?

Return value: 1

Marker 4 is selected.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:SElect <1...6>**


---

This command selects the specified marker. If this marker is not yet activated it, will be switched on.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:SEL 4  
 Selects marker 4.

#### Characteristics

- \* RST value: all markers will be switched off
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV: EPATtern:MARKer:SElect?

This command queries the status of the specified marker.

#### Return value

0	No marker is activated.
1	Marker 1 is selected.
2	Marker 2 is selected.
3	Marker 3 is selected.
4	Marker 4 is selected.
5	Marker 5 is selected.
6	Marker 6 is selected.

#### Example

CALC:DTV:EPAT:MARK:NUM4:SEL?  
 Return value: 1  
 Marker 4 is selected.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:TYPE**


---

This command sets the marker type of the selected marker.

**Parameter**

RELative	Marker level readout is related to the main pulse.
ABSolute	Marker level readout is the absolute level according to the selected amplitude unit.

**Example**

CALC:DTV:EPAT:MARK:TYPE ABS

Sets the marker type of the selected marker to absolute marker level.

**Characteristics**

- \* RST value: REL
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:TYPE?**


---

This command queries the marker type of the selected marker.

**Return value**

REL	Marker level readout is related to the main pulse.
ABS	Marker level readout is the absolute level according to the selected amplitude unit.

**Example**

CALC:DTV:EPAT:MARK:TYPE?

REL

The marker level readout of the selected marker is related to the main pulse.

**Characteristics**

- \* RST value: REL
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:PEAK**

---

This command sets the selected marker to the main pulse.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:PEAK

Sets the selected marker to the main pulse.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV: EPATtern:MARKer:PEAK:ALL**

---

This command sets all selected marker to the peak. M1 to the main pulse, M2 to the 2nd highest pulse, M3 to the 3rd highest pulse, and so on.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:PEAK:ALL

Sets all selected marker to the peak pulses.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:MARKer:PEAK:NEXT**

---

This command sets the selected marker to the next highest peak.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:PEAK:NEXT

Sets the selected marker to the next highest pulse.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:MARKer:CENTer**

---

This command sets the center of the x-scale according to the position of the selected marker. If the auto span is set, the x-scaling is changed to manual span setting. The span value is kept.

**Parameter**

-

**Example**

CALC:DTV:EPAT:MARK:CENT

Sets the center of the x-scale according the position of the selected marker.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:MARKer:X**


---

This command sets the position of the selected marker according to the selected span unit.

**Parameter**

<numeric value>, UP, DOWN, MIN, MAX  
 UP and DOWN move the marker position by 1 grid

**Example**

CALC:DTV:EPAT:MARK:X 0.00011

Sets the selected marker to 110  $\mu$ s if the span unit  $\mu$ s is selected.**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:MARKer:X?**


---

This command queries the x-position of the selected marker.

**Return value**

<numeric value> [selected span unit]

**Example**

```
CALC:DTV:EPAT:MARK:X?  
0.00015
```

The x-position of the selected marker is 150  $\mu$ s if span unit  $\mu$ s is selected.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: all  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:MARKer:Y?**

---

This command queries the marker value of the selected marker. The return value corresponds to the selected marker type and to the selected amplitude unit if it is an absolute marker type.

**Return value**

<numeric value>

**Example**

```
CALC:DTV:EPAT:MARK:Y?  
-30.000
```

The marker value is 30 dB below the main pulse if the relative marker type is selected.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: all  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:EPATtern:TRACe:DATA?**

This command reads the trace data of the Echo Pattern measurement. The trace data are only available in Echo Pattern measurement mode. At first, the start and stop values of the span according to the selected span unit are returned. The span setting data is followed by 631 trace data of the Echo Pattern measurement. The trace data are according to the value of the pixel column. The echo value is presented relative to the main pulse in dB. Trace data outside of the measurement range are presented by '---'. If the OFDM demodulator is not synchronized, just '{}' is returned. This command is a query and therefore has no \*RST value.

**Return value**

start, stop,{ Echo1, Echo2, Echo3, ... , Echo631}

**Example**

CALCulate:DTV:EPAT:TRACe:DATA?

Queries the trace data of the Echo Pattern measurement screen.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

**Mode**

-

**CALCulate:DTV:MERK:MARKer:NUM<1...6>:STATE**

This command activates or deactivates the specified marker.

**Parameter**

1 or ON	Activates the specified marker.
0 or OFF	Deactivates the specified marker.

**Example**

CALC:DTV:MERK:MARK:NUM1:STATE ON

Enables marker 1.

**Characteristics**

- \* RST value: -
  - SCPI: device-specific
  - TV standard: all
  - Compatibility to R&S ETH: yes
  - Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:NUM<1...6>:STATe?**


---

This command queries the status of the specified marker.

**Return value**

1	Specified marker is enabled.
0	Specified marker is disabled.

**Example**

```
CALC:DTV:MERK:MARK:NUM1:STATE?
```

```
1
```

```
Marker 1 is enabled.
```

**Characteristics**

- \* RST value: -
  - SCPI: device-specific
  - TV standard: all
  - Compatibility to R&S ETH: yes
  - Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:NUM<1...6>:SELect**


---

This command selects the specified marker. If this marker is not yet activated, it will be switched on.

**Parameter**

-

**Example**

CALC:DTV:MERK:MARK:NUM4:SEL  
 Selects marker 4.

**Characteristics**

- \* RST value: all markers will be switched off
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:NUM<1...6>:SELect?**


---

This command queries the status of the specified marker.

**Return value**

1	Specified marker is not selected.
0	Specified marker is selected.

**Example**

CALC:DTV:MERK:MARK:NUM4:SEL?  
 1  
 Marker 4 is selected.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:SElect <1...6>**

This command selects the specified marker. If this marker is not yet activated, it will be switched on.

**Parameter**

-

**Example**

CALC:DTV:MERK:MARK:SEL 4  
Selects marker 4.

**Characteristics**

- \* RST value: all markers will be switched off
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:SElect?**

This command queries the status of the specified marker.

**Return value**

0	No marker is activated.
1	Marker 1 is selected.
2	Marker 2 is selected.
3	Marker 3 is selected.
4	Marker 4 is selected.
5	Marker 5 is selected.
6	Marker 6 is selected.

**Example**

CALC:DTV:MERK:MARK:SEL?  
4

Marker 4 is selected.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:MERK:MARKer:TYPE

This command sets the marker type of the selected marker.

#### Parameter

CARRier	Relates the marker position to the carrier number.
RELative	Relates the marker frequency to the set RF.
ABSolute	Sets the absolute marker frequency.

#### Example

CALC:DTV:MERK:MARK:TYPE ABS

Sets the marker type of the selected marker to absolute marker frequency.

#### Characteristics

- \* RST value: carrier
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

**CALCulate:DTV:MERK:MARKer:TYPE?**


---

This command queries the marker type of the selected marker.

**Parameter**

CARR	Marker is related to the carrier number.
REL	Marker frequency is related to the set RF.
ABS	Marker frequency is the absolute frequency.

**Example**

CALC:DTV:MERK:MARK:TYPE?

REL

The marker frequency is related to the set RF.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:PEAK**


---

This command sets the selected marker to the OFDM carrier with the worst MER value.

**Parameter**

-

**Example**

CALC:DTV:MERK:MARK:PEAK

Sets the selected marker to the OFDM carrier with the worst MER value.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:PEAK:ALL**

This command sets all selected marker to the peak. M1 to the OFDM carrier with the worst MER, M2 to the 2nd worst OFDM carrier, M3 to the 3rd worst OFDM carrier, and so on.

**Parameter**

-

**Example**

CALC:DTV:MERK:MARK:PEAK:ALL

Sets all selected marker to the peak pulses.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:MERK:MARKer:PEAK:NEXT**

This command sets the selected marker to the OFDM carrier with the next worse MER value.

**Parameter**

-

**Example**

CALC:DTV:MERK:MARK:PEAK:NEXT

Sets the selected marker to the OFDM carrier with the next worse MER value.

**Characteristics**

- \* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:MERK:MARKer:X**

This command sets the position of the selected marker according to the selected marker type.

**Parameter**

<numeric value>, UP, DOWN, MIN, MAX

UP and DOWN move the marker position by 1 grid.

**Example**

CALC:DTV:MERK:MARK:X 3457

Sets the selected marker to OFDM carrier 3457 if the 'carrier' marker type is selected.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:MERK:MARKer:X?**

This command queries the x-position of the selected marker. The return value corresponds to the selected marker type.

**Return value**

<numeric value>

**Example**

CALC:DTV:MERK:MARK:X?

2345

The x-position of the selected marker is the OFDM carrier 2345 if the 'carrier' marker type is selected.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:MERK:MARKer:Y?

This command queries the MER value of the selected marker. The return value corresponds to the selected marker type and to the selected amplitude unit if it is an absolute marker type.

#### Return value

<numeric value>

#### Example

```
CALC:DTV:MERK:MARK:Y?
30.000
```

The MER value of the selected marker is 30 dB.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:MERK:TRACe:DATA?

This command reads the trace data of the MER(k) measurement. The trace data are only available in MER(k) measurement mode. At first, the start and stop carrier of the span are returned. The span setting data is followed by 631 trace data of the MER(k) measurement. The trace values correspond to the MER value of the pixel column in dB. If the Auto Peak trace detector is set, 631 value pairs

are returned (min peak value, max peak value).  
 If the OFDM demodulator is not synchronized, just '{}' is returned.  
 This command is a query and therefore has no \*RST value.

#### Return value

start carrier,stop carrier,{ MER1, MER2, MER3, ... , MER631}

#### Example

CALC:DTV:MERK:TRACe:DATA?

Queries the trace data of the MER(k) measurement screen.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

#### Mode

-

### CALCulate:DTV:RESult:DSpectrum?

This command reads the measurement values in the Spectrum measurement mode of the TV Analyzer. The 'LEVel' parameter is also available in the Spectrum Emission Mask measurement mode.

This command is a query and therefore has no \*RST value.

#### Return value

Parameter	Return value	Description
LEVel	<numeric value>	Channel power according to the selected power unit. This parameter is also available in Spectrum Emission Mask measurement.
AFResponse	<numeric value>	Amplitude frequency response within the OFDM bandwidth, peak – peak value in dB.
SALower	<numeric value>	Shoulder attenuation of lower shoulder in dB.

SAUPper	<numeric value>	Shoulder attenuation of upper shoulder in dB.
OBANdwidth	<numeric value>	Occupied bandwidth in Hz.
CN	<numeric value>	Carrier-to-noise ratio in dB.

**Example**

CALC:DTV:RES:DSP? SAL  
 Queries the lower shoulder attenuation.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:SEM:RESult?**

This command reads the status of the Spectrum Emission Mask test. This command is a query and therefore has no \*RST value. This command is available in Spectrum Emission Mask measurement mode of the TV Analyzer.

**Return value**

PASS	Spectrum emission mask test is passed.
FAIL	Spectrum emission mask test is failed.
UNKNOWN	No spectrum emission mask test is selected.

**Example**

CALC:DTV:SEM:RESULT?  
 Queries the Spectrum Emission Mask test status.

**Characteristics**

- \* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

#### Mode

-

### CALCulate:DTV:SEM:DATA?

This command returns the measurement values of the emission mask list. This command is available in the Spectrum Emission Mask measurement mode of the TV Analyzer.

This command is a query and therefore has no \*RST value.

#### Return value

```
{(<a1>,<b1>,<c1>,<d1>,<e1>,<f1>,<g1>,<h1>,<i1>),
(<a2>,<b2>,<c2>,<d2>,<e2>,<f2>,<g2>,<h2>,<i2>), ...
(<an>,<bn>,<cn>,<dn>,<en>,<fn>,<gn>,<hn>,<in>)}
```

n represents the number of segments. The count of segments depends on the spectrum emission mask definition file.

If no spectrum emission mask file is selected, '{}' is returned.

Parameter	Return value	Description
a	<segment number>	Segment number according to the emission mask definition file.
b	< start frequency>	Start frequency of the segment.
c	< stop frequency>	Stop frequency of the segment.
d	< RBW setting>	RBW setting in Hz.
e	< frequency of emission peak>	Frequency w. r. t. RF of the emission peak within the segment.
f	<emission level>	Emission peak level within the segment according to the selected AMPT unit..
g	< attenuation>	Attenuation in dB w. r. t. the channel power within the segment.
h	< margin >	Worst margin to the emission mask within the segment. A

		negative value means the emission mask is violated.
i	< pass/fail>	Pass / fail information regarding the segment. 0: fail 1: pass

**Example**

INIT:CONT OFF

Switches to single sweep mode.

INIT;\*WAI

Starts a sweep and waits for its end.

CALCULATE:DTV:SEM:DATA?;

Queries the spectrum emission mask list.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**12.2.9 Setting the Frequency**

The following commands configure the frequency parameters in DVB-T/H Receiver mode.

**List of Commands**

- [SENSe:]FREQuency:RF
- [SENSe:]FREQuency:RF:STEP
- [SENSe:]FREQuency:RF:OFFSet
- [SENSe:]FREQuency:INPut:MODE
- [SENSe:] CHANnel:TABLE:SElect
- [SENSe:] CHANnel:TABLE:SElect?
- [SENSe:] CHANnel

**[SENSe:]FREQuency:RF**

---

---

This command defines the receive frequency for the frequency input mode.

**Parameter**

4 MHz to fmax  
fmax is specified in the data sheet

**Example**

FREQ:RF 100MHz  
Sets the receive frequency to 100 MHz.

**Characteristics**

- \* RST value:  $f_{max} / 2$  with  $f_{max}$  = maximum receive frequency
- SCPI: conform  
TV standard: all  
Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**[SENSe:]FREQuency:RF:STEP**

---

This command defines the step size of the receive frequency.

**Parameter**

0 to fmax

**Example**

FREQ:RF:STEP 8MHz  
Sets the step size to 8 MHz.

**Characteristics**

- \* RST value: 1 MHz
- SCPI: conform  
TV standard: all  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:]FREQuency:RF:OFFSet**

---

This command defines the receive frequency offset.

**Parameter**

–100 GHz to 100 GHz

**Example**

FREQ:RF:OFFS 1GHZ.

**Characteristics**

- \* RST value: 0 Hz
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:]FREQuency:INPut:MODE**

---

This command selects the frequency mode. Select the Channel frequency mode only if you want to work with channel tables. In this case, the input of the receive frequency is not a frequency value, but a channel number.

**Parameter**

CHANnel | FREQ

**Example**

FREQ:INP:MODE CHAN

Sets the frequency mode to work with channel tables.

**Characteristics**

- \* RST value: FREQ
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:] CHANnel:TABLE:SElect**

This command loads the specified channel table for upcoming measurements. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMory:CDIRectory](#) command. This command is an event and therefore has no query and no \*RST value

**Parameter**

<string> = <file name>

**Example**

CHAN:TABL:SEL 'CATV.CHNTAB'

Loads the channel table with the name CATV from the current default directory.

CHAN:TABL:SEL '\\Storage Card\\Public\\CHANNEL TABLES\\CATV.CHNTAB'

Loads the channel table with the name 'CATV' from the directory \\SD card\\public\\channel tables\\.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:] CHANnel:TABLE:SElect?**

This command returns the file name and its table description of the loaded channel table.

This command is an event and therefore has no query and no \*RST value

**Parameter**

<string1>,<string2>

string1: "channel table file name"

string2: "channel table description"

**Example**

CHAN:TABL:SEL 'CATV.CHNTAB'

Loads the channel table with the name CATV from the current default directory.

CHAN:TABL:SEL '\\Storage Card\\Public\\CHANNEL TABLES\\CATV.CHNTAB'

Loads the channel table with the name 'CATV' from the directory \\SD card\\public\\channel tables\\.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:] CHANnel**

This command defines the receive channel for the channel input mode. A channel table must be loaded prior with the **[SENSe:] CHANnel:TABLE:SElect** command. The frequency input mode must be set to 'CHANNEL', see **[SENSe:]FREQUency:INPut:MODE** command.

**Parameter**

<numeric value> = Minimum channel number to maximum channel number w. r. t. the selected channel table

**Example**

CHAN 35

Sets the receive frequency w. r. t. channel 35 of the selected channel table.

**Characteristics**

- \* RST value: 1
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**12.2.10 Setting Amplitude Parameters**

The following commands configure the gain control, RF preselection, amplitude parameters, impedance and transducers in the Measurement List, Constellation Diagram, Echo Pattern and MER(k) measurement modes. For the DVB Spectrum measurement mode, the same commands are available as for Spectrum Analyzer mode, see "[Setting Amplitude Parameters](#)".

### List of Commands

- INPut:ATTenuation
- INPut:ATTenuation:CHANGed?
- INPut:ATTenuation:CHANGed:RST
- INPut:ATTenuation:CHANGed:VALue?
- INPut:ATTenuation:MODE
- INPut:ATTenuation:AUTO
- INPut:PRESelection:STATe
- INPut:IMPedance
- INPut:IMPedance:PAD
- INPut:IMPedance:TRANSformer:LOSS
- DISPlay:WINDow:DTV:RLEVel:OFFSet
- [SENSe:]CORRection:TRANsducer<1...2>[:STATe]
- [SENSe:]CORRection:TRANsducer<1...2>:SElect
- [SENSe:]CORRection:TRANsducer<1...2>:UNIT?
- UNIT:POWer

### INPut:ATTenuation

---

This command programs the input attenuator. The attenuation can be set in 5 dB steps.

The input attenuation must be set to manual control prior, see [INPut:ATTenuation:AUTO](#) command.

#### Parameter

<numeric\_value> in dB; range specified in data sheet

#### Example

```
INP:ATT 30dB
```

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

#### Characteristics

- \* RST value: 0 dB (AUTO is set to ON)

SCPI: conform

TV standard: all

Compatibility to R&S ETL and R&S ETH: yes

#### Mode

-

### INPut:ATTenuation:CHANGed?

---

This command reads whether the input attenuator status has been changed since the last reset ([INPut:ATTenuation:CHANged:RST](#)).

#### Return value

1	Attenuation has been changed.
0	Attenuation has not been changed.

#### Example

INP:ATT:CHAN?

#### Characteristics

- \* RST value: -
- SCPI: device specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

#### Mode

-

### INPut:ATTenuation:CHANged:RST

This command resets the status check of the attenuation back to unchanged (0). The status is queried using the [INPut:ATTenuation:CHANged?](#) command.

#### Parameter

-

#### Example

INP:ATT:CHAN:RST

#### Characteristics

- \* RST value: -
- SCPI: device specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

#### Mode

-

### INPut:ATTenuation:CHANged:VALue?

If the input attenuator status has been changes ([INPut:ATTenuation:CHANged?](#) returns 1), this command returns the new value of the first attenuation change since the last reset ([INPut:ATTenuation:CHANged:RST](#)). Otherwise the return value is undefined.

#### Parameter

-

#### Example

```
INP:ATT:CHAN:VAL?
```

#### Characteristics

- \* RST value: -
- SCPI: device specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: no

#### Mode

-

### INPut:ATTenuation:MODE

This command defines the controlling of the RF input attenuator for automatically controlled input attenuation.

For further information on controlling the RF attenuator refer to the user manual.

#### Parameter

LDISortion | LNOise

#### Example

```
INP:ATT:MODE LNO
```

Sets the attenuation mode to Auto Low Noise.

#### Characteristics

- \* RST value: LDIS
- SCPI: device specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### **INPut:ATTenuation:AUTO**

---

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

#### **Parameter**

ON | OFF or 1 | 0

#### **Example**

INP:ATT:AUTO ON

Couples the attenuation set on the attenuator to the reference level.

#### **Characteristics**

- \* RST value: ON
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### **Mode**

-

### **INPut:PRESelection:STATe**

---

This command switches the RF preselection path of the instrument on or off (only available with installed option R&S ETC-K1).

#### **Parameter**

ON | OFF or 1 | 0

#### **Example**

INP:PRESELECTION:STAT ON

Activates the RF preselection path.

#### **Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: -

**Mode**

-

**INPut:ATTenuation**

---

This command programs the input attenuator.

The attenuation can be set in 5 dB steps. If the defined reference level cannot be set for the set RF attenuation, the reference level will be adjusted accordingly.

In the default state with Spectrum Analyzer mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

**Parameter**

<numeric\_value> in dB; range specified in data sheet

**Example**

INP:ATT 30dB

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

**Characteristics**

- \* RST value: 0 dB (AUTO is set to ON)

SCPI: conform

**Mode**

-

**INPut:ATTenuation:MODE**

---

This command defines the controlling of the RF input attenuator for automatically controlled input attenuation.

For further information on controlling the RF attenuator refer to the user manual.

**Parameter**

LDISortion | LNOise

**Example**

INP:ATT:MODE LNO

Sets the attenuation mode to Auto Low Noise.

**Characteristics**

- \* RST value: LDIS

SCPI: device-specific

**Mode**

-

**INPut:ATTenuation:AUTO**

---

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

**Parameter**

ON | OFF

**Example**

INP:ATT:AUTO ON

Couples the attenuation set on the attenuator to the reference level.

**Characteristics**

\* RST value: ON

SCPI: conform

**Mode**

-

**INPut:PRESelection:STATe**

---

This command activates or deactivates the RF preselection path of the instrument (only available with installed option R&S ETC-K1).

**Parameter**

ON | OFF

**Example**

INP:PRESELECTION:STAT ON

Activates the RF preselection path.

**Characteristics**

\* RST value: OFF

SCPI: device-specific

**Mode**

-

**INPut:IMPedance**

---

This command sets the nominal input impedance of the instrument. The set impedance is taken into account in all level indications of results .  
 The setting 75  $\Omega$  should be selected, if the 50  $\Omega$  input impedance is transformed to a higher impedance using a 75  $\Omega$  adapter of the RAZ type (= 25  $\Omega$  in series to the input impedance of the instrument). The correction value in this case is 1.76 dB =  $10 \log(75\Omega / 50\Omega)$ . As an alternative the resistive matching pads R&S RAM or R&S FSH-Z38 can be used. In that cases the correction value is 5.72 dB. For matching pad selection see [INPut:IMPedance:PAD](#) command

#### Parameter

50 | 75

#### Example

INP:IMP 75

Sets the input impedance to 75 Ohm.

#### Characteristics

- \* RST value: 50  $\Omega$
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### Mode

-

### INPut:IMPedance:PAD

This command defines RF matching pad if the RF impedance is set to 75  $\Omega$ . For RF impedance selection see [INPut:IMPedance](#) command.

R&S RAZ (= 25  $\Omega$  in series to the input impedance of the instrument). The correction value in this case is 1.76 dB =  $10 \log(75\Omega / 50\Omega)$ .

R&S RAM and R&S FSH-Z38 are resistive 50/75  $\Omega$  matching pads. In that cases the correction value is 5.72 dB.

The 75  $\Omega$  transformer is user specific transforming pad. The loss of transformer is user-defined and can be set via the [INPut:IMPedance:TRANSformer:LOSS](#) command.

#### Parameter

RAM | RAZ | HZTE | TRANSformer

RAM	Resistive 75/50 $\Omega$ matching pad R&S RAM, attenuation 5.72 dB
RAZ	Resistive 75/50 $\Omega$ matching pad R&S RAZ, attenuation 1.76 dB

HZTE	Resistive 75/50 $\Omega$ matching pad R&S FSH-Z38, attenuation 5.72 dB
TRANSformer	75 $\Omega$ transformer with user-defined transformer loss

**Example**

INP:IMP:PAD RAM

Sets the matching pad R&S RAM.

**Characteristics**

- \* RST value: -
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**INPut:IMPedance:TRANSformer:LOSS**

This command set the RF transformer loss value that is used by the selection of [INPut:IMPedance:PAD](#) command.

**Parameter**

-30 to 30 dB

**Example**

INP:IMP:TRAN:LOSS 5.72

Sets the transformer loss of 5.72dB. Note : -ve means a gain of the transformer loss value

**Characteristics**

- \* RST value: -
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**DISPlay:WINDow:DTV:RLEVel:OFFSet**

This command sets the reference level offset in the Constellation Diagram and Measurement List measurement modes.

**Parameter**

-100 to 100 dB

**Example**

DISPLAY:WINDOW:DTV:RLEVEL:OFFSET 10  
Sets the reference level offset to 10 dB.

**Characteristics**

- \* RST value: 0
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>[:STATe]**

This command switches the selected transducer factor on or off. A transducer file must be loaded prior with the [\[SENSe:\]CORRection:TRANsducer<1...2>:SElect](#) command.

The suffix<1...2> specifies the primary or secondary transducer.

**Parameter**

ON | OFFFor 1 | 0

**Example**

CORR:TRAN1 ON  
Activates the primary transducer

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>:SElect**

This command loads the transducer factor designated by <name>. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMory:CDIRectory](#) command. The selected transducer can be switched on or off with the [\[SENSe:\]CORRection:TRANsducer<1...2>\[:STATe\]](#) command.

The suffix <1...2> specifies the primary or secondary transducer.

**Parameter**

<string>= <name of the transducer file including extension> in string data form with a maximum of 8 characters

**Example**

```
CORR:TRAN1:SEL 'FACTOR1.PRITRD'
```

Loads the primary transducer 'FACTOR1' from the default directory.

```
CORR:TRAN2:SEL '\Storage Card\Public\TRANSDUCERS\FACTOR1'
```

Loads the secondary transducer 'FACTOR1' from the directory \SD card\public\transducers\

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>:UNIT?**

This command queries the unit of the transducer factor in use. The suffix <1...2> specified the primary or secondary transducer.

**Parameter**

-

**Example**

```
CORR:TRAN1:UNIT?
```

Queries the unit of the primary transducer

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**UNIT:POWer**


---

This command selects the default unit.

**Parameter**

DBM | DBUV | DBMV | V | W | DUVM | DUAM | V\_M | W\_M2

**Example**

UNIT:POW DBUV  
 Sets the power unit to dB $\mu$ V

**Characteristics**

- \* RST value: DBM
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**12.2.11 Configuring Limits**

The following commands define limits.

**List of Commands**

- [CALCulate:DTV:LIMit:STATe](#)
- [CALCulate:DTV:LIMit:SElect](#)
- [CALCulate:DTV:LIMit:SElect?](#)
- [CALCulate:DTV:LIMit:BEEP\[:STATe\]](#)
- [CALCulate:DTV:LIMit:DEMod\[:STATe\]](#)
- [CALCulate:DTV:LIMit:FEC\[:STATe\]](#)
- [CALCulate:DTV:LIMit:LEVel:LOWer:STATe](#)

- CALCulate:DTV:LIMit:LEVel:LOWer
- CALCulate:DTV:LIMit:LEVel:UPPer:STATe
- CALCulate:DTV:LIMit:LEVel:UPPer
- CALCulate:DTV:LIMit:CFACtor:LOWer:STATe
- CALCulate:DTV:LIMit:CFACtor:LOWer
- CALCulate:DTV:LIMit:CFACtor:UPPer:STATe
- CALCulate:DTV:LIMit:CFACtor:UPPer
- CALCulate:DTV:LIMit:CFOFfset:LOWer:STATe
- CALCulate:DTV:LIMit:CFOFfset:LOWer
- CALCulate:DTV:LIMit:CFOFfset:UPPer:STATe
- CALCulate:DTV:LIMit:CFOFfset:UPPer
- CALCulate:DTV:LIMit:SROFfset:LOWer:STATe
- CALCulate:DTV:LIMit:SROFfset:LOWer
- CALCulate:DTV:LIMit:SROFfset:UPPer:STATe
- CALCulate:DTV:LIMit:SROFfset:UPPer
- CALCulate:DTV:LIMit:EVMPeak:UPPer:STATe
- CALCulate:DTV:LIMit:EVMPeak:UPPer
- CALCulate:DTV:LIMit:EVMRms:UPPer:STATe
- CALCulate:DTV:LIMit:EVMRms:UPPer
- CALCulate:DTV:LIMit:MERPeak:LOWer:STATe
- CALCulate:DTV:LIMit:MERPeak:LOWer
- CALCulate:DTV:LIMit:MERRms:LOWer:STATe
- CALCulate:DTV:LIMit:MERRms:LOWer
- CALCulate:DTV:LIMit:MERR:A|B|C:LOWer:STATe
- CALCulate:DTV:LIMit:MERR:A|B|C:LOWer
- CALCulate:DTV:LIMit:BBViterbi:UPPer:STATe
- CALCulate:DTV:LIMit:BBViterbi[:UPPer]
- CALCulate:DTV:LIMit:BBViterbi:A|B|C:UPPer:STATe
- CALCulate:DTV:LIMit:BBViterbi:A|B|C[:UPPer]
- CALCulate:DTV:LIMit:BBRS:UPPer:STATe
- CALCulate:DTV:LIMit:BBRS[:UPPer]
- CALCulate:DTV:LIMit:BBRS:A|B|C:UPPer:STATe
- CALCulate:DTV:LIMit:BBRS:A|B|C[:UPPer]
- CALCulate:DTV:LIMit:BARS:A|B|C:UPPer:STATe
- CALCulate:DTV:LIMit:BARS:A|B|C[:UPPer]
- CALCulate:DTV:LIMit:PERatio:UPPer:STATe
- CALCulate:DTV:LIMit:PERatio[:UPPer]
- CALCulate:DTV:LIMit:PERRors:UPPer:STATe
- CALCulate:DTV:LIMit:PERRors[:UPPer]
- CALCulate:DTV:LIMit:PERRors:A|B|C:UPPer:STATe
- CALCulate:DTV:LIMit:PERRors:A|B|C[:UPPer]
- CALCulate:DTV:LIMit:BBCH:UPPer:STATe
- CALCulate:DTV:LIMit:BBCH[:UPPer]
- CALCulate:DTV:LIMit:BERLdpc:UPPer:STATe
- CALCulate:DTV:LIMit:BERLdpc[:UPPer]
- CALCulate:DTV:LIMit:EPPLp:UPPer:STATe
- CALCulate:DTV:LIMit:EPPLp[:UPPer]
- CALCulate:DTV:LIMit:ERPLp:UPPer:STATe
- CALCulate:DTV:LIMit:ERPLp[:UPPer]

- CALCulate:DTV:LIMit:MPLO:LOWer:STATe
- CALCulate:DTV:LIMit:MPLO:LOWer
- CALCulate:DTV:LIMit:MRLO:LOWer:STATe
- CALCulate:DTV:LIMit:MRLO:LOWer
- CALCulate:DTV:LIMit:MPPLp:LOWer:STATe
- CALCulate:DTV:LIMit:MPPLp:LOWer
- CALCulate:DTV:LIMit:MRPLp:LOWer:STATe
- CALCulate:DTV:LIMit:MRPLp:LOWer
- CALCulate:DTV:LIMit:ITLDpc:UPPer:STATe
- CALCulate:DTV:LIMit:ITLDpc[:UPPer]
- CALCulate:DTV:LIMit:BBFRame:UPPer:STATe
- CALCulate:DTV:LIMit:BBFRame[:UPPer]

### CALCulate:DTV:LIMit:STATe

This command activates or deactivates all limits checking. The limit state is the master on / off switch. In case switched off, no limits will be checked regardless of other limit settings.

#### Parameter

ON | OFF  
1 | 0

#### Example

CALCULATE:DTV:LIMIT:STAT ON  
Activates the limit checking.

#### Characteristics

- \* RST value: OFF
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### Mode

-

### CALCulate:DTV:LIMit:SElect

This command loads a limit table from a file. If the filename starts with “\”, the path is considered absolute. If the filename does not start with “\”, the path is considered relative to the current directory that can be set with the [MMEMory:CDIRectory](#) command.

#### Parameter

<string> = <limit table filename>

### Example

CALCULATE:DTV:LIMIT:SELECT "table1.dvblim"

Loads "table1" from the default directory.

CALCULATE:DTV:LIMIT:SELECT "\Storage Card\Public\TABLE1.DVBLIM"

Loads "table1" from the directory \storage card\public\.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

### Mode

-

## CALCulate:DTV:LIMit:SElect?

---

This command returns the actual loaded limit table.

### Return value

<string1>,<string2>,<string3>

string1 "limit table name"

string2 "limit table description"

string3 "limit table modification state" (individual fields altered after loading the limit table?)

### Example

CALCULATE:DTV:LIMIT:SELECT?

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

### Mode

-

**CALCulate:DTV:LIMit:BEEP[:STATe]**

This command activates or deactivates the audio beep. If active, the R&S ETC outputs a beep each time a limit is exceeded.

**Parameter**

ON | OFF

**Example**

CALC:DTV:LIM:BEEP ON  
Activates the audio beep.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:DEMod[:STATe]**

This command activates or deactivates the limit check for the OFDM demodulator status.

**Parameter**

ON | OFF  
1 | 0

**Example**

CALC:DTV:LIM:DEM ON  
Activates the demodulator status limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

### **CALCulate:DTV:LIMit:FEC[:STATe]**

---

This command activates or deactivates the limit check for the FEC decoder status.

#### **Parameter**

ON | OFF

1 | 0

#### **Example**

CALC:DTV:LIM:FEC ON

Activates the FEC decoder status limit checking.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### **Mode**

-

### **CALCulate:DTV:LIMit:LEVel:LOWer:STATe**

---

This command activates or deactivates the level lower limit checking.

#### **Parameter**

ON | OFF or 1 | 0

#### **Example**

CALCULATE:DTV:LEVEL:LIMIT:LOWER:STAT ON

Activates the level lower limit checking.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

#### **Mode**

-

### **CALCulate:DTV:LIMit:LEVel:LOWer**

---

This command defines the lower limit of the signal power respectively signal power. The value is referred to the selected amplitude unit.

#### **Parameter**

-199.9 ... +99.9 dBm [referred to the selected ampt unit]  
MINimum to MAXimum (depending on current unit)

#### **Example**

CALC:DTV:LIMIT:LEV:LOW -22.0

Sets the lower limit of the signal power to -22 dBm if the unit dBm is selected.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

#### **Mode**

-

### **CALCulate:DTV:LIMit:LEVel:UPPer:STATe**

---

This command activates or deactivates the level upper limit checking.

#### **Parameter**

ON | OFF

1 | 0

#### **Example**

CALCULATE:DTV:LEVEL:LIMIT:UPPER:STAT ON

Activates the level upper limit checking.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:LEVel:UPPer**

This command defines the upper limit of the signal power respectively signal power. The value is referred to the selected amplitude unit.

**Parameter**

-199.9 ... +99.9 dBm [referred to the selected ampt unit]  
MINimum to MAXimum (depending on current unit)

**Example**

CALC:DTV:LIMIT:LEV:UPP -12.0

Sets the upper limit of the signal power to -12 dBm if the unit dBm is selected.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:CFACtor:LOWer:STATe**

This command activates or deactivates the crest factor lower limit checking.

**Parameter**

ON | OFF or 1 | 0

**Example**

CALCULATE:DTV:CF:LIMIT:LOWER:STAT ON

Activates the crest factor lower limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:CFACTOR:LOWer**

This command defines the lower limit of the crest factor of the input signal.

**Parameter**

0 to 30 dB

**Example**

CALC:DTV:LIMIT:CF:LOW 10.0

Sets the lower limit of the crest factor to 10 dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:CFACTOR:UPPer:STATe**

This command activates or deactivates the crest factor upper limit checking.

**Parameter**

ON | OFF or 1 | 0

**Example**

CALCULATE:DTV:CF:LIMIT:UPPER:STAT ON

Activates the crest factor upper limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:CFACTOR:UPPer**

This command defines the upper limit of the crest factor of the input signal.

**Parameter**

0 to 30 dB

**Example**

CALC:DTV:LIMIT:CF:LOW 12.0

Sets the upper limit of the crest factor to 12 dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:CFOffset:LOWer:STATE**

This command activates or deactivates the carrier frequency offset lower limit checking.

**Parameter**

ON | OFF or 1 | 0

**Example**

CALCULATE:DTV:CFOF:LIMIT:LOWER:STAT ON

Activates the carrier frequency offset lower limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:CFOffset:LOWer**

This command defines the lower limit of the carrier frequency offset.

**Parameter**

-999999 to +999999 [Hz]

**Example**

CALC:DTV:LIM:CFOF:LOW -1000

Sets the lower limit of the carrier frequency offset to -1000 Hz.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

---

**CALCulate:DTV:LIMit:CFOffset:UPPer:STATe**

This command activates or deactivates the carrier frequency offset upper limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:CFOF:LIMIT:UPPER:STAT ON

Activates the carrier frequency offset upper limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

TV standard: all  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:CFOffset:UPPer**

This command defines the upper limit of the carrier frequency offset.

**Parameter**

-999999 to +999999 [Hz]

**Example**

CALC:DTV:LIM:CFOF:UPP 1000

Sets the upper limit of the carrier frequency offset to 1000 Hz.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:SROffset:LOWer:STATe**

This command activates or deactivates the symbol rate offset lower limit checking.

**Parameter**

ON | OFF or 1 | 0

**Example**

CALCULATE:DTV:SROF:LIMIT:LOWER:STAT ON

Activates the symbol rate offset lower limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

TV standard: all  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:SROFset:LOWer**

---

This command defines the lower limit of the symbol rate offset.

**Parameter**

-99.9 to +99.9 [ppm]

**Example**

CALC:DTV:LIM:SROF:LOW -5  
Sets the lower limit of the symbol rate offset to -5 ppm.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:SROFset:UPPer:STATe**

---

This command activates or deactivates the symbol rate offset upper limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:SROF:LIMIT:UPPER:STAT ON  
Activates the symbol rate offset upper limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:SROFset:UPPer**


---

This command defines the upper limit of the symbol rate offset.

**Parameter**

-99.9 to +99.9 [ppm]

**Example**

CALC:DTV:LIM:SROF:UPP 5

Sets the upper limit of the symbol rate offset to 5 ppm.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:EVMPeak:UPPer:STATe**


---

This command activates or deactivates the EVM peak limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:LIMIT:EVMPEAK:UPPER:STAT ON

Activates the EVM peak limit checking.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: DVB-T/H  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:EVMPeak:UPPer**

---

This command defines the upper limit of the peak value of the error vector magnitude.

**Parameter**

0.1 to 100 [percent]

**Example**

CALC:DTV:LIM:EVMP:UPP 20

Sets the upper limit of the peak value of the error vector magnitude to 20 %.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: DVB-T/H  
Compatibility to R&S ETH: yes  
Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:EVMRms:UPPer:STATe**

---

This command activates or deactivates the EVM rms limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:LIMIT:EVMRMS:UPPER:STAT ON  
 Activates the EVM rms limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:EVMRms:UPPer**

---

This command defines the upper limit of the root mean square value of the error vector magnitude.

**Parameter**

0.1 to 100 [percent]

**Example**

CALC:DTV:LIM:EVMP:UPP 1.5

Sets the upper limit of the rms value of the error vector magnitude to 1.5 %.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:MERPeak:LOWer:STATe**

---

This command activates or deactivates the MER peak limit checking. For the ISDB-T standard, it is related to the parameter MER (total,peak).

**Parameter**

ON | OFF

1 | 0

### Example

CALCULATE:DTV:LIMIT:MERPEAK:LOWER:STAT ON  
Activates the MER peak limit checking.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

### Mode

-

## CALCulate:DTV:LIMit:MERPeak:LOWer

---

This command defines the lower limit of the peak value of the modulation error ratio. For the ISDB-T standard, it is related to the parameter MER (total,peak).

### Parameter

0.0 to 60.0 [percent]

### Example

CALC:DTV:LIM:MERP:LOW 20  
Sets the lower limit of the peak value of the modulation error ratio to 20 dB.

### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

### Mode

-

## CALCulate:DTV:LIMit:MERRms:LOWer:STATe

---

This command activates or deactivates the MER rms limit checking. For the ISDB-T standard, it is related to the parameter MER (total,rms).

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:LIMIT:MERRMS:LOWER:STAT ON

Activates the MER rms limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MERRms:LOWer**


---

This command defines the lower limit of the rms value of the modulation error ratio. For the ISDB-T standard, it is related to the parameter MER (total,rms).

**Parameter**

0.0 to 60.0 [percent]

**Example**

CALC:DTV:LIM:MERR:LOW 30

Sets the lower limit of the rms value of the modulation error ratio to 30 dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:MERR:A|B|C:LOWer:STATe**

---

This command activates or deactivates the MER rms limit checking of the corresponding layer.

**Parameter**

ON | OFF

1 | 0

**Example**

```
CALCULATE:DTV:LIMIT:MERR:B:LOWER:STAT ON
```

Activates the MER rms limit checking of layer B.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MERR:A|B|C:LOWer**

---

This command defines the lower limit of the rms value of the modulation error ratio of the corresponding layer.

**Parameter**

0.0 to 60.0 [percent]

**Example**

```
CALC:DTV:LIM:MERR:LOW 30
```

Sets the lower limit of the rms value of the modulation error ratio to 30 dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBViterbi:UPPer:STATe**

This command activates or deactivates the BER before Viterbi limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:BBV:UPP:STAT ON

Activates the BER before Viterbi limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBViterbi[:UPPer]**

This command defines the upper limit of the bit error ratio before Viterbi decoder.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BBV 3.5E-4

Sets the upper limit of the BER before Viterbi decoder to 3.5e-4.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:BBViterbi:A|B|C:UPPer:STATe**

This command activates or deactivates the BER before Viterbi limit checking of the corresponding layer.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:BBV:A:UPPER:STAT ON

Activates the BER before Viterbi limit checking for layer A.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBViterbi:A|B|C[:UPPer]**

This command defines the upper limit of the bit error ratio before Viterbi decoder of the corresponding layer.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BBV:A 3.5E-4

Sets the upper limit of the BER before Viterbi decoder of layer A to 3.5e-4.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBRS:UPPer:STATe**

This command activates or deactivates the BER before Reed Solomon decoder limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALCULATE:DTV:LIMIT:BBRS:UPPER:STAT ON

Activates the BER before Reed Solomon decoder limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBRS[:UPPer]**

This command defines the upper limit of the bit error ratio before Viterbi decoder of the corresponding layer.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BBV 3.5E-5

Sets the upper limit of the BER before Reed Solomon decoder to 3.5e-5.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

TV standard: DVB-T/H

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: yes

**Mode**

-

---

**CALCulate:DTV:LIMit:BBRS:A|B|C:UPPer:STATe**

This command activates or deactivates the BER before Reed Solomon decoder limit checking of the corresponding layer.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:BBRS:C:UPP:STAT ON

Activates the BER before Reed Solomon decoder of layer C limit checking.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: ISDB-T

Compatibility to R&S ETH: yes

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:BBRS:A|B|C[:UPPer]**

This command defines the upper limit of the bit error ratio before Reed Solomon decoder of the corresponding layer.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BBRS:C 3.5E-5

Sets the upper limit of the BER before Reed Solomon decoder of layer C to 3.5e-5.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:BARs:A|B|C:UPPer:STATe**

This command activates or deactivates the BER after Reed Solomon decoder limit checking of the corresponding layer.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:BARs:C:UPP:STAT ON

Activates the BER after Reed Solomon decoder of layer C limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BARs:A|B|C[:UPPer]**

This command defines the upper limit of the bit error ratio after Reed Solomon decoder of the corresponding layer.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BARS:C 3.5E-5

Sets the upper limit of the BER after Reed Solomon decoder of layer C to 3.5e-5.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:PERatio:UPPer:STATe**

This command activates or deactivates the Packet Error Ratio (PER) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:PER:UPP:STAT ON

Activates the PER limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:PERatio[:UPPer]**

This command defines the upper limit of the Packet Error Ratio.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:PER:UPP 3.7E-06

Sets the upper limit of the packet error ratio to 3.7e-6.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:PERRors:UPPer:STATe**


---

This command activates or deactivates the packet errors limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:PERR:UPP:STAT ON

Activates the PER limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:PERRors[:UPPer]**


---

This command defines the upper limit of the Packet Errors per second.

**Parameter**

0 to 99999

**Example**

CALC:DTV:LIM:PERR 10

Sets the upper limit to 10 packet errors per second.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:PERRors:A|B|C:UPPer:STATE**

---

This command activates or deactivates the packet errors limit checking of the corresponding layer.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:PERR:A:UPP:STAT ON

Activates the PER limit checking of layer A.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:PERRors:A|B|C[:UPPer]**

---

---

This command defines the upper limit of the Packet Errors per second of the corresponding layer.

**Parameter**

0 to 99999

**Example**

CALC:DTV:LIM:PERR:A 10

Sets the upper limit of packet errors of layer A to 10 packet errors per second.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBCH:UPPer:STATe**

---

This command activates or deactivates the bit error ratio before BCH limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:BBCH:UPP:STAT ON

Activates the BER before BCH limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBCH[:UPPer]**

This command defines the upper limit of the bit error ratio before BCH.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

CALC:DTV:LIM:BBCH 3.5E-5

Sets the upper limit of the bit error ratio before BCH to 3.5e-5.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: DVB-T2  
Compatibility to R&S ETH: new  
Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:BERLdpc:UPPer:STATe**

This command activates or deactivates the bit error ratio before LDPC limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:LDPC:UPP:STAT ON

Activates the BER before LDPC limit checking.

**Characteristics**

- \* RST value: -  
SCPI: device-specific  
TV standard: DVB-T2  
Compatibility to R&S ETH: new  
Compatibility to R&S ETL: new

**Mode**

-

### **CALCulate:DTV:LIMit:BERLdpc[:UPPer]**

---

This command defines the upper limit of the bit error ratio before LDPC.

#### **Parameter**

0.0E-15 to 9.9E-1

#### **Example**

CALC:DTV:LIM:BERL 3.5E-5

Sets the upper limit of the bit error ratio before LDPC to 3.5e-5.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

#### **Mode**

-

### **CALCulate:DTV:LIMit:EPPLp:UPPer:STATe**

---

This command activates or deactivates the error vector magnitude EVM(PLP, peak) limit checking.

#### **Parameter**

ON | OFF

1 | 0

#### **Example**

CALC:DTV:LIM:EPPL:UPP:STAT ON

Activates the error vector magnitude EVM(PLP, peak) limit checking.

#### **Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:EPPLp[:UPPer]**

---

This command defines the upper limit of the peak value of the error vector magnitude EVM(PLP,peak).

**Parameter**

0.1 to 100 [percent]

**Example**

CALC:DTV:LIM:EPPL:UPP 1.5

Sets the upper limit of the peak value of the error vector magnitude EVM(PLP,peak) to 1.5%.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:ERPLp:UPPer:STATe**

---

This command activates or deactivates the error vector magnitude EVM(PLP, rms) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:ERPL:UPP:STAT ON

Activates the error vector magnitude EVM(PLP, rms) limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:ERPLp[:UPPer]**

This command defines the upper limit of the root mean square value of the error vector magnitude EVM(PLP,rms).

**Parameter**

0.1 to 100 [percent]

**Example**

CALC:DTV:LIM:ERPL:UPP 1.5

Sets the upper limit of the rms value of the error vector magnitude EVM(PLP,rms) to 1.5%.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

---

**CALCulate:DTV:LIMit:MPLO:LOWer:STATe**

This command activates or deactivates the lower limit modulation error ratio MER(L1,peak) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:MPLO:LOW:STAT ON

Activates the modulation error ratio MER(L1,peak) limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MPLO:LOWer**


---

This command defines the lower limit of the peak value of the modulation error ratio MER(L1,peak).

**Parameter**

0.0 to 60.0 [dB]

**Example**

CALC:DTV:LIM:MPLO:LOW 20

Sets the lower limit of the peak value of the modulation error ratio MER(L1,peak) to 20dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:MRLO:LOWer:STATe**


---

This command activates or deactivates the lower limit modulation error ratio MER(L1,rms) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:MRLO:LOW:STAT ON

Activates the modulation error ratio MER(L1,rms) limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MRLO:LOWer**


---

This command defines the lower limit of the root mean square value of the modulation error ratio MER(L1,rms).

**Parameter**

0.0 to 60.0 [dB]

**Example**

CALC:DTV:LIM:MRLO:LOW 20

Sets the lower limit of the rms value of the modulation error ratio MER(L1,rms) to 20dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:MPPLp:LOWer:STATe**


---

This command activates or deactivates the lower limit for modulation error ratio MER(PLP,peak) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:MPPL:LOW:STAT ON

Activates the lower limit for modulation error ratio MER(PLP,peak) limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MPPLp:LOWer**


---

This command defines the lower limit of the peak value of the modulation error ratio MER(PLP,peak).

**Parameter**

0.0 to 60.0 [dB]

**Example**

CALC:DTV:LIM:MPPL:LOW 20

Sets the lower limit of the peak value of the modulation error ratio MER(PLP,peak) to 20dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:MRPLp:LOWer:STATe**

---

This command activates or deactivates the lower limit for modulation error ratio MER(PLP,rms) limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:MRPL:LOW:STAT ON

Activates the lower limit for modulation error ratio MER(PLP,rms) limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:MRPLp:LOWer**

---

This command defines the lower limit of the root mean square value of the modulation error ratio MER(PLP,rms).

**Parameter**

0.0 to 60.0 [dB]

**Example**

CALC:DTV:LIM:MRPL:LOW 20

Sets the lower limit of the rms value of the modulation error ratio MER(PLP,peak) to 20dB.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:ITLDpc:UPPer:STATe**

This command activates or deactivates the number of LDPC iteration limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

CALC:DTV:LIM:ITLD:UPP:STAT ON

Activates the number of LDPC iteration limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:ITLDpc[:UPPer]**

This command defines the upper limit of the number of LDPC iteration.

**Parameter**

0 to 64

**Example**

CALC:DTV:LIM:ITLD 20

Sets the upper limit of the number of LDPC iteration count to 20.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBFRame:UPPer:STATE**

This command activates or deactivates the upper limit for Baseband Frame error ratio limit checking.

**Parameter**

ON | OFF

1 | 0

**Example**

```
CALC:DTV:LIM:BBFR:UPP:STAT ON
```

Activates the upper limit for BaseBand Frame error ratio limit checking.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:BBFRame[:UPPer]**

This command defines the upper limit of the value of the Baseband Frame error ratio.

**Parameter**

0.0E-15 to 9.9E-1

**Example**

```
CALC:DTV:LIM:BBFR 3.5E-4
```

Sets the upper limit of the Baseband Frame error ratio to 3.5e-4.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: new

**Mode**

-

## 12.2.12 Using Limit Functions

The following commands define limits and perform the corresponding limit checks.

### List of Commands

- CALCulate:DTV:LIMit:RESult:LEVel:LOWer?
- CALCulate:DTV:LIMit:RESult:LEVel:UPPer?
- CALCulate:DTV:LIMit:RESult:CFACTOR:LOWer?
- CALCulate:DTV:LIMit:RESult:CFACTOR:UPPer?
- CALCulate:DTV:LIMit:RESult:CFOffset:LOWer?
- CALCulate:DTV:LIMit:RESult:CFOffset:UPPer?
- CALCulate:DTV:LIMit:RESult:SROffset:LOWer?
- CALCulate:DTV:LIMit:RESult:SROffset:UPPer?
- CALCulate:DTV:LIMit:RESult:MERRms:LOWer?
- CALCulate:DTV:LIMit:RESult:MERRms:UPPer?
- CALCulate:DTV:LIMit:RESult:MERRms:A|B|C?
- CALCulate:DTV:LIMit:RESult:MTRMs?
- CALCulate:DTV:LIMit:RESult:MARMs?
- CALCulate:DTV:LIMit:RESult:EVMRms:UPPer?
- CALCulate:DTV:LIMit:RESult:EVMPeak:UPPer?
- CALCulate:DTV:LIMit:RESult:BBViterbi:UPPer]?
- CALCulate:DTV:LIMit:RESult:BBViterbi:A|B|C?
- CALCulate:DTV:LIMit:RESult:BBRS[:UPPer]?
- CALCulate:DTV:LIMit:RESult:BBRS:A|B|C?
- CALCulate:DTV:LIMit:RESult:BARS:A|B|C?
- CALCulate:DTV:LIMit:RESult:PERatio[:UPPer]?
- CALCulate:DTV:LIMit:RESult:PERRors[:UPPer]?
- CALCulate:DTV:LIMit:RESult:PERRors:A|B|C?
- CALCulate:DTV:LIMit:RESult:BBCH[:UPPer]?
- CALCulate:DTV:LIMit:RESult:BERLdpc[:UPPer]?
- CALCulate:DTV:LIMit:RESult:EPPLp:UPPer?
- CALCulate:DTV:LIMit:RESult:ERPLp:UPPer?
- CALCulate:DTV:LIMit:RESult:MPLO:LOWer?
- CALCulate:DTV:LIMit:RESult:MRLO:LOWer?
- CALCulate:DTV:LIMit:RESult:MPPLp:LOWer?
- CALCulate:DTV:LIMit:RESult:MRPLp:LOWer?
- CALCulate:DTV:LIMit:RESult:ITLDpc[:UPPer]?
- CALCulate:DTV:LIMit:RESult:BBFRame[:UPPer]?

**CALCulate:DTV:LIMit:RESult:LEVel:LOWer?**

This command returns the result of the lower limit check for the signal level. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:LEVEL:LOWER?  
Queries the lower limit check of the signal level.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:LEVel:UPPer?**

This command returns the result of the upper limit check for the signal level. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:LEVEL:UPPER?  
Queries the upper limit check of the signal level.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:CFACTOR:UPPer?**

This command returns the result of the upper limit check for the crest factor of the input signal. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:CFACTOR:UPPER?  
Queries the upper limit check of the crest factor.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:CFACTOR:LOWer?**

This command returns the result of the lower limit check for the crest factor of the input signal. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

**CALCULATE:DTV:LIMIT:RESULT:CFACTOR:LOWER?**

Queries the lower limit check of the crest factor.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:CFOffset:LOWer?**

This command returns the result of the lower limit check for the carrier frequency offset. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example****CALCULATE:DTV:LIMIT:RESULT:CFOFFSET:LOWER?**

Queries the lower limit check of the carrier frequency offset.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:CFOffset:UPPer?**

This command returns the result of the upper limit check for the carrier frequency offset. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:CFOFFSET:UPPER?

Queries the upper limit check of the carrier frequency offset.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:SROFfset:LOWer?**


---

This command returns the result of the lower limit check for the symbol rate offset. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:SROFFSET:LOWER?

Queries the lower limit check of the symbol rate offset.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:SROFfset:UPPer?**

This command returns the result of the upper limit check for the carrier frequency offset. This command is a query and therefore has no \*RST value.

#### Return value

0	Passed
1	Failed

#### Example

CALCULATE:DTV:LIMIT:RESULT:SROFFSET:UPPER?

Queries the upper limit check of the symbol rate offset.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all
- Compatibility to R&S ETL and R&S ETH: yes

#### Mode

-

### CALCulate:DTV:LIMit:RESult:MERRms:LOWer?

This command returns the result of the lower limit check for the root mean square value of the Modulation Error Ratio. This command is a query and therefore has no \*RST value. For the ISDB-T standard, it is related to the parameter MER (total,rms).

#### Return value

0	Passed
1	Failed

#### Example

CALCULATE:DTV:LIMIT:RESULT:SROFFSET:LOWER?

Queries the lower limit check of the MER rms value.

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: all

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:MERPeak:LOWer?**

This command returns the result of the lower limit check for the peak value of the Modulation Error Ratio. This command is a query and therefore has no \*RST value. For the ISDB-T standard, it is related to the parameter MER (total,rms).

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MERPEAK:LOWER?

Queries the lower limit check of the peak value for the Modulation Error Ratio.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: all

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:MERRms:A|B|C?**

This command returns the result of the lower limit check for the rms value of the MER of the corresponding layer. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MERRMS:A?

Queries the lower limit check of the rms value for the MER of layer A.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:MTRMs?**

This command returns the result of the lower limit check for the rms value of the MER of the TMCC carriers. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MTRMS?

Queries the lower limit check of the rms value for the MER of the TMCC carriers.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:MARMs?**

This command returns the result of the lower limit check for the rms value of the MER of the AC carriers. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MARMS?

Queries the lower limit check of the rms value for the MER of the AC carriers.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:EVMRms:UPPer?**

This command returns the result of the upper limit check for the root mean square value of the error vector magnitude. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT: EVMRMS:UPPER?

Queries the lower limit check of the rms value for the Error Vector Magnitude.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:EVMPeak:UPPer?**

This command returns the result of the upper limit check for the peak value of the Error Vector Magnitude. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT: EVMPEAK:UPPER?

Queries the lower limit check of the peak value for the Error Vector Magnitude.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBViterbi[:UPPer]?**

This command returns the result of the upper limit check for the bit error ratio before viterbi decoder. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BBVITERBI:UPPER?

Queries the upper limit check of the peak value for the Error Vector Magnitude.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

TV standard: DVB-T/H

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBViterbi:A|B|C?**

This command returns the result of the upper limit check for the bit error ratio before viterbi decoder of the corresponding layer. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BBVITERBI:A?

Queries the upper limit check of the BER before viterbi decoder of layer A.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: ISDB-T

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBRS[:UPPer]?**

This command returns the result of the upper limit check for the bit error ratio before Reed Solomon decoder. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

**CALCULATE:DTV:LIMIT:RESULT:BBRS:UPPER?**

Queries the upper limit check of the bit error ratio before Reed Solomon decoder.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBRS:A|B|C?**

This command returns the result of the upper limit check for the bit error ratio before Reed Solomon decoder of the corresponding layer. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example****CALCULATE:DTV:LIMIT:RESULT:BBRS:B?**

Queries the upper limit check of the bit error ratio before Reed Solomon decoder of layer B.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BARs:A|B|C?**

This command returns the result of the upper limit check for the bit error ratio after Reed Solomon decoder of the corresponding layer. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BARs:B?

Queries the upper limit check of the bit error ratio after Reed Solomon decoder of layer B.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: ISDB-T
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:PERatio[:UPPer]?**

This command returns the result of the upper limit check for the Packet Error Ratio. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:PERATIO:UPPER?

Queries the upper limit check of the packet error ratio.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:PERRors[:UPPer]?**

This command returns the result of the upper limit check for the Packet Errors. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:PERRORS:UPPER?

Queries the upper limit check of the packet errors.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T/H
- Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:PERRors:A|B|C?**

This command returns the result of the upper limit check for the Packet Errors of the corresponding layer. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:PERRORS:A?

Queries the upper limit check of the packet errors of layer A.

**Characteristics**

- \* RST value: -

SCPI: device-specific

TV standard: ISDB-T

Compatibility to R&S ETL and R&S ETH: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBCH[:UPPer]?**

This command returns the result of the upper limit check for bit error ratio before BCH. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BBCH:UPPER?

Queries the upper limit check of the bit error ratio before BCH.

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BERLdpc[:UPPer]?**

This command returns the result of the upper limit check for bit error ratio before LDPC. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BERLDPC:UPPER?  
 Queries the upper limit check of the bit error ratio before LDPC.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: yes

**Mode**

-

**CALCulate:DTV:LIMit:RESult:EPPLp:UPPer?**


---

This command returns the result of the upper limit check for the peak value of error vector magnitude EVM(PLP,peak). This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:EPPLP:UPPER?  
 Queries the upper limit check of the peak value of error vector magnitude EVM(PLP,peak).

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETL and R&S ETH: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:ERPLp:UPPer?**

This command returns the result of the upper limit check for the root mean square value of error vector magnitude EVM(PLP,peak). This command is a query and therefore has no \*RST value.

#### Return value

0	Passed
1	Failed

#### Example

CALCULATE:DTV:LIMIT:RESULT:ERPLP:UPPER?

Queries the upper limit check of the rms value of error vector magnitude EVM(PLP,rms).

#### Characteristics

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETL and R&S ETH: yes

#### Mode

-

#### CALCulate:DTV:LIMit:RESult:MPLO:LOWer?

This command returns the result of the lower limit of the peak value of the modulation error ratio MER(L1,peak). This command is a query and therefore has no \*RST value.

#### Return value

0	Passed
1	Failed

#### Example

CALCULATE:DTV:LIMIT:RESULT:MPLO:LOWER?

Queries the upper limit check of the peak value of the modulation error ratio MER(L1,peak)

#### Characteristics

- \* RST value: -
- SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: yes

**Mode**

-

---

**CALCulate:DTV:LIMit:RESult:MRLO:LOWer?**

This command returns the result of the lower limit of the root mean square value of the modulation error ratio MER(L1,rms). This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MRLO:LOWER?

Queries the lower limit check of the root mean square value of the modulation error ratio MER(L1,rms)

**Characteristics**

\* RST value: -

SCPI: device-specific

TV standard: DVB-T2

Compatibility to R&S ETH: new

Compatibility to R&S ETL: yes

**Mode**

-

---

**CALCulate:DTV:LIMit:RESult:MPPLp:LOWer?**

This command returns the result of the lower limit of the peak value of the modulation error ratio MER(PLP,peak). This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
---	--------

1	Failed
---	--------

**Example**

CALCULATE:DTV:LIMIT:RESULT:MPPLP:LOWER?

Queries the lower limit of the peak value of the modulation error ratio MER(L1,rms)

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:MRPLp:LOWer?**


---

This command returns the result of the lower limit of the root mean square value of the modulation error ratio MER(PLP,rms). This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:MRPLP:LOWER?

Queries the lower limit of the root mean square value of the modulation error ratio MER(PLP,rms).

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:ITLDpc[:UPPer]?**

This command returns the result of the upper limit check for the LDPC iteration number. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:ITLDPC:UPPER?

Queries the upper limit check for the LDPC iteration number.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- TV standard: DVB-T2
- Compatibility to R&S ETH: new
- Compatibility to R&S ETL: new

**Mode**

-

**CALCulate:DTV:LIMit:RESult:BBFRame[:UPPer]?**

This command returns the result of the upper limit check for the Baseband frame error ratio. This command is a query and therefore has no \*RST value.

**Return value**

0	Passed
1	Failed

**Example**

CALCULATE:DTV:LIMIT:RESULT:BBFRAME:UPPER?

Queries the upper limit check for the Baseband frame error ratio.

**Characteristics**

- \* RST value: -
  - SCPI: device-specific
  - TV standard: DVB-T2
  - Compatibility to R&S ETH: new
  - Compatibility to R&S ETL: new
- Mode**
- 

## 12.3 Remote Commands in Spectrum Mode

This section provides a detailed description of all remote control commands required to configure and perform measurements in Spectrum Analyzer mode.

- [Setting the Frequency and the Span](#)
- [Setting Amplitude Parameters](#)
- [Setting the Bandwidths](#)
- [Setting and Triggering the Sweep](#)
- [Working with Traces](#)
- [Using Markers](#)
- [Using Display Lines and Limit Lines](#)
- [Configuring and Using Measurement Functions](#)

### 12.3.1 Setting the Frequency and the Span

The following commands configure the frequency axis (x-axis) of the active display.




---

Commands independent of the operating mode

Note that most of the commands for setting the frequency and span are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

---

#### List of Commands

- [\[SENSe:\]FREQuency:CENTer](#)
- [\[SENSe:\]FREQuency:CENTer:STEP](#)
- [\[SENSe:\]FREQuency:CENTer:STEP:LINK](#)
- [\[SENSe:\]FREQuency:MODE](#)
- [\[SENSe:\]FREQuency:OFFSet](#)
- [\[SENSe:\]FREQuency:SPAN](#)
- [\[SENSe:\]FREQuency:SPAN:AUTO](#)

- [SENSe:]FREQuency:SPAN:FULL
- [SENSe:]FREQuency:START
- [SENSe:]FREQuency:STOP
- [SENSe:]CHANnel:TABLE:SElect
- [SENSe:]CHANnel:TABLE:SElect?
- [SENSe:]CHANnel

### [SENSe:]FREQuency:CENTer

---

This command defines the center frequency or the measuring frequency for span = 0.

#### Parameter

0 to fmax

fmax is specified in the data sheet.

#### Example

FREQ:CENT 100MHz

Sets the center frequency to 100 MHz

#### Characteristics

- \* RST value:  $f_{max} / 2$  with  $f_{max}$  = maximum frequency

SCPI: conform

#### Mode

-

### [SENSe:]FREQuency:CENTer:STEP

---

This command defines the step size of the center frequency.

#### Parameter

0 to fmax

#### Example

FREQ:CENT:STEP 120MHz

Sets the step size to 120 MHz

#### Characteristics

- \* RST value: – (AUTO 0.1\*SPAN is switched on)

SCPI: conform

#### Mode

-

**[SENSe:]FREQuency:CENTer:STEP:LINK**

This command couples the step size of the center frequency to span (span >0) or to the resolution bandwidth (span = 0) or cancels the couplings.

**Parameter**

DIVTen	Coupling of the step size to 10% of the span
OFF	Manual input, no coupling

**Example**

FREQ:CENT:STEP:LINK DIVT  
 Couples the step size to 10% of the span.

**Characteristics**

- \* RST value: DIVTen
- SCPI: device-specific

**Mode**

-

**[SENSe:]FREQuency:MODE**

This command switches between span > 0 (SWEep) and zero span (CW | FIXed). For CW and FIXed, the frequency is set via the [\[SENSe:\]FREQuency:CENTer](#) command. In sweep mode, it is via the [\[SENSe:\]FREQuency:START](#), [\[SENSe:\]FREQuency:STOP](#), [\[SENSe:\]FREQuency:CENTer](#), and [\[SENSe:\]FREQuency:SPAN](#) commands.

**Parameter**

CW | FIXed | SWEep

**Example**

FREQ:MODE SWE  
 Activates sweep mode.

**Characteristics**

- \* RST value: SWEep
- SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:OFFSet**

---

This command defines the frequency offset.

**Parameter**

–100 GHz to 100 GHz

**Example**

FREQ:OFFS 1GHZ

**Characteristics**

- \* RST value: 0 Hz
- SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:SPAN**

---

This command defines the frequency span.

**Parameter**

0 to fmax  
fmax is specified in the data sheet.

**Example**

FREQ:SPAN 10MHz

**Characteristics**

- \* RST value: fmax with fmax = maximum frequency
- SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:SPAN:AUTO**

---

This command activates and deactivates automatic setting of the span. If the Auto Span is active, the R&S ETC automatically sets the span to best fit the measured channel.

**Parameter**

ON | OFF

**Example**

FREQ:SPAN:AUTO ON  
Activates the Auto Span function

**Characteristics**

- \* RST value: OFF  
SCPI: device-specific

**Mode**

-

**[SENSe:]FREQuency:SPAN:FULL**

---

This command sets the frequency span to its maximum.

**Parameter**

fmax, specified in the data sheet.

**Example**

FREQ:SPAN:FULL

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:STARt**

---

This command defines the start frequency of the analyzer. This command is only available with span > 0.

**Parameter**

0 to fmax  
fmax is specified in the data sheet.

**Example**

FREQ:STAR 20MHz

**Characteristics**

- \* RST value: 0  
SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:STOP**

This command defines the stop frequency of the analyzer. This command is only available with span > 0.

**Parameter**

0 to fmax  
fmax is specified in the data sheet.

**Example**

FREQ:STOP 200MHz

**Characteristics**

- \* RST value: fmax
- SCPI: conform

**Mode**

-

**[SENSe:]FREQuency:INPut:MODE**

This command selects the frequency mode. Select the Channel frequency mode only if you want to work with channel tables. In this case, the input of the center frequency is not a frequency value, but a channel number.

**Parameter**

CHANnel | FREQ

**Example**

FREQ:INP:MODE CHAN  
Sets the frequency mode to work with channel tables.

**Characteristics**

- \* RST value: FREQ
- SCPI: device-specific

**Mode**

-

**[SENSe:]CHANnel:TABLE:SElect**

This command loads the specified channel table for upcoming measurements. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMemory:CDIRectory](#) command.

---

This command is an event and therefore has no query and no \*RST value

**Parameter**

<string> = <file name>

**Example**

CHAN:TABL:SEL 'CATV.CHNTAB'

Loads the channel table with the name CATV from the current default directory.

CHAN:TABL:SEL '\\Storage Card\\Public\\CHANNEL TABLES\\CATV.CHNTAB'

Loads the channel table with the name 'CATV' from the directory \\SD card\\public\\channel tables\\.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**[SENSe:]CHANnel:TABLE:SElect?**

---

This command returns the file name including file extension of the loaded channel table.

This command is an event and therefore has no query and no \*RST value

**Parameter**

<string.chntab>

string: channel table file name

**Example**

CHAN:TABL:SEL?

Reads the channel table file name.

**Characteristics**

- \* RST value: -
- SCPI: device-specific
- Compatibility to R&S ETL: -

**Mode**

-

**[SENSe:]CHANnel**

---

This command defines the receive channel for the channel input mode. A channel table must be loaded prior with the [\[SENSe:\]CHANnel:TABLE:SElect](#) command. The frequency input mode must be set to 'CHANNEL', see [\[SENSe:\]FREQUency:INPut:MODE](#) command.

#### Parameter

<numeric value> = Minimum channel number to maximum channel number w. r. t. the selected channel table.

#### Example

CHANNEL 10  
Sets channel number 10.

#### Characteristics

- \* RST value: 1
- SCPI: conform

#### Mode

-

## 12.3.2 Setting Amplitude Parameters

The following commands configure the level axis (y-axis) and level parameters of the active display.



Commands independent of the operating mode

Note that some of the commands for setting the level parameters are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

#### List of Commands

- [DISPlay\[:WINDow\]:TRACe<1|2>:Y:SPACing](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]:ADJust](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]:RLEVel](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]:RLEVel:OFFSet](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]:RPOStion](#)
- [INPut:ATTenuation](#)
- [INPut:ATTenuation:MODE](#)
- [INPut:ATTenuation:AUTOINPut:ATTenuation:AUTO](#)
- [INPut:PRESelection:STATe](#)
- [INPut:IMPedance](#)

- INPut:IMPedance:PAD
- INPut:IMPedance:TRANSformer:LOSS
- [SENSe:]CORRection:TRANsducer<1...2>[:STATe]
- [SENSe:]CORRection:TRANsducer<1...2>:SElect
- [SENSe:]CORRection:TRANsducer<1...2>:UNIT?
- [SENSe:]CORRection:TRANsducer<1...2>:ISOTropic[:STATe]?
- UNIT:POWer

### DISPlay[:WINDow]:TRACe<1|2>:Y:SPACing

This command selects the scaling for the level display range.

#### Parameter

LOGarithmic	Selects logarithmic scaling.
LINear	Selects linear scaling in %.

#### Example

DISP:TRAC:Y:SPAC LIN  
Selects linear scaling of the level axis.

#### Characteristics

- \* RST value: LOGarithmic
- SCPI: conform

#### Mode

-

### DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALE]

This command defines the display range of a level axis with logarithmic scaling ([DISPlay\[:WINDow\]:TRACe<1|2>:Y:SPACing](#)).

For linear scaling, the display range is fixed and cannot be modified.  
The numeric suffix <1|2> is irrelevant.

#### Parameter

10 dB to 150 dB

#### Example

DISP:TRAC:Y 120dB  
Sets the display range to 120 dB.

#### Characteristics

- \* RST value: 100dB

SCPI: device-specific

**Mode**

-

**DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALe]:ADJust**

---

This command automatically sets the scaling of the level axis to best fit the measurement results of the indicated trace.

This command is an event and therefore has no query and no \*RST value.

**Parameter**

<numeric\_value> in dBm, range specified in data sheet

**Example**

DISP:TRAC:Y:ADJ

Adjusts the y-axis

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

**DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALe]:RLEVel**

---

This command defines the reference level.

With the reference level offset <> 0, the indicated value range of the reference level is modified by the offset.

The unit depends on the setting defined with [UNIT:POWer](#).

The numeric suffix <1|2> is irrelevant.

**Parameter**

<numeric\_value> in dBm, range specified in data sheet

**Example**

DISP:TRAC:Y:RLEV -60dBm

Sets the reference level to -60 dBm

**Characteristics**

\* RST value: -20dBm

SCPI: conform

**Mode**

-

### **DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALe]:RLEVel:OFFSet**

---

This command defines the offset of the reference level.  
The numeric suffix <1|2> is irrelevant.

#### **Parameter**

–200dB to 200dB

#### **Example**

DISP:TRAC:Y:RLEV:OFFS –10dB

#### **Characteristics**

- \* RST value: 0dB
- SCPI: conform

#### **Mode**

-

### **DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALe]:RPOSition**

---

This command defines the position of the reference value. It requires a tracking generator and active normalization in the Tracking Generator mode.  
The numeric suffixes <1|2> is irrelevant.

#### **Parameter**

0 to 100PCT

#### **Example**

DISP:TRAC:Y:RPOS 50PCT  
Sets the position of the reference value to 50%

#### **Characteristics**

- \* RST value: 100 PCT (Spectrum Analyzer mode), 50 PCT (Network Analyzer mode)
- SCPI: conform

#### **Mode**

-

### **INPut:ATTenuation**

---

This command programs the input attenuator.  
The attenuation can be set in 5 dB steps. If the defined reference level cannot be

---

set for the set RF attenuation, the reference level will be adjusted accordingly. In the default state with Spectrum Analyzer mode, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

**Parameter**

<numeric\_value> in dB; range specified in data sheet

**Example**

INP:ATT 30dB

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

**Characteristics**

- \* RST value: 0 dB (AUTO is set to ON)
- SCPI: conform

**Mode**

-

**INPut:ATTenuation:MODE**

---

This command defines the controlling of the RF input attenuator for automatically controlled input attenuation. For further information on controlling the RF attenuator refer to the user manual.

**Parameter**

LDISortion | LNOise

**Example**

INP:ATT:MODE LNO

Sets the attenuation mode to Auto Low Noise.

**Characteristics**

- \* RST value: LDIS
- SCPI: device-specific

**Mode**

-

**INPut:ATTenuation:AUTO**

---

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

**Parameter**

ON | OFF

**Example**

INP:ATT:AUTO ON

Couples the attenuation set on the attenuator to the reference level.

**Characteristics**

\* RST value: ON

SCPI: conform

**Mode**

-

**INPut:PRESelection:STATe**


---

This command activates or deactivates the RF preselection path of the instrument (only available with installed option R&S ETC-K1).

**Parameter**

ON | OFF

**Example**

INP:PRESELECTION:STAT ON

Activates the RF preselection path.

**Characteristics**

\* RST value: OFF

SCPI: device-specific

**Mode**

-

**INPut:IMPedance**


---

The setting 75  $\Omega$  should be selected, if the 50  $\Omega$  input impedance is transformed to a higher impedance using a 75  $\Omega$  adapter of the RAZ type (= 25  $\Omega$  in series to the input impedance of the instrument). The correction value in this case is 1.76 dB =  $10 \log(75\Omega / 50\Omega)$ . As an alternative the resistive matching pads R&S RAM or R&S FSH-Z38 can be used. In that cases the correction value is 5.72 dB. For matching pad selection see [INPut:IMPedance:PAD](#) command

**Parameter**

50 | 75

**Example**

INP:IMP 75

Sets the input impedance to 75 Ohm.

**Characteristics**

- \* RST value: 50  $\Omega$

SCPI: conform

**Mode**

-

**INPut:IMPedance:PAD**

This command defines RF matching pad if the RF impedance is set to 75  $\Omega$ . For RF impedance selection see [INPut:IMPedance](#) command.

R&S RAZ (= 25  $\Omega$  in series to the input impedance of the instrument). The correction value in this case is 1.76 dB =  $10 \log (75\Omega \square / 50\Omega)$ .

R&S RAM and R&S FSH-Z38 are resistive 50/75  $\Omega$  matching pads. In that cases the correction value is 5.72 dB.

The 75  $\Omega$  transformer is user specific transforming pad. The loss of transformer is user-defined and can be set via the [INPut:IMPedance:TRANSformer:LOSS](#) command.

**Parameter**

RAM | RAZ | HZTE | TRANSformer

RAM	Resistive 75/50 $\Omega$ matching pad R&S RAM, attenuation 5.72 dB
RAZ	Resistive 75/50 $\Omega$ matching pad R&S RAZ, attenuation 1.76 dB
HZTE	Resistive 75/50 $\Omega$ matching pad R&S FSH-Z38, attenuation 5.72 dB
TRANSformer	75 $\Omega$ transformer with user-defined transformer loss

**Example**

INP:IMP:PAD RAM

Sets the matching pad R&S RAM.

**Characteristics**

- \* RST value: -

SCPI: conform

**Mode**

-

**INPut:IMPedance:TRANSformer:LOSS**

This command set the RF transformer loss value that is used by the selection of [INPut:IMPedance:PAD](#) command.

**Parameter**

-30 to 30 dB

**Example**

INP:IMP:TRAN:LOSS 5.72

Sets the transformer loss of 5.72dB. Note : -ve means a gain of the transformer loss value

**Characteristics**

- \* RST value: -
- SCPI: conform
- TV standard: all
- Compatibility to R&S ETH: yes
- Compatibility to R&S ETL: new

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>[:STATe]**

This command activates or deactivates the selected transducer factor. A transducer file must be loaded prior with the [\[SENSe:\]CORRection:TRANsducer<1...2>:SELeCt](#) command. The suffix<1...2> specifies the primary or secondary transducer.

**Parameter**

ON | OFFFor 1 | 0

**Example**

CORR:TRAN1 ON

Activates the primary transducer

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>:SElect**

This command loads the transducer factor designated by <name>. The file is loaded from the current default directory if no path is set. The default directory can be set with the [MMEMory:CDIRectory](#) command. The selected transducer can be switched on or off with the [INPut:IMPedance:TRANsformer:LOSS](#).

**Parameter**

<string>= <name of the transducer file including extension> in string data form with a maximum of 8 characters

**Example**

```
CORR:TRAN1:SEL 'FACTOR1.PRITRD'
```

Loads the primary transducer 'FACTOR1' from the default directory.

```
CORR:TRAN2:SEL '\Storage Card\Public\TRANSDUCERS\FACTOR1'
```

Loads the secondary transducer 'FACTOR1' from the directory \SD card\public\transducers\

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>:UNIT?**

This command queries the unit of the transducer factor in use. The suffix <1...2> specified the primary or secondary transducer.

**Parameter**

-

**Example**

```
CORR:TRAN1:UNIT?
```

Queries the unit of the primary transducer

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**[SENSe:]CORRection:TRANsducer<1...2>:ISOTropic[:STATe]?**

This command queries if the currently selected transducer is an isotropic antenna.

**Return value**

DBM | DBUV | DBMV | V | W | DUVM | DUAM | V\_M | W\_M2

0	Transducer is not an isotropic antenna
1	Transducer is an isotropic antenna

**Example**

CORR:TRAN:ISOT?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**UNIT:POWer**

This command configures the unit for the channel power. The units dB $\mu$ V/m, dB $\mu$ A/m V/m and W/m<sup>2</sup> are only available in combination with an according primary transducer.

**Parameter**

DBM | DBUV | DBMV | V | W | DUVM | DUAM | V\_M | W\_M2

**Example**

UNIT:POW DBUV  
Sets the power unit to dB $\mu$ V

**Characteristics**

- \* RST value: DBM
- SCPI: conform
- TV standard: all

**Mode**

-

### 12.3.3 Setting the Bandwidths

The following commands configure the filter bandwidths of the R&S ETC. Note that both groups of commands (BANDwidth and BWIDth) are the same.



#### Commands independent of the operating mode

Note that most of the commands for setting the bandwidth are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section

#### List of Commands

- [SENSe:]BANDwidth|BWIDth[:RESolution]
- [SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO
- [SENSe:]BANDwidth|BWIDth:VIDeo
- [SENSe:]BANDwidth|BWIDth:VIDeo:AUTO

#### [SENSe:]BANDwidth|BWIDth[:RESolution]

This command defines the resolution bandwidth.  
Analog resolution filters of 100 Hz to 3 MHz in 1 - 3 - 10 steps are available

##### Parameter

100 Hz to 3 MHz

##### Example

BAND 100 kHz  
Sets the IF bandwidth to 100 kHz

##### Characteristics

- \* RST value: – (AUTO is set to ON)
- SCPI: conform

##### Mode

-

#### [SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO

This command couples the resolution bandwidth to the span or cancels the coupling.

##### Parameter

ON | OFF

**Example**

BAND:AUTO OFF

Deactivates the coupling of the resolution bandwidth to the span

**Characteristics**

\* RST value: ON

SCPI: conform

**Mode**

-

**[SENSe:]BANDwidth|BWIDth:VIDeo**

---

This command defines the instruments video bandwidth.

**Parameter**

10 Hz to 3 MHz

**Example**

BAND:VID 10kHz

**Characteristics**

\* RST value: – (AUTO is set to ON)

SCPI: conform

**Mode**

-

**[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO**

---

This command either automatically couples the instruments video bandwidth to the resolution bandwidth or cancels the coupling.

**Parameter**

ON | OFF

**Example**

BAND:VID:AUTO OFF

**Characteristics**

\* RST value: ON

SCPI: conform

**Mode**

-

### 12.3.4 Setting and Triggering the Sweep

The following commands configure the sweep.

**Commands independent of the operating mode**

Note that most of the commands for setting and triggering are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

**List of Commands**

- \*WAI
- ABORt
- INITiate[:IMMediate]
- INITiate:CONTInuous
- [SENSe:]SWEep:TIME
- [SENSe:]SWEep:TIME:AUTO
- TRIGger[:SEQuence]:HOLDoff[:TIME]
- TRIGger[:SEQuence]:LEVel:VIDeo
- TRIGger[:SEQuence]:SLOPe
- TRIGger[:SEQuence]:SOURce

**ABORt**

This command aborts a current measurement and resets the trigger system.

**Parameter**

-

**Example**

ABOR;:INIT:IMM

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**INITiate[:IMMEDIATE]**


---

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command \*OPC, \*OPT? or \*WAI. In continuous-sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

This command is an event and therefore has no \*RST value and no query

**Parameter**

ON | OFF

**Example**

INIT:CONT OFF

Switches to single sweep mode.

DISP:WIND:TRAC:MODE AVER

Activates trace averaging.

INIT;\*WAI

Starts the measurement and waits for the end of the sweep

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**INITiate:CONTinuous**


---

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

This setting refers to the sweep sequence (switching between continuous/single sweep)

**Parameter**

ON | OFF

**Example**

INIT:CONT OFF

Switches the sequence single sweep.

INIT:CONT ON

Switches the sequence to continuous sweep.

**Characteristics**

- \* RST value: ON
- SCPI: conform

**Mode**

-

**[SENSe:]SWEep:COUNT**


---

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

**Parameter**

0 to 999

**Example**

```
SWE:COUN 64
Sets the number of sweeps to 64..

INIT:CONT OFF
Switches to single sweep mode.

INIT;*WAI
Starts a sweep and waits for its end
```

**Characteristics**

- \* RST value: 1
- SCPI: conform

**Mode**

-

**[SENSe:]SWEep:TIME**


---

In analyzer mode, this command defines the sweep time. The available time values vary depending on the span setting.

If [\[SENSe:\]SWEep:TIME](#) is directly programmed, automatic coupling to resolution bandwidth and video bandwidth is switched off.

**Parameter**

Refer to data sheet

**Example**

```
SWE:TIME 10s
Sets the measurement time to 10 s
```

**Characteristics**

- \* RST value: – (AUTO is set to ON)

SCPI: conform

**Mode**

-

**[SENSE:]SWEep:TIME:AUTO**

---

This command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings.

If [SENSE:]SWEep:TIME is directly programmed, automatic coupling is switched off.

**Parameter**

ON | OFF

**Example**

SWE:TIME:AUTO ON

Activates the coupling to frequency span and bandwidths

**Characteristics**

- \* RST value: ON

SCPI: conform

**Mode**

-

**TRIGger[:SEQuence]:HOLDoff[:TIME]**

---

This command defines the length of the trigger delay.

**Parameter**

0 s to +100 s

**Example**

TRIG:HOLD 500us

Sets the trigger delay to 500 µs

**Characteristics**

- \* RST value: 0 s

SCPI: conform

**Mode**

-

### TRIGger[:SEQuence]:LEVel:VIDeo

---

This command sets the level of the video trigger source. Video triggering is active in Zero Span only.

#### Parameter

0 to 100 PCT

#### Example

TRIG:LEV:VID 50PCT

#### Characteristics

- \* RST value: 50 PCT  
SCPI: device-specific

#### Mode

-

### TRIGger[:SEQuence]:SLOPe

---

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

#### Parameter

POSitive | NEGative

#### Example

TRIG:SLOP NEG

#### Characteristics

- \* RST value: POSitive  
SCPI: conform

#### Mode

-

### TRIGger[:SEQuence]:SOURce

---

This command selects the trigger source for the start of a sweep.

#### Parameter

IMMEDIATE (Free Run) | EXTern | VIDEo

Refer details on trigger modes refer to the user manual.

#### Example

TRIG:SOUR EXT

Selects the external trigger input as source of the trigger signal.

#### Characteristics

\* RST value: IMMEDIATE

SCPI: conform

#### Mode

-

## 12.3.5 Working with Traces

The following commands set up the trace and the various functions associated with it, e.g. trace mathematics or the selection of the detector.



### Commands independent of the operating mode

Note that most of the commands concerning trace settings are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

#### List of Commands

- CALCulate:MATH<1...2>[:EXPRession][:DEFine]
- CALCulate:MATH<1...2>:COPY:MEMory
- CALCulate:MATH<1...2>:STATe
- DISPLAY[:WINDow]:TRACe<1|2>[:STATe]
- DISPLAY[:WINDow]:TRACe<1|2>:MODE
- DISPLAY[:WINDow]:TRACe<1|2>:MEMory[:STATe]
- FORMat:BORDER
- [SENSe:]DETEctor[:FUNCTion]
- [SENSe:]DETEctor<1...6>[:FUNCTion]:AUTO
- TRACe<1|2>[:DATA]?

#### CALCulate:MATH<1...2>[:EXPRession][:DEFine]

This command defines the mathematical expression for relating traces to trace1. The trace mathematics are activated with [CALCulate:MATH<1...2>:STATe](#).

**Parameter**

(TRACE–MTRACE) Subtracts the trace in memory from the current trace.

(MTRACE–TRACE) Subtracts the current trace from the trace in memory.

**Example**

CALC:MATH (MTRACE–TRACE)

Selects the subtraction of the current trace from trace in the memory.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**CALCulate:MATH<1...2>:COPY:MEMory**


---

This command stores the current trace into the memory trace of the R&S ETC.  
This command is an event and therefore has no query and no \*RST value.

**Parameter**

-

**Example**

CALC:MATH:COPY:MEM

Copies the trace into the memory.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**CALCulate:MATH<1...2>:STATe**


---

This command activates or deactivates the mathematical relation of traces.

**Parameter**

ON | OFF

**Example**

CALC:MATH:STAT ON

Activates the trace mathematics.

**Characteristics**

- \* RST value: OFF  
SCPI: conform

**Mode**

-

**DISPlay[:WINDow]:TRACe<1|2>[:STATe]**

---

This command activates or deactivates the display of the corresponding trace.

**Parameter**

ON | OFF

**Example**

DISP:TRAC2 ON

**Characteristics**

- \* RST value: ON for TRACe1, OFF for TRACe2  
SCPI: conform

**Mode**

-

**DISPlay[:WINDow]:TRACe<1|2>:MEMory[:STATe]**

---

This command activates and deactivates the trace stored in the memory of the R&S ETC. The suffix at TRACe selects the memory slot the trace is stored in.

**Parameter**

ON | OFF

**Example**

DISP:TRAC:MEM ON  
Activates memory trace 1.

**Characteristics**

- \* RST value: OFF  
SCPI: device-specific

**Mode**

-

**DISPlay[:WINDow]:TRACe<1|2>:MODE**

This command defines the type of display and the evaluation of the traces. WRITE corresponds to the Clr/Write mode of manual operation. The trace is switched off (= BLANK in manual operation) with [DISPlay\[:WINDow\]:TRACe<1|2>\[:STATe\]](#). The number of measurements for AVERage, MAXHold and MINHold is defined with the [\[SENSe:\]SWEep:COUNt](#) command. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

**Parameter**

WRITE | AVERage | MAXHold | MINHold | VIEW  
For details on trace modes refer to the user manual

**Example**

SWE:CONT OFF

Switching to single sweep mode.

SWE:COUN 16

Sets the number of measurements to 16.

DISP:TRAC:MODE MAXH

Activates MAXHold mode for the trace.

INIT;\*WAI

Starts the measurement and waits for the end of the 16 sweeps.

**Characteristics**

- \* RST value: WRITE
- SCPI: device-specific

**Mode**

-

**FORMat:BORDER**

This command controls whether binary data is transferred in normal or swapped byte order.

**Parameter**

SWAPped	The least significant byte is transferred first (little endian)
NORMal	The most significant byte is transferred first (big endian)

**Example**

FORM:BORD NORM

Changes the byte order to normal mode.

**Characteristics**

- \* RST value: SWAPped

SCPI: conform

**Mode**

-

**[SENSe:]DETEctor[:FUNCTion]**


---

This command selects the detector for recording measured values of the selected trace.

**Parameter**

APEak | NEGative | POSitive | SAMPlE | RMS

For details on detectors refer to the user manual

**Example**

DET POS

Sets the prescan detector to "positive peak".

**Characteristics**

- \* RST value: POS

SCPI: conform

**Mode**

-

**[SENSe:]DETEctor<1...6>[:FUNCTion]:AUTO**


---

This command either couples the detector to the current trace setting or deactivates the coupling. The trace is selected by the numeric suffix at DETector.

**Parameter**

ON | OFF

**Example**

DET:AUTO OFF.

**Characteristics**

- \* RST value: ON

SCPI: conform

**Mode**

-

**TRACe<1|2>[:DATA]?**

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred.

**Parameter**

TRACE1 | TRACE2

Return value for trace data in Spectrum Analyzer mode  
631 results are returned, one result for each point of the trace. The returned values are scaled in the currently selected unit

**Example**

TRAC:DATA? TRACE1

Reads out the data for trace 1.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**12.3.6 Using Markers**

- [Markers and Deltamarkers](#)
- [Marker Functions](#)

**12.3.6.1 Markers and Deltamarkers**

The following commands are for setting and controlling markers and delta markers. If not otherwise noted, the numeric suffix <1...6> at MARKer or DELTAmarker select the marker to be controlled.

In Spectrum Analyzer mode, the numeric suffix <1|2> at CALCulate is irrelevant.

**Commands independent of the operating mode**

Note that most of the commands for using markers are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

### List of Commands

- CALCulate<1|2>:DELTamarker<1...6>[:STATe]
- CALCulate<1|2>:DELTamarker<1...6>:AOFF
- CALCulate<1|2>:DELTamarker<1...6>:MAXimum[:PEAK]
- CALCulate<1|2>:DELTamarker<1...6>:MAXimum:NEXT
- CALCulate<1|2>:DELTamarker<1...6>:MINimum[:PEAK]
- CALCulate<1|2>:DELTamarker<1...6>:X
- CALCulate<1|2>:DELTamarker<1...6>:X:RELative?
- CALCulate<1|2>:DELTamarker<1...6>:Y?
- CALCulate<1|2>:MARKer<1...6>[:STATe]
- CALCulate<1|2>:MARKer<1...6>:AOFF
- CALCulate<1|2>:MARKer<1...6>:MAXimum[:PEAK]
- CALCulate<1|2>:MARKer<1...6>:MAXimum:NEXT
- CALCulate<1|2>:MARKer<1...6>:MINimum[:PEAK]
- CALCulate<1|2>:MARKer<1...6>:MINimum:NEXT
- CALCulate<1|2>:MARKer<1...6>:X
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits[:STATe]
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits:LEFT
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits:RIGHT
- CALCulate<1|2>:MARKer<1...6>:Y?

### CALCulate<1|2>:DELTamarker<1...6>[:STATe]

This command switches the delta marker indicated by the suffix on or off. The suffix 1 is interpreted as delta marker 2 because the first marker has to be a normal marker. Therefore, using no suffix indicates delta marker 2. If more than one marker (2 to 6) is already active, the command turns these marker into delta markers. If no delta marker is active yet, the command activates the delta marker and positions it on the trace maximum

#### Parameter

ON | OFF

#### Example

CALC:DELT3 ON  
Switches marker 3 to delta marker mode.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### CALCulate<1|2>:DELTamarker<1...6>:AOFF

---

This command switches off all active delta markers.

**Parameter**

-

**Example**

CALC:DELT:AOFF  
Switches off all delta markers.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:DELTamarker<1...6>:MAXimum[:PEAK]**

---

This command positions the delta marker indicated by the suffix to the current trace maximum. If necessary, the corresponding delta marker is activated first. This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:DELT3:MAX  
Sets delta marker 3 to the maximum value of the associated trace.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:DELTamarker<1...6>:MAXimum:NEXT**

---

This command positions the delta marker indicated by the suffix to the next smaller maximum value of the trace. The corresponding delta marker is activated first, if necessary. This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:DELT2:MAX:NEXT

Sets delta marker 2 to the next smaller maximum value.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:DELTamarker<1...6>:MINimum[:PEAK]**

This command positions the delta marker indicated by the suffix to the current trace minimum. The corresponding delta marker is activated first, if necessary. This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:DELT3:MIN

Sets delta marker 3 to the minimum value of the associated trace.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:DELTamarker<1...6>:X**

This command positions the delta marker indicated by the suffix to the specified frequency (span > 0) or time (span = 0). The corresponding delta marker is activated first, if necessary.

Note: It is possible to place the marker outside the visible trace. In that case, this value is invalid.

**Parameter**

0 to MAX (frequency | sweep time)

**Example**

CALC:DELT:MOD REL

Switches the input for all delta markers to relative to marker 1.

CALC:DELT2:X 10.7MHz

Positions delta marker 2 10.7 MHz to the right of marker 1.

CALC:DELT:X?

Outputs the absolute frequency/time of delta marker 1.

CALC:DELT:X:REL?

Outputs the relative frequency/time of delta marker 1.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

#### CALCulate<1|2>:DELTamarker<1...6>:X:RELative?

This command queries the frequency (span > 0) or time (span = 0) of the delta marker indicated by the suffix relative to marker 1 or to the reference position. The command activates the corresponding delta marker, if necessary.

#### Return Value

Frequency in Hz (span > 0) or time in seconds (span = 0)

#### Example

CALC:DELT3:X:REL?

Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

#### CALCulate<1|2>:DELTamarker<1...6>:Y?

This command queries the measured value of the delta marker indicated by the suffix. The output is always a relative value referred to marker 1. The corresponding delta marker will be activated, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must have been performed between the activation of the delta marker

and the query of the y value. This is only possible in single sweep mode.

### Return Value

Depending on the unit defined or on the activated measuring functions, the query result is output in the units below:

Parameter or measuring functions	Output unit
DBM   DBPW   DBUV   DBMV   DBUA	dB (lin/log)
WATT   VOLT   AMPere	dB (lin), % (log)

### Example

INIT:CONT OFF

Switches to single sweep mode.

CALC:DELT2 ON

Switches on delta marker 2.

INIT;\*WAI

Starts a sweep and waits for its end.

CALC:DELT2:Y?

Outputs measurement value of delta marker 2.

### Characteristics

- \* RST value: -
- SCPI: device-specific

### Mode

-

### CALCulate<1|2>:MARKer<1...6>[:STATe]

This command switches on or off the currently selected marker. If no indication is made, marker 1 is selected automatically. If marker 2 to 6 is selected and used as a delta marker, it is switched to marker mode.

### Parameter

ON | OFF

### Example

CALC:MARK3 ON

Switches on marker 3 or switches to marker mode.

### Characteristics

- \* RST value: OFF

SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:AOFF**

This command switches off all active markers and all delta markers and active marker/delta marker measurement functions.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:MARK:AOFF  
Switches off all markers.

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:MAXimum[:PEAK]**

This command positions the marker to the current maximum value of the corresponding trace. The corresponding marker is activated first or switched to the marker mode.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:MARK2:MAX  
Positions marker 2 to the maximum value of the trace.

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:MAXimum:NEXT**

This command positions the marker to the next smaller maximum value of the corresponding trace.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:MARK2:MAX:NEXT

Positions marker 2 to the next lower maximum value.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:MINimum[:PEAK]**

This command positions the marker to the current minimum value of the corresponding trace. The corresponding marker is activated first or switched to marker mode, if necessary.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

0 to MAX (frequency | sweep time)

**Example**

CALC:MARK2:MIN

Positions marker 2 to the minimum value of the trace.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:MINimum:NEXT**

---

This command positions the marker to the next higher minimum value of the corresponding trace.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

0 to MAX (frequency | sweep time)

**Example**

CALC:MARK2:MIN

Positions marker 2 to the minimum value of the trace.

CALC:MARK2:MIN:NEXT

Positions marker 2 to the next higher minimum value.

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

---

**CALCulate<1|2>:MARKer<1...6>:X**

This command positions the selected marker to the indicated frequency (span > 0) or time (span = 0). If marker 2 to 6 are selected and used as delta marker, it is switched to marker mode.

**Parameter**

0 to MAX (frequency | sweep time)

**Example**

CALC:MARK2:X 10.7MHz

Positions marker 2 to frequency 10.7 MHz.

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

---

**CALCulate<1|2>:MARKer<1...6>:X:SLIMits[:STATe]**

This command activates and deactivates marker search limits.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

---

The numeric suffix <1...6> is irrelevant for this command.

**Parameter**

ON | OFF

**Example**

CALC:MARK:X:SLIM ON  
Activates search limitation.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

---

**CALCulate<1|2>:MARKer<1...6>:X:SLIMits:LEFT**

This command sets the left limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffix <1...6> is irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

**Parameter**

0 to MAX (frequency | sweep time)

**Example**

CALC:MARK:X:SLIM ON  
Switches the search limit function on.

CALC:MARK:X:SLIM:LEFT 10MHz  
Sets the left limit of the search range to 10 MHz.

**Characteristics**

- \* RST value: – (is set to the left diagram border when switching on search limits)
- SCPI: device-specific

**Mode**

-

---

**CALCulate<1|2>:MARKer<1...6>:X:SLIMits:RIGHT**

This command sets the right limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines

a frequency (span > 0) or time (span = 0).  
 The numeric suffix <1...6> is irrelevant for this command.  
 If the power measurement in zero span is active, this command limits the evaluation range to the trace.

#### Parameter

0 to MAX (frequency | sweep time)

#### Example

CALC:MARK:X:SLIM ON

Switches the search limit function on.

CALC:MARK:X:SLIM:RIGH 20MHz

Sets the right limit of the search range to 20 MHz.

#### Characteristics

- \* RST value: – (is set to the right diagram border when switching on search limits)

SCPI: device-specific

#### Mode

-

### CALCulate<1|2>:MARKer<1...6>:Y?

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

#### Return Value

Numeric value of the marker position, the unit depends on currently set unit (see [UNIT:POWer](#))

#### Example

INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK2 ON

Switches marker 2.

INIT;\*WAI

Starts a sweep and waits for the end.

CALC:MARK2:Y?

Outputs the measured value of marker 2.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### 12.3.6.2 Marker Functions

The following commands perform various kinds of analysis at the marker position.

#### List of Commands

- [CALCulate:MARKer<1...6>:COUNT\[:STATe\]](#)
- [CALCulate:MARKer<1...6>:COUNT:FREQuency?](#)
- [CALCulate:MARKer<1...6>:FREQuency:MODE](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NDBDown:STATe](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NDBDown](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NDBDown: FREQuency?](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NDBDown:RESult?](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NOISe\[:STATe\]](#)
- [CALCulate:MARKer<1...6>:FUNCTion:NOISe:RESult?](#)

#### **CALCulate:MARKer<1...6>:COUNT[:STATe]**

This command switches on or off the frequency counter at the marker position. The count result is queried with [CALCulate:MARKer<1...6>:COUNT:FREQuency?](#) Frequency counting is possible only for one marker at a time. If it is activated for another marker, it is automatically deactivated for the previous marker. It should be noted that a complete sweep must be performed after switching on the frequency counter to ensure that the frequency to be measured is actually reached. The synchronization to the sweep end required for this is only possible in single sweep mode.

#### Parameter

ON | OFF

#### Example

INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK ON

Switches on marker 1.

CALC:MARK:COUN ON

Switches on the frequency counter for marker 1.

INIT;\*WAI

Starts a sweep and waits for the end.

CALC:MARK:COUN:FREQ?

Outputs the measured value.

#### Characteristics

- \* RST value: OFF

SCPI: device-specific

#### Mode

-

### CALCulate:MARKer<1...6>:COUNT:FREQUency?

This command performs a frequency measurement at the position of the marker indicated by the suffix at MARKer and returns the result. Before the command, the frequency counter should be switched on and a complete measurement performed to obtain a correct count result. Therefore, a single sweep with synchronization must be performed between switching on the frequency counter and querying the count result.

This command is only a query and therefore has no \*RST value

#### Parameter

-

#### Example

INIT:CONT OFF.

Switches to single sweep mode.

CALC:MARK2 ON

Switches on marker 2.

CALC:MARK2:COUN ON

Switches the frequency counter for marker 2.

INIT;\*WAI

Starts a sweep and waits for the end.

CALC:MARK2:COUN:FREQ?

Outputs the measured value of marker 2

#### Characteristics

- \* RST value: -

SCPI: device-specific

#### Mode

-

### **CALCulate:MARKer<1...6>:FREQuency:MODE**

---

This command sets the marker frequency display mode.

#### **Parameter**

FREQ | CHAN

#### **Example**

CALC:MARK:FREQ:MODE FREQ  
Selects the frequency display mode.

#### **Characteristics**

- \* RST value: FREQ
- SCPI: device-specific

#### **Mode**

-

### **CALCulate:MARKer<1...6>:FUNCTion:NDBDown:STATe**

---

This command activates and deactivates the n dB Down marker function. The n dB down function sets two temporary markers n dB below the level of the reference marker (marker 1), one on the right and the other marker to the left of the reference marker.  
The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

#### **Parameter**

ON | OFF

#### **Example**

CALC:MARK:FUNC:NDBD:STAT ON  
Activates the n dB down marker function.

#### **Characteristics**

- \* RST value: OFF
- SCPI: device-specific

#### **Mode**

-

### **CALCulate:MARKer<1...6>:FUNCTion:NDBDown**

---

This command defines the distance in dB of the two temporary n dB down markers to the reference marker.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

#### Return value

-

#### Example

CALC:MARK:FUNC:NDBDown 9

Sets the two temporary markers 9 dB below the reference marker.

#### Characteristics

- \* RST value: 3 dB
- SCPI: device-specific

#### Mode

-

### CALCulate:MARKer<1...6>:FUNCtion:NDBDown: FREQuency?

This command queries the frequencies of the two temporary n dB down markers. The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

#### Return value

<frequency1>	absolute frequency of the n dB marker to the left of the reference marker in Hz.
<frequency2>	absolute frequency of the n dB marker to the right of the reference marker in Hz.

#### Example

CALC:MARK:FUNC:NDBD:FREQ?

This command would return, for example, 100000000, 200000000, meaning that the first marker position is at 100 MHz, the second marker position is at 200 MHz

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### CALCulate:MARKer<1...6>:FUNCtion:NDBDown:RESult?

---

This command queries the frequency spacing or bandwidth of the two temporary n dB down markers.

The command is independent of the selected marker, the suffixes 1 to 6 are irrelevant.

**Return value**

Bandwidth in Hz

**Example**

CALC:MARK:FUNC:NDBD:RES?

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate:MARKer<1...6>:FUNCtion:NOISe[:STATe]**

---

This command activates or deactivates the noise measurement for all markers. The noise power density is measured at the position of the markers. The result can be queried with [CALCulate:MARKer<1...6>:FUNCtion:NOISe:RESult?](#).

**Parameter**

ON | OFF

**Example**

CALC:MARK:FUNC:NOIS ON  
Activates the noise measurement.

**Characteristics**

- \* RST value: OFF  
SCPI: device-specific

**Mode**

-

**CALCulate:MARKer<1...6>:FUNCtion:NOISe:RESult?**

---

This command queries the result of the noise measurement. A complete sweep with synchronization to the sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode.

---

This command is a query and therefore has no \*RST value.

### Return value

Noise level, the unit depends on the unit set with [UNIT:POWER](#).

### Example

INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK2 ON

Switches on marker 2.

CALC:MARK2:FUNC:NOIS ON

Switches on noise measurement for marker 2.

INIT;\*WAI

Starts a sweep and waits for the end.

CALC:MARK2:NOIS:RES?

Outputs the noise result of marker 2

### Characteristics

- \* RST value: –
- SCPI: device-specific

### Mode

-

## 12.3.7 Using Display Lines and Limit Lines

### 12.3.7.1 Display Lines

The following commands define the position of the display line.

#### List of Commands

- [CALCulate<1|2>:DLINe](#)
- [CALCulate<1|2>:DLINe:STATe](#)

#### **CALCulate<1|2>:DLINe**

---

This command defines the position of the display line indicated by the suffix. The display line can be used to mark any level in the diagram.

The command accepts a variety of units which enables you to express a display line position in a preferred unit without the need to adapt to the instrument's current unit. Omitting an unit uses instrument's current unit

**Parameters**

MINimum to MAXimum (depending on current unit)

**Example**

CALC:DLIN -20dBm

**Characteristics**

- \* RST value: - (STATe to OFF)

SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:DLINe:STATe**

This command switches the display line on or off.

**Parameter**

ON | OFF

**Example**

CALC:DLIN2:STAT OFF

**Characteristics**

- \* RST value: OFF

SCPI: device-specific

**Mode**

-

### 12.3.7.2 Limit Lines

The following commands define limit lines and perform the corresponding limit checks.

**List of Commands**

- CALCulate<1|2>:LIMit<1|2>:BEEP[:STATe]
- CALCulate<1|2>:LIMit<1|2>:COMMENT?
- CALCulate<1|2>:LIMit<1|2>:DELeTe
- CALCulate<1|2>:LIMit<1|2>:FAIL?
- CALCulate<1|2>:LIMit<1|2>:LOWer:SElect
- CALCulate<1|2>:LIMit<1|2>:STATe
- CALCulate<1|2>:LIMit<1|2>:UNIT:X?
- CALCulate<1|2>:LIMit<1|2>:UNIT[:Y]?
- CALCulate<1|2>:LIMit<1|2>:UPPer:SElect

**CALCulate<1|2>:LIMit<1|2>:BEEP[:STATe]**

This command activates or deactivates the audio beep. If active, the R&S ETC output a beep each time a limit is exceeded.  
The numeric suffix <1|2> is irrelevant.

**Parameter**

ON | OFF

**Example**

CALC:LIM:BEEP ON  
Activates the audio beep.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:COMMeNt?**

This command queries the description of the limit line indicated by the numeric suffix <1|2>. The maximum number of characters for the comment is 32.  
This command is a query and therefore has no RST value.

**Return value**

<string> = description of the limit line

**Example**

CALC:LIM:COMM?  
Queries the description of limit line 1.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:DELeTe**

This command deletes the limit line indicated by the suffix.  
This command is an event and therefore has no \*RST value and no query.

**Parameter**

-

**Example**

CALC:LIM2:DEL  
 Deletes the second limit line

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:FAIL?**


---

This command queries the result of the limit check for the limit line indicated by the suffix.

Note that a complete sweep must have been performed to obtain a correct result. A synchronization with \*OPC, \*OPT? or \*WAI should therefore be applied. The result of the limit check is given with 0 for PASS, 1 for FAIL

**Return value**

0 for PASS and 1 for FAIL

**Example**

INIT;\*WAI  
 Starts a new sweep and waits for its end.

CALC:LIM1:FAIL?  
 Queries the result of the check for limit line 1.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:LOWer:SElect**


---

This command selects the lower limit line.  
 This command is an event and therefore has no \*RST value and no query.

**Parameter**

<string> = file name of the limit line

**Example**

CALC:LIM:LOW:SEL 'LINE1'

Selects the limit line with the name LINE1 as the lower limit line.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:STATe**

---

This command activates and deactivates the limits.

The result of the limit check can be queried with

[CALCulate<1|2>:LIMit<1|2>:FAIL?](#).

**Parameter**

ON | OFF

**Example**

CALC:LIM:STAT ON

Activates the limit check for limit line 1.

**Characteristics**

- \* RST value: OFF
- SCPI: conform

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:UNIT:X?**

---

This command queries the unit of the x-axis.

This command is a query and therefore has no \*RST value.

**Parameter**

-

**Example**

CALC:LIM:UNIT:X?

Queries the x-unit of the first limit line.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:UNIT[:Y]?**

---

This command queries the unit of the level axis (y-unit).  
This command is a query and therefore has no \*RST value.

**Parameter**

-

**Example**

CALC:LIM1:UNIT?  
Queries the y-unit of the first limit line

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:LIMit<1|2>:UPPer:SElect**

---

This command selects the upper limit line.  
This command is an event and therefore has no \*RST value and no query.

**Parameter**

<string>  
with <string> = file name of the limit line.

**Example**

CALC:LIM:UPP:SEL 'LINE2'  
Selects the limit line with the name LINE2 as the upper limit line

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

## 12.3.8 Configuring and Using Measurement Functions

The R&S ETC provides measurement functions which allow you to perform advanced measurements and can also be controlled remotely.

- [Power Measurements](#)
- [Measuring the Channel Power](#)
- [Measuring the Adjacent Channel Power](#)
- [Measuring the Occupied Bandwidth](#)
- [TDMA Measurements](#)

### 12.3.8.1 Power Measurements

The following commands configure power measurements. To perform the actual measurement, use the commands described in section "[Setting and Triggering the Sweep](#)".

#### List of Commands

- [CALCulate:MARKer:FUNCtion:LEVel:ONCE](#)
- [CALCulate:MARKer:FUNCtion:POWer\[:STATe\]](#)
- [CALCulate:MARKer:FUNCtion:POWer:PRESet](#)
- [CALCulate:MARKer:FUNCtion:POWer:PRESet:CHECK?](#)
- [CALCulate:MARKer:FUNCtion:POWer:RESult?](#)
- [CALCulate:MARKer:FUNCtion:POWer:SELect](#)

#### **CALCulate:MARKer:FUNCtion:LEVel:ONCE**

This command adjusts the reference level of the R&S ETC to the measured power.

This command activates and deactivates the selected power measurement.

This ensures that the RF attenuation and reference level are optimally adjusted to the signal level without overloading the R&S ETC or limiting the dynamic range by too small a S/N ratio.

Current measurements are aborted when pressing the softkey to run a series of test sweeps. The actual measurements are resumed after the automatic level detection is finished.

#### Parameter

ON | OFF

#### Example

```
CALC:MARK:FUNC:LEV:ONCE
```

#### Characteristics

\* RST value: -

SCPI: device-specific

**Mode**

-

**CALCulate:MARKer:FUNCtion:POWer[:STATE]**

This command activates and deactivates the selected power measurement.  
This command is an event and therefore has no \*RST value

**Parameter**

ON | OFF

**Example**

CALC:MARK:FUNC:POW OFF  
Deactivates the power measurement.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate:MARKer:FUNCtion:POWer:PRESet**

This command loads and initializes a predefined Standard from the specified file, and switches to the corresponding measurement mode. A Standard comprises of parameters specifying default values for settings related to power measurements. Parameters such as channel bandwidth, resolution bandwidth, detector type, and sweep time are examples of parameters stored in a Standard.

**Parameter**

&lt;string&gt; = file name of the standard

**Example**

CALC:MARK:FUNC:POW:PRES 'cdma.chpstd'  
Selects the file CDMA.CHPSTD for the measurement.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**CALCulate:MARKer:FUNCtion:POWer:PRESet:CHECK?**

This command determines whether the current instrument state is still in compliance with the Standard currently in use. Modifying instrument settings that are not included in a Standard do not break Standard compliance; modifying settings that are included in a Standard, will break compliance. This command is a query and therefore has no \*RST value.

**Return value**

0	Instrument settings are not compliant to the selected standard.
1	Instrument settings are compliant to the selected standard.

**Example**

CALC:MARK:FUNC:POW:PRES:CHEC?

Queries compliance to the standard currently in use.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:MARKer:FUNCtion:POWer:RESult?**

This command queries the result of the performed power measurement. If necessary, the measurement is switched on prior to the query. To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode. This command is a query and therefore has no \*RST value.

**Parameter**

CPOWer	Channel power measurement With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.
OBANdwidth   OBWidth	Measurement of occupied bandwidth The occupied bandwidth in Hz is returned.

TDMA	TDMA measurement. Returns the power of the TDMA signal.
------	--

**Example**

POW:BAND 90PCT

Defines 90% as the percentage of the power to be contained in the bandwidth range to be measured.

INIT:CONT OFF

Switches over to single sweep mode.

INIT;\*WAI

Starts a sweep and waits for the end of the sweep.

CALC:MARK:FUNC:POW:RES? OBW

Queries the occupied bandwidth measured.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:MARKer:FUNCtion:POWER:SElect**

This command selects the power measurement setting for a standard and previously activates the corresponding measurement, if required. The configuration for a standard comprises of the parameters weighting filter, channel bandwidth and spacing, resolution and video bandwidth, as well as detector and sweep time.

**Parameter**

CPOWer	Channel power measurement
ACP	ACP / ACLR measurement
OBANdwidth   OBWidth	Measurement of occupied bandwidth
TDMA	Measurement on TDMA signals

**Example**

CALC:MARK:FUNC:POW:SEL CPOW

Selects the channel power measurement.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

### 12.3.8.2 Measuring the Channel Power

The following commands configure channel power measurements. To perform the actual measurement, use the commands described in section "[Setting and Triggering the Sweep](#)".

Note that the numeric suffix <1...6> at MARKer is irrelevant when using these commands.

**List of Commands**

- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:BANDwidth
- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:MODE
- CALCulate:MARKer<1...6>:FUNCtion:CPOWer:UNIT

#### CALCulate:MARKer<1...6>:FUNCtion:CPOWer:BANDwidth

---

This command sets the channel bandwidth for channel power measurements. The numeric suffix <1...6> is irrelevant

**Parameter**

<numeric> | UP | DOWN

**Example**

CALC:MARK:FUNC:CPOW:BAND 4 MHZ  
Sets the channel bandwidth to 4 MHz.

**Characteristics**

- \* RST value: 3.84 MHz  
SCPI: device-specific

**Mode**

-

#### CALCulate:MARKer<1...6>:FUNCtion:CPOWer:MODE

---

This command sets the power display mode to Clear / Write or Max Hold for channel power measurements.

---

The numeric suffix <1...6> is irrelevant

**Parameter**

CLR | MAX

**Example**

CALC:MARK:FUNC:CPOW:MODE CLR  
Selects clear/write trace mode.

**Characteristics**

- \* RST value: CLR  
SCPI: device-specific

**Mode**

-

**CALCulate:MARKer<1...6>:FUNCtion:CPOwer:UNIT**

---

This command defines the unit for channel power measurements.  
The numeric suffix <1...6> is irrelevant

**Parameter**

DBM | DBMV | DBUV | VOLT | WATT | DUVM | DUAM | V | W | V\_M | W\_M2

**Example**

CALC:MARK:FUNC:CPOW:UNIT DBM  
Sets the unit to dBm.

**Characteristics**

- \* RST value: dBm  
SCPI: device-specific

**Mode**

-

### 12.3.8.3 Measuring the Adjacent Channel Power

The following commands configure Adjacent Channel Power measurements. To perform the actual measurement, use the commands described in section "[Setting and Triggering the Sweep](#)".

- [Configuring and Performing the ACP Measurement](#)
- [Adjacent Channel Power Limit Check](#)

## Configuring and Performing the ACP Measurement

The following commands are for configuring and performing the adjacent channel power measurement.

### List of Commands

- [SENSe:]POWer:ACHannel:ACPairs
- [SENSe:]POWer:ACHannel:BANDwidth[:CHANnel]
- [SENSe:]POWer:ACHannel:BANDwidth:ACHannel
- [SENSe:]POWer:ACHannel:BANDwidth:ALTErnate<1...11>
- [SENSe:]POWer:ACHannel:MODE
- [SENSe:]POWer:ACHannel:PRESet:RLEVel
- [SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO
- [SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual
- [SENSe:]POWer:ACHannel:SPACing[:ACHannel]
- [SENSe:]POWer:ACHannel:SPACing:ALTErnate<1...11>
- [SENSe:]POWer:ACHannel:SPACing:CHANnel<1...11>
- [SENSe:]POWer:ACHannel:TXCHannel:COUNt

### [SENSe:]POWer:ACHannel:ACPairs

This command sets the number of adjacent channels pair to the left and to the right of the Tx channel.

#### Parameter

1 to 12

#### Example

POW:ACH:ACP 3

Sets 3 adjacent or alternate channels to the left and to the right of the transmission channel.

#### Characteristics

- \* RST value: 1
- SCPI: device-specific

#### Mode

-

### [SENSe:]POWer:ACHannel:BANDwidth[:CHANnel]

This command sets the channel bandwidth of the radio communication system. The bandwidths of adjacent channels are not influenced by this command. Instead of BANDwidth, you can also use the alias BWIDth

#### Parameter

100 Hz to 1000 MHz

**Example**

POW:ACH:BAND 120 KHZ  
Sets the bandwidth to 120 kHz.

**Characteristics**

- \* RST value: 14 kHz
- SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:BANDwidth:ACHannel**

---

This command sets the channel bandwidth of the adjacent channel in the radio communication system. If you change the bandwidth of the adjacent channel, the bandwidth of all other alternate channels is adjusted to the same value. Instead of BANDwidth, you can also use the alias BWIDth

**Parameter**

100 Hz to 1000 MHz

**Example**

POW:ACH:BAND:ACH 120 KHZ  
Sets the bandwidth of the adjacent channel to 120 kHz.

**Characteristics**

- \* RST value: 14 kHz
- SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:BANDwidth:ALTErnate<1...11>**

---

This command sets the bandwidth of the alternate channels in the radio communication system. If you change the bandwidth of the first alternate channel, the bandwidth of all other alternate channels is adjusted to the same value. The suffix <1...11> selects the number of the alternate channel. Instead of BANDwidth, you can also use the alias BWIDth

**Parameter**

100 Hz to 1000 MHz

**Example**

POW:ACH:BAND:ALT2 120 KHZ

Sets the bandwidth of the second alternate channel to 120 kHz.

#### Characteristics

- \* RST value: 14 kHz
- SCPI: device-specific

#### Mode

-

### [SENSe:]POWer:ACHannel:MODE

---

This command selects either absolute or relative adjacent channel measurements. The command is available if span > 0 and if the number of adjacent channel is greater than 0.

#### Parameter

ABSolute | RELative

#### Example

POW:ACH:MODE ABS

Performs an absolute ACP measurement.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### [SENSe:]POWer:ACHannel:PRESet:RLEVel

---

This command adjusts the reference level to the currently measured channel power. It also initiates an adjacent channel power measurement. This ensures that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded. This command is an event and therefore has no \*RST value and no query.

#### Parameter

-

#### Example

POW:ACH:PRES:RLEV

Initiates an ACP measurement and adjusts the reference level.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### [SENSe:]POWer:ACHannel:REFerence:TXCHannel:AUTO

This command activates the automatic selection of a transmission channel to be used as a reference channel in relative ACP measurements.

You can define the Tx channel with the highest power, the lowest power, or the Tx channel nearest to the adjacent channels as the reference channel.

The command is available only for multi-carrier channel and adjacent-channel power measurements with span > 0

#### Parameter

MINimum	Tx channel with the lowest power
MAXimum	Tx channel with the highest power
LHIGhest	Lowest Tx channel for lower adjacent channels and highest Tx channel for upper adjacent channels

#### Example

POW:ACH:REF:TXCH:AUTO MIN

Sets the TX channel with the lowest power as reference channel.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### [SENSe:]POWer:ACHannel:REFerence:TXCHannel:MANual

This command defines a transmission channel as the reference channel for relative ACP measurements.

The command is available only for multi-carrier channel and adjacent-channel

---

power measurements with span > 0.

**Parameter**

1 to 12

**Example**

POW:ACH:REF:TXCH:MAN 2

Sets the second Tx channel as reference channel.

**Characteristics**

- \* RST value: 1
- SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:SPACing[:ACHannel]**

---

This command sets the spacing between the carrier and its adjacent channel. A change of the adjacent channel spacing causes a change in the spacing of all alternate channels above the adjacent channel.

**Parameter**

100 Hz to 2000 MHz

**Example**

POW:ACH:SPAC 10 KHZ

Defines a channel spacing of the adjacent channel of 10 kHz.

**Characteristics**

- \* RST value: 14 kHz
- SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:SPACing:ALTErnate<1...11>**

---

This command sets the spacing between transmission channel and the alternate channels. A change of the alternate channel spacing causes a change in the spacing of all alternate channels above the modified alternate channel. Alternate channels below the modified remain the same. The numeric suffix <1...11> at ALTErnate selects the alternate channel.

**Parameter**

100 Hz to 2000 MHz

**Example**

POW:ACH:SPAC:ALT2 20 kHz

Defines a channel spacing of the second alternate channel to the transmission channel of 20 kHz.

**Characteristics**

- \* RST value: ALT1: 40 kHz; ALT2: 60 kHz; ALT3: 80 kHz etc

SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:SPACing:CHANnel<1...11>**

---

This command defines the channel spacing of the transmission channels. The numeric suffix <1...11> at CHANnel selects the TX channel.

**Parameter**

14 kHz to 2000 MHz

**Example**

POW:ACH:SPAC:CHAN2 20 kHz

Defines a channel spacing of the second Tx channel of 14 kHz.

**Characteristics**

- \* RST value: 20 kHz

SCPI: device-specific

**Mode**

-

**[SENSe:]POWer:ACHannel:TXChannel:COUNT**

---

This command sets the number of transmission channels. The command is available for measurements with span > 0.

**Parameter**

1 to 12

**Example**

POW:ACH:TXCH:COUN 2

Sets 2 Tx channels.

**Characteristics**

- \* RST value: 1
- SCPI: device-specific

**Mode**

-

**Adjacent Channel Power Limit Check**

The following commands configure and perform limit checks when measuring the adjacent channel power.

Note that the numeric suffix <1|2> at LIMit is irrelevant when using these commands.

**List of Commands**

- [CALCulate:LIMit<1|2>:ACPower\[:STATe\]](#)
- [CALCulate:LIMit<1|2>:ACPower:ACHannel\[:RELative\]](#)
- [CALCulate:LIMit<1|2>:ACPower:ACHannel\[:RELative\]:STATe](#)
- [CALCulate:LIMit<1|2>:ACPower:ACHannel:ABSolute](#)
- [CALCulate:LIMit<1|2>:ACPower:ACHannel:ABSolute:STATe](#)
- [CALCulate:LIMit<1|2>:ACPower:ACHannel:RESult?](#)
- [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>>\[:RELative\]](#)
- [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>>\[:RELative\]:STATe](#)
- [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>:ABSolute](#)
- [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>:ABSolute:STATe](#)
- [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>:RESult?](#)

**CALCulate:LIMit<1|2>:ACPower[:STATe]**

This command activates and deactivates the limit check for ACP measurements. You have to use [CALCulate:LIMit<1|2>:ACPower:ACHannel\[:RELative\]:STATe](#) or [CALCulate:LIMit<1|2>:ACPower:ALTernate<1...11>>\[:RELative\]:STATe](#) in combination with this command to specify whether the limit check should be performed for the upper / lower adjacent channel or for the alternate adjacent channels.

The numeric suffix <1|2> at LIMit is irrelevant.

**Parameter**

ON | OFF

**Example**

CALC:LIM:ACP ON  
Activates the limit check.

**Characteristics**

- \* RST value: OFF

SCPI: device-specific

#### Mode

-

### **CALCulate:LIMit<1|2>:ACPower:ACHannel[:RELative]**

This command sets the relative limit of the upper / lower adjacent channel. The reference value for the relative limit value is the measured channel power. Note that the relative limit has no effect on the limit check if it is below the absolute limit value (see [CALCulate:LIMit<1|2>:ACPower:ACHannel:ABSolute](#)). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards. The numeric suffix <1|2> at LIMit is irrelevant.

#### Parameter

<numeric value> = relative limit for the upper or lower adjacent channel between 0 and 100 dB

#### Example

CALC:LIM:ACP:ACH 30  
Defines a limit of 30 dB.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### **CALCulate:LIMit<1|2>:ACPower:ACHannel[:RELative]:STATe**

This command activates the relative limit check of the adjacent channel. The limit check must be activated with [CALCulate:LIMit<1|2>:ACPower\[:STATe\]](#) For the command to take effect. [CALCulate:LIMit<1|2>:ACPower:ACHannel:RESult?](#) queries the result. Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available. The numeric suffix <1|2> at LIMit is irrelevant.

#### Parameter

ON | OFF

#### Example

CALC:LIM:ACP:ACH:STAT ON  
 Activates the relative limit check.

#### Characteristics

- \* RST value: OFF
- SCPI: device-specific

#### Mode

-

### CALCulate:LIMit<1|2>:ACPower:ACHannel:ABSolute

This command defines the absolute limit for the lower / upper adjacent channel. It should be noted that the absolute limit has no effect on the limit check if it is below the relative limit (see [CALCulate:LIMit<1|2>:ACPower:ACHannel\[:RELative\]](#)). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards. The numeric suffix <1|2> at LIMit is irrelevant.

#### Parameter

<numeric value> = absolute limit for the upper or lower adjacent channel. The range is from -200 dBm to + 200 dBm.

#### Example

CALC:LIM:ACP:ACH:ABS -30  
 Sets the absolute limit to -30 dBm.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### CALCulate:LIMit<1|2>:ACPower:ACHannel:ABSolute:STATe

This command activates the absolute limit check of the adjacent channel. The limit check must be activated with [CALCulate:LIMit<1|2>:ACPower\[:STATe\]](#) For this command to take effect. [CALCulate:LIMit<1|2>:ACPower:ACHannel:RESult?](#) queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available. The numeric suffix <1|2> at LIMit is irrelevant.

#### Parameter

ON | OFF

**Example**

CALC:LIM:ACP:ACH:ABS:STAT ON  
 Activates the absolute limit check.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**CALCulate:LIMit<1|2>:ACPower:ACHannel:RESult?**

This command queries the result of the limit check of the upper / lower adjacent channel. In case the ACP measurement is not active, the command returns a error.

This command is a query and therefore has no \*RST value.

**Return value**

FAILED | PASSED

**Example**

CALC:LIM:ACP:ACH:RES?  
 Queries the limit check results.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:LIMit<1|2>:ACPower:ALternate<1...11>>[:RELative]**

This command sets the relative limit of the alternate channels. The reference value for the relative limit value is the measured channel power.

Note that the relative limit has no effect on the limit check if it is below the absolute limit value (see

[CALCulate:LIMit<1|2>:ACPower:ALternate<1...11>:ABSolute](#)). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffix <1...11> at ALternate selects the alternate channel number.

**Parameter**

<numeric value> = absolute limit for the alternate channels between 0 and 100 dB

**Example**

CALC:LIM:ACP:ALT3 30

Defines a limit of 30 dB for the third alternate channel.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:LIMit<1|2>:ACPpower:ALternate<1...11>>[:RELative]:STATe**

This command activates the relative limit check of the alternate channels. The limit check must be activated with [CALCulate:LIMit<1|2>:ACPpower\[:STATe\]](#) for the command to take effect.. [CALCulate:LIMit<1|2>:ACPpower:ACHannel:RESult?](#) queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available. The numeric suffix <1...11> at ALternate selects the alternate channel number.

**Parameter**

ON | OFF

**Example**

CALC:LIM:ACP:ALT3:STAT ON

Activates the relative limit check for the third alternate channel.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**CALCulate:LIMit<1|2>:ACPpower:ALternate<1...11>:ABSolute**

This command defines the absolute limit for the lower / upper adjacent channel. It should be noted that the absolute limit has no effect on the limit check if it is below the relative limit (see [CALCulate:LIMit<1|2>:ACPpower:ALternate<1...11>>\[:RELative\]](#)). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

---

The numeric suffix <1...11> at ALTErnate selects the alternate channel number.

#### Parameter

<numeric value> = absolute limit for the upper or lower adjacent channel. The range is from -200 dBm to + 200 dBm.

#### Example

CALC:LIM:ACP:ALT3:ABS -30

Sets the absolute limit to -30 dBm for the third alternate channel.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### CALCulate:LIMit<1|2>:ACPpower:ALTErnate<1...11>:ABSolute:STATe

---

This command activates the absolute limit check of the alternate channels. The limit check must be activated with [CALCulate:LIMit<1|2>:ACPpower\[:STATe\]](#) for the command to take effect.. [CALCulate:LIMit<1|2>:ACPpower:ACHannel:RESult?](#) queries the result.

Note that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available. The numeric suffix <1...11> at ALTErnate selects the alternate channel number.

#### Parameter

ON | OFF

#### Example

CALC:LIM:ACP:ALT3:ABS:STAT ON

Activates the absolute limit check for the third alternate channel.

#### Characteristics

- \* RST value: OFF
- SCPI: device-specific

#### Mode

-

### CALCulate:LIMit<1|2>:ACPpower:ALTErnate<1...11>:RESult?

---

This command queries the result of the limit check of the upper / lower alternate channels. In case the ACP measurement is not active, the command returns an

---

error.

The numeric suffix <1...11> at ALTeRnate selects the alternate channel number. This command is a query and therefore has no \*RST value.

**Return value**

FAILED | PASSED

**Example**

CALC:LIM:ACP:ALT3:RES?

Queries the limit check results for the third alternate channel.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.3.8.4 Measuring the Occupied Bandwidth

The following commands configure the measurement of the Occupied Bandwidth. To perform the actual measurement, use the commands described in section "Setting and Triggering the Sweep".

**List of Commands**

- [CALCulate:MARKer<1...6>:FUNction:OBAN|OBW:BANDwidth](#)
- [CALCulate:MARKer<1...6>:FUNction:OBAN|OBW:BANDwidth:PCT](#)

**CALCulate:MARKer<1...6>:FUNction:OBAN|OBW:BANDwidth**

---

This command sets the channel bandwidth for occupied bandwidth measurements.

**Parameter**

<numeric>

**Example**

CALC:MARK:FUNC:OBW:BAND 1 MHZ

Sets the channel bandwidth to 1 MHz.

**Characteristics**

- \* RST value: 3.84 MHz
- SCPI: device-specific

**Mode**

-

**CALCulate:MARKer<1...6>:FUNCtion:OBAN|OBW:BANDwidth:PCT**


---

This command sets the percentage of the total power that defines the occupied bandwidth.

**Parameter**

10 to 99

**Example**

CALC:MARK:FUNC:OBW:BAND:PCT 95  
Sets the power percentage to 95%.

**Characteristics**

- \* RST value: 99%
- SCPI: device-specific

**Mode**

-

### 12.3.8.5 TDMA Measurements

The following commands configure TDMA measurements. To perform the actual measurement, use the commands described in section "[Setting and Triggering the Sweep](#)".

**List of Commands**

- [CALCulate:MARKer<1...6>:FUNCtion:TDMA:BURSt](#)

**CALCulate:MARKer<1...6>:FUNCtion:TDMA:BURSt**


---

This command sets the burst length of the TDMA signal.

**Parameter**

31.7 us to 19 ms

**Example**

CALC:MARK:FUNC:TDMA:BURS 80 US  
Sets the burst length to 80 us.

**Characteristics**

- \* RST value: 470 us  
SCPI: device-specific

**Mode**

-

## 12.4 Remote Commands in Network Analyzer Mode

The chapter provides information on remote commands that configure and perform measurements with the tracking generator. These commands are available in Network Analyzer mode only.



Availability of remote commands for the Network Analyzer

Some of the listed remote commands take effect only if options R&S FSH-K42 Vector Reflection and Transmission Measurements are installed (for ETH only)

### 12.4.1 Setting the Frequency and Span

The following commands configure the frequency axis (x-axis) of the active display.

**List of Commands**

- [SENSe:]FREQUency:CENTer
- [SENSe:]FREQUency:CENTer:STEP
- [SENSe:]FREQUency:CENTer:STEP:LINK
- [SENSe:]FREQUency:SPAN
- [SENSe:]FREQUency:SPAN:FULL
- [SENSe:]FREQUency:START
- [SENSe:]FREQUency:STOP

For a detailed description of the commands refer to "[Setting the Frequency and the Span](#)" in Spectrum Analyzer mode.

### 12.4.2 Setting Amplitude Parameters

The following commands configure the level axis (y-axis) and level parameters of the active display.

In Network Analyzer mode, the numeric suffix <1|2> at DISPlay selects the measurement screen in dual trace mode.

### List of Commands

- DISPLAY<1|2>:GDElay:REFerence
- DISPLAY<1|2>:GDElay:REFerence:POSition
- DISPLAY<1|2>:GDElay:Y:SCALe
- DISPLAY<1|2>:IMPedance:REFerence:POSition
- DISPLAY<1|2>:LOSS:REFerence
- DISPLAY<1|2>:LOSS:REFerence:POSition
- DISPLAY<1|2>:LOSS:Y:SCALe
- DISPLAY<1|2>:MAGNitude:REFerence
- DISPLAY<1|2>:MAGNitude:REFerence:POSition
- DISPLAY<1|2>:MAGNitude:Y:SCALe
- DISPLAY<1|2>:MAGNitude:Y:SPACing
- DISPLAY<1|2>:PHASe:REFerence
- DISPLAY<1|2>:PHASe:REFerence:POSition
- DISPLAY<1|2>:PHASe:Y:SCALe
- DISPLAY<1|2>:PHASe:UNWRap
- DISPLAY<1|2>:REFLection:Y:SCALe
- DISPLAY<1|2>:REFLection:UNIT
- DISPLAY<1|2>:VSWR:Y:SCALe
- INPut:ATTenuation
- INPut:ATTenuation:AUTO
- INPut:ATTenuation:MODE
- INPut:IMPedance
- SOURce:TG:ATTenuation
- UNIT:POWER

For a detailed description of commands not described below refer to "[Setting Amplitude Parameters](#)" in Spectrum Analyzer mode.

### DISPLAY<1|2>:GDElay:REFerence

This command sets the reference level for the Group Delay measurement format.

#### Parameter

1 to 10000 ns

#### Example

DISP:GDEL:REF 20

Sets the reference level to 20 nanoseconds.

#### Characteristics

\* RST value: 0 ns

SCPI: device-specific

#### Mode

-

**DISPlay<1|2>:GDElay:REFerence:POSition**

This command defines the position of the reference value on the display for the Group Delay measurement format. Each step shifts the reference position one grid line up or down.

**Parameter**

1 to 10

**Example**

DISP:GDEL:REF:POS 0

Sets the reference to the bottom of the display (i.e. the first grid line from the bottom).

**Characteristics**

- \* RST value: 5
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:GDElay:Y:SCALe**

This command defines the display range of the y-axis for the Group Delay measurement format.

**Parameter**

<numeric\_value>

**Example**

DISP:GDEL:Y:SCAL 20E-9

Sets the display range to 20 nanoseconds.

**Characteristics**

- \* RST value: 100 ns
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:LOSS:REFerence**

This command sets the reference level for the Cable Loss measurement format.

**Parameter**

1 to 10

**Example**

DISP:LOSS:REF 10  
Sets the reference level to 10 dB.

**Characteristics**

- \* RST value: 0 dB
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:LOSS:REFerence:POSition**

---

This command defines the position of the reference value on the display for the Cable Loss measurement format. Each step shifts the reference position one grid line up or down.

**Parameter**

1 to 10

**Example**

DISP:LOSS:REF:POS 5  
Sets the reference to the center of the display (i.e. the fifth grid line from the bottom).

**Characteristics**

- \* RST value: 10
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:LOSS:Y:SCALE**

---

This command defines the display range of the y-axis with logarithmic scaling for the Cable Loss measurement format.

Use the [DISPlay\[:WINDow\]:TRACe<1|2>:Y:SPACing](#) command to switch to logarithmic scaling.

**Parameter**

&lt;numeric value&gt;

**Example**

DISP:LOSS:Y:SCAL 20  
Sets the display range to 20 dB

**Characteristics**

- \* RST value: 100 dB
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:MAGNitude:REFerence**

---

This command sets the reference level for the magnitude measurement format.

**Parameter**

<numeric value>

**Example**

DISP:MAGN:REF -10  
Sets the reference level to -10 dB

**Characteristics**

- \* RST value: 0 dB
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:MAGNitude:REFerence:POSition**

---

This command defines the position of the reference value on the display for the magnitude measurement format. Each step shifts the reference position one grid line up or down.

**Parameter**

1 to 10

**Example**

DISP:MAGN:REF:POS 5  
Sets the reference to the center of the display (i.e. the fifth grid line from the bottom).

**Characteristics**

- \* RST value: 10

SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:MAGNitude:Y:SCALE**

This command defines the display range of the y-axis with logarithmic scaling for the Magnitude measurement format.

Use the [DISPlay\[:WINDow\]:TRACe<1|2>:Y:SPACing](#) command to switch to logarithmic scaling.

**Parameter**

<numeric value>

**Example**

DISP:MAGN:Y:SCAL 50 DB

Sets the display range of the y-axis to 50 dB

**Characteristics**

- \* RST value: 100 dB

SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:MAGNitude:Y:SPACing**

This command sets the scaling of the y-axis for the Magnitude measurement format to either linear or logarithmic.

**Parameter**

LINear | LOGarithmic

**Example**

DISP:MAGN:Y:SPAC LIN

Changes the y-axis to linear scaling.

**Characteristics**

- \* RST value: LOGarithmic

SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:PHASe:REFerence**

---

This command sets the reference level for the Phase measurement format.

**Parameter**

<numeric\_value>

**Example**

DISP:MAGN:REF -10  
Sets the reference level to -10 dB.

**Characteristics**

- \* RST value: 0 dB
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:PHASe:REFerence:POSition**

---

This command defines the position of the reference value on the display for the Phase measurement format.

**Parameter**

1 to 10

**Example**

DISP:LOSS:REF:POS 5  
Sets the reference to the center of the display (i.e. the fifth grid line from the bottom).

**Characteristics**

- \* RST value: 10
- SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:PHASe:Y:SCALe**

---

This command defines the display range of the y-axis for the Phase measurement format. Phase can have values from 0° to 100000°.

**Parameter**

<numeric value>

#### Example

DISP:PHAS:Y:SCAL 180

Sets the display range of the phase measurement to 180°.

#### Characteristics

- \* RST value: 360°
- SCPI: device-specific

#### Mode

-

### DISPlay<1|2>:PHASe:UNWRap

This command removes the restriction limiting the value range to +/- 180°. Phase can have values from 0° to 100000°.

#### Parameter

ON | OFF

#### Example

DISP:PHAS:UNWR ON

Activates the phase unwrap.

#### Characteristics

- \* RST value: OFF
- SCPI: device-specific

#### Mode

-

### DISPlay<1|2>:REFLection:Y:SCALe

This command defines the display range of the y-axis for the Reflection Coefficient measurement format.

Use the [DISPlay\[:WINDow\]:TRACe<1|2>:Y:SPACing](#) command to switch to logarithmic scaling

#### Parameter

0 to 1000 mp

#### Example

DISP:REFL:Y:SCAL 100

Scales the logarithmic y-axis to 100 mp.

**Characteristics**

- \* RST value: 1000 mp  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:REFlection:UNIT**

---

This command defines the unit for the reflection coefficient.

**Parameter**

RHO | MRHO

**Example**

DISP:REFL:UNIT RHO  
Sets the unit to RHO.

**Characteristics**

- \* RST value: MRHO  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:VSWR:Y:SCALe**

---

This command defines the display range of the y-axis for the VSWR measurement format.

**Parameter**

1...1.1 | 1.5 | 2 | 6 | 11 | 21 | 71

**Example**

DISP:VSWR:Y:SCAL 50  
Sets the range to 1...71.

**Characteristics**

- \* RST value: 1...21  
SCPI: device-specific

**Mode**

-

### SOURce:TG:ATTenuation

This command sets the output level of the tracking generator. You can set the output level by selecting an attenuation value. The range is from 0 dB to 50 dB. Setting the attenuation to 0 dB results in an output level of 0 dBm. If you set the attenuation to 50 dB, the resulting output level is -50 dBm

#### Parameter

0 to 50

#### Example

SOUR:TG:ATT 50

Sets the attenuation to 50 dB and therefore an output level of -50 dBm.

#### Characteristics

- \* RST value: 10 dB
- SCPI: device-specific

#### Mode

-

### 12.4.3 Setting the Bandwidth

The following commands configure the filter bandwidths of the R&S ETC. Note that both groups of commands (BANDwidth and BWIDth) are the same.

#### List of Commands

- [\[SENSe:\]BANDwidth|BWIDth\[:RESolution\]](#)
- [\[SENSe:\]BANDwidth|BWIDth\[:RESolution\]:AUTO](#)

For a detailed description of commands refer to "[Setting the Bandwidths](#)" in Spectrum Analyzer mode.

### 12.4.4 Setting and Triggering the Sweep

The following commands configure the sweep.

#### List of Commands

- [\\*WAI](#)
- [ABORt](#)
- [INITiate\[:IMMediate\]](#)
- [INITiate:CONTinuous](#)
- [\[SENSe:\]SWEep:COUNt](#)
- [\[SENSe:\]SWEep:TIME](#)
- [\[SENSe:\]SWEep:TIME:AUTO](#)
- [TRIGger\[:SEQuence\]:HOLDoff\[:TIME\]](#)
- [TRIGger\[:SEQuence\]:SLOPe](#)

- [TRIGger\[:SEQuence\]:SOURce](#)

For a detailed description of commands refer to "[Setting and Triggering the Sweep](#)" in Spectrum Analyzer mode.

## 12.4.5 Working with Traces

The following commands set up the trace and the various functions associated with it, e.g. the selection of the detector.

### List of Commands

- [DISPlay\[:WINDow\]:TRACe<1|2>\[:STATe\]](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:MEMory\[:STATe\]](#)
- [DISPlay\[:WINDow\]:TRACe<1|2>:MODE](#)
- [FORMat:BORDER](#)
- [\[SENSe:\]DETEctor\[:FUNCTion\]](#)
- [\[SENSe:\]DETEctor<1...6>\[:FUNCTion\]:AUTO](#)
- [TRACE<1|2>\[:DATA\]?](#)

For a detailed description of commands refer to "[Working with Traces](#)" in Spectrum Analyzer mode.

### TRACE<1|2>[:DATA]?

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred.

#### Parameter

TRACE1 | TRACE2

#### Return value for trace data in Network Analyzer mode

631 results are returned, one result for each point of the trace. The result depends on the measurement format. The return values are scaled in the currently selected unit.

Note that for the MPHase format (simultaneous measurement of magnitude and phase) 631 polar values are returned in ASCII format separated by commas. For each value, first the magnitude and then the phase is output.

#### Example

```
TRAC:DATA? TRACE1
```

Reads out the data for trace 1.

#### Characteristics

- \* RST value: -
- SCPI: conform

TV standard: all

### Mode

-

## 12.4.6 Using Markers and Deltamarkers

### 12.4.6.1 Markers and Deltamarkers

The following commands are for setting and controlling markers and delta markers. If not otherwise noted, the numeric suffix <1...6> at MARKer or DELTAmarker select the marker to be controlled.

In Network Analyzer mode, the numeric suffix <1|2> at CALCulate selects the measurement screen in dual trace mode.

#### List of Commands

- CALCulate<1|2>:DELTAmarker<1...6>[:STATe]
- CALCulate<1|2>:DELTAmarker<1...6>:AOFF
- CALCulate<1|2>:DELTAmarker<1...6>:MAXimum[:PEAK]
- CALCulate<1|2>:DELTAmarker<1...6>:MAXimum:NEXT
- CALCulate<1|2>:DELTAmarker<1...6>:MINimum[:PEAK]
- CALCulate<1|2>:DELTAmarker<1...6>:X
- CALCulate<1|2>:DELTAmarker<1...6>:X:RELative?
- CALCulate<1|2>:DELTAmarker<1...6>:Y?
- CALCulate<1|2>:MARKer<1...6>[:STATe]
- CALCulate<1|2>:MARKer<1...6>:AOFF
- CALCulate<1|2>:MARKer<1...6>:MAXimum[:PEAK]
- CALCulate<1|2>:MARKer<1...6>:MAXimum:NEXT
- CALCulate<1|2>:MARKer<1...6>:MINimum[:PEAK]
- CALCulate<1|2>:MARKer<1...6>:MINimum:NEXT
- CALCulate<1|2>:MARKer<1...6>:MODE
- CALCulate<1|2>:MARKer<1...6>:X
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits[:STATe]
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits:LEFT
- CALCulate<1|2>:MARKer<1...6>:X:SLIMits:RIGHT
- CALCulate<1|2>:MARKer<1...6>:Y?

For a detailed description of commands not described below refer to "[Using Markers](#)" in Spectrum Analyzer mode.

#### CALCulate<1|2>:MARKer<1...6>:MODE

---

This command selects the marker mode.

#### Parameter

NORMal	
RPDB	Reflection Coefficient in complex format (Magnitude (dB) and Phase (Rho))
RPL	Reflection Coefficient in complex format (Magnitude (lin) and Phase (Rho))
RSCalar	Reflection Coefficient in complex format (Real and Imaginary (Rho))
IMPedance	Impedance in complex format (Real and Imaginary)
ADMittance	Admittance in complex format (Real and Imaginary)
NIMPedance	Standardized impedance in complex format (Real and Imaginary)
NADMittance	Standardized admittance in complex format (Real and Imaginary)

**Example**

CALC:MARK:MODE ADM

Selects admittance in complex format with real and imaginary components.

**Characteristics**

- \* RST value: NORMal
- SCPI: device-specific

**Mode**

-

**CALCulate<1|2>:MARKer<1...6>:Y?**

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

**Return value**

The return values depend on the current measurement format, set with

NORMal	<value> = trace value
--------	-----------------------

RPDB (Reflection Coefficient)	<magnitude in dB>, <phase>
RPL (Reflection Coefficient)	<magnitude linear>, <phase>
RSCalar (Reflection Coefficient)	<real part>, <imaginary part>
IMPedance (complex impedance)	<real part>, <imaginary part>
ADMittance (complex admittance)	<real part>, <imaginary part>
NIMPedance (complex normalized impedance)	<real part>, <imaginary part>
NADMittance (complex normalized admittance)	<real part>, <imaginary part>

**Example**

INIT:CONT OFF

Switches to single sweep mode.

CALC:MARK2 ON

Switches marker 2.

INIT;\*WAI

Starts a sweep and waits for the end.

CALC:MARK2:Y?

Outputs the measured value of marker 2.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**12.4.6.2 Marker Functions**

The following commands perform various kinds of analysis at the marker position.

In Network Analyzer mode, the numeric suffix <1|2> at DISPlay selects the measurement screen in dual trace mode.

**List of Commands**

- DISPlay<1|2>:IMPedance:REFerence:POSition
- DISPlay<1|2>:ZOOM:AREA[:STATe]
- DISPlay<1|2>:ZOOM:FACTor
- DISPlay<1|2>:ZOOM:X
- DISPlay<1|2>:ZOOM:Y

**DISPlay<1|2>:IMPedance:REFeRence:POSition**

This command defines the reference impedance for the Smith chart measurement format. The impedance can be between 1mΩ and 10 kΩ.

**Parameters**

<numeric\_value>

**Example**

DISP:IMP:REF:POS 75 OHM  
Sets the reference impedance to 75 Ohm.

**Characteristics**

- \* RST value: 50  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:ZOOM:AREA[:STATe]**

This command activates and deactivates the marker zoom function in a Smith chart.

**Parameters**

ON | OFF

**Example**

DISP:ZOOM:AREA ON  
Activates the marker zoom function.

**Characteristics**

- \* RST value: OFF  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:ZOOM:FACTor**

This command defines the zoom factor of the marker zoom function in a Smith chart.

**Parameters**

2 | 4 | 8

**Example**

DISP:ZOOM:FACT 4  
Sets the zoom factor to 4.

**Characteristics**

- \* RST value: 0  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:ZOOM:X**

---

This command shifts the zoom window on the x-axis of the Smith chart. '0%' marks the center of the x-axis in the Smith chart.

**Parameters**

-50 to 50

**Example**

DISP:ZOOM:X 10  
Shifts the zoom window 10% to the right.

**Characteristics**

- \* RST value: 0  
SCPI: device-specific

**Mode**

-

**DISPlay<1|2>:ZOOM:Y**

---

This command shifts the zoom window on the y-axis of the Smith chart. '0%' marks the center of the y-axis in the Smith chart.

**Parameters**

-50 to 50

**Example**

DISP:ZOOM:Y -25  
Shifts the zoom window 25% down.

**Characteristics**

- \* RST value: 0
- SCPI: device-specific

**Mode**

-

## 12.4.7 Configuring the Measurement

This chapter provides information on how to configure two-port measurements with the tracking generator. The structure follows the order of the actual operation sequence used when performing a measurement:

- [Selecting the Measurement Mode](#)
- [Calibrating the Measurement](#)
- [Selecting the Result Display](#)
- [Selecting the Measurement Format](#)

To perform the actual measurement, use the commands described in section "Setting and Triggering the Sweep".



Commands independent of the operating mode

Note that some of the commands for configuring two-port measurements are also used in other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

### 12.4.7.1 Selecting the Measurement Mode

The following commands select the measurement mode and configure user calibration for two-port measurements.

**List of Commands**

- `MEASurement<1|2>:MODE`
- `CALCulate:CALKit:USER[:STATe]`
- `CALCulate:CALKit:USER:LENGth`
- `CALCulate:CALKit:USER:OFFSet:LENGth`
- `CALCulate:CALKit:USER:NAME`

**MEASurement<1|2>:MODE**

This command sets the measurement mode for network analysis measurements. The numeric suffix <1|2> at MEASurement selects the measurement screen in dual trace mode.

**Parameters**

Network analysis SCALar | VECTor | VVMeter

**Example**

MEAS:MODE SCAL

Switches the network analysis to scalar measurement mode.

**Characteristics**

- \* RST value: VECTor
- SCPI: device-specific

**Mode**

-

**CALCulate:CALKit:USER[:STATe]**

---

This command activates and deactivates the user calibration.

**Parameters**

ON | OFF

**Example**

CALK:USER ON

Activates the calibration standard.

**Characteristics**

- \* RST value: OFF
- SCPI: device-specific

**Mode**

-

**CALCulate:CALKit:USER:LENGth**

---

This command defines the electrical length of the user calibration. It is taken into account for phase measurements and in the Smith Chart.

**Parameters**

0 mm to 1 m

**Example**

CALK:USER:LENG 5 MM

Sets the electrical length to 5 millimeter.

**Characteristics**

- \* RST value: 5.27 mm

SCPI: device-specific

**Mode**

-

**CALCulate:CALKit:USER:OFFSet:LENGth**

---

This command defines the electrical length offset. It is taken into account for phase measurements and in the Smith Chart when phase correction for additional cables and adapters has to be performed.

**Parameters**

0 mm to 100 m

**Example**

CALK:USER:LENG 500 MM  
Sets the offset length to 500 millimeter.

**Characteristics**

- \* RST value: 0 mm  
SCPI: device-specific

**Mode**

-

**CALCulate:CALKit:USER:NAME**

---

This command defines a name for the user calibration to save the customized settings under a user defined name.

**Parameters**

<string>

**Example**

CALKit:USER:NAME CALKIT1  
Renames the calibration standard to CALKIT1

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

### 12.4.7.2 Calibrating the Measurement

The following commands query and control calibration for two-port measurements.

#### List of Commands

- CALibration:MODE?
- CALibration:STATus?

#### CALibration:MODE?

This command queries if the current measurement mode is calibrated.  
This command is a query and therefore has no \*RST value.

#### Return value

0	Not calibrated
1	Calibrated

#### Example

CAL:MODE?

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

#### CALibration:STATus?

This command queries whether the R&S ETC is fully calibrated for the current measurement mode or not.  
This command is a query and therefore has no \*RST value.

#### Return value

NORM	The R&S ETC is fully calibrated
APPR	The R&S ETC is approximately calibrated, meaning that greater measurement uncertainty must be anticipated

#### Example

CAL:STAT?

Queries the calibration status of the R&S ETC.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.4.7.3 Selecting the Result Display

The following commands select the result display for two-port measurements.

**List of Commands**

- [MEASurement<1|2>:FUNCtion:SElect](#)

**MEASurement<1|2>:FUNCtion:SElect**


---

This command selects the result display.  
The numeric suffix <1|2> at MEASurement selects the measurement screen in dual trace mode

**Parameter**

S11 | S12 | S21 | S22

**Example**

MEAS:FUNC:SEL S11

**Characteristics**

- \* RST value: S11
- SCPI: device-specific

**Mode**

-

### 12.4.7.4 Selecting the Measurement Format

The following commands are for selecting and configuring the measurement formats available for two-port measurements.

**List of Commands**

- [CALCulate:TRACe:CABLe:LENGth\[:STATe\]](#)
- [CALCulate:TRACe:CABLe:LENGth:RESult?](#)
- [CALCulate:TRACe:LIMit:VSWR:FAIL?](#)
- [DISPlay:GDELay:APERture:STEP](#)

- [MEASurement<1|2>:FORMat](#)

### **CALCulate:TRACe:CABLE:LENGth[:STATe]**

---

This command sets the electrical cable length state.

#### **Parameter**

ON | OFF

#### **Example**

CALC:TRAC:CABL:LENG ON  
Activates the electrical cable length.

#### **Characteristics**

- \* RST value: OFF  
SCPI: device-specific

#### **Mode**

-

### **CALCulate:TRACe:CABLE:LENGth:RESult?**

---

This command queries the measurement result of the electrical cable length.  
This command is a query and therefore has no \*RST value.

#### **Parameter**

-

#### **Example**

CALC:TRAC:CABL:LENG:RES?  
Queries the measurement result of the electrical cable length.

#### **Characteristics**

- \* RST value: -  
SCPI: device-specific

#### **Mode**

-

### **CALCulate:TRACe:LIMit:VSWR:FAIL?**

---

This command queries the results of the limit check for the VSWR measurement format.

---

This command is a query and therefore has no \*RST value.

#### Return value

0	Failed
1	Passed

#### Example

CALC:TRAC:LIM:VSWR:FAIL?  
 Queries the results of the limit check.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### DISPlay:GDElay:APERture:STEP

---

This command sets the aperture steps for Group Delay measurements.

#### Parameter

1 to 630

#### Example

DISP:GDEL:APER:STEP 100  
 Sets 100 aperture steps.

#### Characteristics

- \* RST value: 10
- SCPI: device-specific

#### Mode

-

### MEASurement<1|2>:FORMat

---

This command specifies the graphical format in which the measurement result are presented.

The numeric suffix <1|2> at MEASurement selects the measurement screen in dual trace mode.

**Parameter**

Reflection Measurements	MAGNitude   PHASe   MPHase   VSWR   REFlection   SMITH   LOSS   GDElay
Transmission Measurements	MAGNitude   PHASe   MPHase   GDElay

**Example**

MEAS:MODE VECT  
Switches to vector measurement mode.

MEAS:FUNC:REFL ON  
Activates reflection measurement.

MEAS:FORM SMITH  
Displays the reflection in a Smith Chart.

**Characteristics**

- \* RST value: MAGNitude
- SCPI: device-specific

**Mode**

-

## 12.5 Remote Commands in Power Meter Mode

The chapter provides information on remote commands that configure and perform power measurements with the power sensor. These commands are available in Network Analyzer mode only.



Availability of remote commands for Power Sensor measurements

Note that the listed remote commands take effect only if the power sensors R&S FSH-Z1, R&S FSH-Z18, R&S FSH-Z14 or R&S FSH-Z44 are installed.

### 12.5.1 Setting the Frequency

The following chapter describes commands necessary to define frequency settings.

**List of Commands**

- [\[SENSe:\]PMETer:FREQuency](#)

**[SENSe:]PMETer:FREQuency**

---

This command sets the frequency of the power sensor.

**Parameter**

<numeric value> = frequency in Hz

**Example**

PMET:FREQ 500 MHZ

Sets the power sensor's frequency to 500 MHz.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

## 12.5.2 Configuring Power Level Readout

The following chapter describes commands that configure the power level readout.

**List of Commands**

- [CALCulate:PMETer:RELative\[:MAGNitude\]](#)
- [CALCulate:PMETer:RELative\[:MAGNitude\]:AUTO](#)
- [CALCulate:PMETer:RELative\[:MAGNitude\]:OFFSet](#)
- [UNIT<1|2>:PMETer:POWer](#)

**CALCulate:PMETer:RELative[:MAGNitude]**

---

This command sets the reference level for relative measurements.

**Parameter**

<numeric value> = level of the reference value

**Example**

CALC:PMET:REL 30

The reference value to 30 dBm.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:PMETer:RELative[:MAGNitude]:AUTO**

This command sets the current measurement result as the reference level for relative measurements.

This command is an event and therefore has no \*RST value and no query.

**Parameter**

ONCE

**Example**

CALC:PMET:REL ONCE

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**CALCulate:PMETer:RELative[:MAGNitude]:OFFSet**

This command sets the offset of the reference level for relative measurements.

**Parameter**

<numeric value> = reference offset

**Example**

CALC:PMET:REL -10

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**UNIT<1|2>:PMETer:POWer**

This command sets the video bandwidth for power sensor measurements.  
The suffix at UNIT has the following effects:

Power measurement with R&S FSH-Z1 and R&S FSH-Z18:

Unit 1 : Power unit

Unit 2 : Not available

Power measurement with R&S FSH-Z14 and R&S FSH-Z44:

---

Unit 1 : Forward power  
Unit 2 : Reflected power

**Parameter**

DBM | WATT | W | DB | VSWR

DB: if applied to UNIT1, the power is relative to the reference level; if applied to UNIT2, the return loss is displayed.

VSWR: the parameter is only available if applied to UNIT2

**Example**

UNIT1:PMET:POW DBM

If measurement with the R&S FSH-Z1 or R&S FSH-Z18: sets the unit to dBm.

If measurement with the R&S FSH-Z14 or R&S FSH-Z44: sets the unit of forward power to dBm.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.5.3 Setting the Bandwidths

The following commands configure the filter bandwidths of the R&S ETC.

- [CALCulate:PMETer:PRESet:BANDwidth:VIDeo](#)

#### **CALCulate:PMETer:PRESet:BANDwidth:VIDeo**

---

This command sets the video bandwidth for power sensor measurements.

**Parameter**

<numeric value> = video bandwidth in Hz

**Example**

CALC:PMET:PRES:BAND:VID 4 kHz

Sets a 4 kHz video bandwidth.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**12.5.4 Defining the Measurement Time**

The following chapter describes commands to define the measurement time of the power sensor.

- [\[SENSe:\]PMETer:MTIMe](#)

**[SENSe:]PMETer:MTIMe**


---

This command sets the duration of measurements with the power sensor.

**Parameter**

SHORT | NORMAl | LONG

**Example**

PMET:MTIMe SHOR

Sets a short measurement time for power measurements.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**12.5.5 Performing Measurements with the Power Sensor**

The following chapter describes all commands that are available for performing power measurements with the power sensor.

- [CALibration:PMETer:ZERO:AUTO](#)
- [\[SENSe:\]PMETer:DETEctor\[:FUNCTion\]](#)
- [FETch<1...2>:PMETer?](#)
- [CALCulate:PMETer:PRESet\[:STATe\]](#)
- [CALCulate:PMETer:PRESet:SElect](#)

**12.5.5.1 Zeroing of the Power Sensor****CALibration:PMETer:ZERO:AUTO**


---

This commands starts to zero the power sensor.

**Parameter**

ONCE

**Example**

CAL:PMET:ZERO:AUTO ONCE  
Starts to zero the power meter.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.5.5.2 Forward Power Display

Note that the forward power is only available in conjunction with the R&S FSH-Z14 or R&S FSH-Z44.

**[SENSe:]PMETer:DETector[:FUNction]**


---

This command selects the forward power display of the power sensor.

**Parameter**

AVERage    average power  
PENvelope    peak envelope power

**Example**

PMET:DET AVER  
Selects the Average weighting mode.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.5.5.3 Reading Out Measurement Results

**FETch<1...2>:PMETer?**


---

This command queries the results of measurements with the power sensor.

**Return Value**

Measurements with R&S FSH-Z1 or R&S FSH-Z18:

FETch1	Returns the power unit
FETch2	Not available

Measurements with R&S FSH-Z14 or R&S FSH-Z44

FETch1	Forward power
FETch2	Reflected power

**Example**

FET2:PMET?

Returns nothing for R&S FSH-Z1 / R&S FSH-Z18 and the reflected power for R&S FSH-Z14 / Z44.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**12.5.5.4 Selecting a Standard**

These commands apply radio communication standards to measurements with the power sensor.

**CALCulate:PMETer:PRESet[:STATe]**

This command activates and deactivates the usage of a standard for power sensor measurements.

**Parameter**

ON | OFF

**Example**

CALC:PMET:PRES ON

Activates usage of a standard

**Characteristics**

- \* RST value: -

SCPI: device-specific

**Mode**

-

**CALCulate:PMETer:PRESet:SElect**

This command selects the standard for measurements with the power sensor.

**Parameter**

GSM | EDGE | WCDMA | CDMAOne | CDMA2000 | DVBT | DAB | TETRA | USER

**Example**

CALC:PMET:PRES:SEL GSM

Selects the GSM standard for power sensor measurements.

**Characteristics**

\* RST value: -

SCPI: device-specific

**Mode**

-

## 12.6 Saving and Restoring Instrument Settings and Measurement Results

The following commands perform various tasks in the context of file management.

These commands are independent from the operating mode.

**List of Commands**

- [DISPlay:WINDow:STORe](#)
- [MMEMory:LOAD:STATe](#)
- [MMEMory:STORe:STATe](#)
- [MMEMory:CATalog?](#)
- [MMEMory:CDIRectory?](#)
- [MMEMory:CDIRectory](#)
- [MMEMory:COPI](#)
- [MMEMory:DATA](#)
- [MMEMory:DATA?](#)
- [MMEMory:DELeTe](#)
- [MMEMory:FILE](#)
- [MMEMory:FILE:DATE](#)
- [MMEMory:FILE:DATE?](#)
- [MMEMory:FILE:TIME](#)

- [MMEMory:FILE:TIME?](#)
- [MMEMory:INIT](#)
- [MMEMory:MDIRectory](#)
- [MMEMory:MOVE](#)
- [MMEMory:RDIRectory](#)

### DISPlay:WINDow:STORe

---

This command makes a screenshot of the current screen and stores it in a file with the name <file name> in PNG format. The file is stored in the current default directory if no path is set. The default directory can be set with the [MMEMory:CDIRectory](#) command.

This command is an event and therefore has no \*RST value and no query.

#### Parameter

<string> = <file name>

#### Example

DISP:WIND:STOR "SCREEN.PNG"

Creates a "SCREEN.PNG" file in the current default directory.

DISP:WIND:STOR "\Storage Card\Screen Shots\SCREEN.PNG"

Creates a "SCREEN.PNG" file in the directory \Storage Card\Screen Shots\.

#### Characteristics

- \* RST value: -
- SCPI: device-specific

#### Mode

-

### MMEMory:LOAD:STATe

---

This command loads the device settings from \*.set files. The contents of the file are loaded and set as the new device state.

#### Parameter

1, '<file\_name>'

with <file\_name> = DOS file name including path and the extension .set

The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

#### Example

MMEM:LOAD:STAT 1, '\Public\Datasets\TEST01.SET'

Loads the settings from the file TEST01.SET of the internal directory \Public\Datasets\.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:STORe:STATe**

---

This command stores the current device settings in a \*.set file.  
This command is an event and therefore has no \*RST value and no query.

**Parameter**

1,<file\_name>  
with <file\_name> = DOS file name without extension

The file name includes the path and may also include the drive name. The path name complies with DOS conventions.

**Example**

MMEM:STOR:STAT 1,'DATASET001.SET'  
Saves the current device settings in the file DATASET001.SET.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:CATalog?**

---

This command queries the storage information of the memory and lists the files of the current default directory. The default directory can be set with the [MMEMory:CDIRectory](#).

This command is a query and therefore has no \*RST value.

**Parameter**

-

**Return value**

<used\_storage>,<available\_storage>{,<file\_entry>}

String	Description
<used_storage>	used storage in bytes
<available_storage>	available storage in bytes
<file_entry>	<file_name>,<file_type>,<file_size>,<file_date>,<file_time>
<file_name>	string of characters
<file_type>	file extension (part after the last dot in the name)
<file_size>	size of the file in bytes
<file_date>	date of file in format <year>, <month>, <day> The format is NOT influenced by the DISP:DATE:FORM command.
<file_time>	time of file in format <hours>, <minutes>, <seconds>

### Example

MMEM:CAT?

3395584,12517376,BP629MHz,set,70559,2010,01,20,15,10,42,DATASET,SET,  
312656,2010,01,27,14,29,16,Transducer OFF,set,59246,2009,12,21,09,10,52

Used Bytes of this memory: 3395584

Available Bytes of this memory: 12517376

BP629MHz,set,70559,2010,01,20,15,10,42

File name: BP629MHz

File type: set

File size in Bytes: 70559

File date: 2010-01-20

File time: 15:10:10

DATASET,SET,312656,2010,01,27,14,29,16

File name: DATASET

File type: SET

File size in Bytes: 312656

File date: 2010-01-27

File time: 14:29:16

Transducer OFF,set,59246,2009,12,21,09,10,52

File name: Transducer OFF

File type: set

File size in Bytes: 59246

File date: 2009-12-21

File time: :09:10:52.

### Characteristics

- \* RST value: -

SCPI: conform

#### Mode

-

### MMEMory:CATalog:DIRectories?

---

This command queries the storage information of the memory and lists the directories of the current default directory. The default directory can be set with the [MMEMory:CDIRectory](#) command.

This command is a query and therefore has no \*RST value.

#### Parameter

-

#### Example

```
MMEM:CAT:DIR?
84115456,945717248,Test,2010,02,02,17,16,36
```

Used Bytes of this memory: 84115456

Available Bytes of this memory: 945717248

Test,2010,02,02,17,16,36

Directory name: TEST

Directory date: 2010-02-02

File time: 17:16:36.

#### Characteristics

\* RST value: -

SCPI: device-specific

#### Mode

-

### MMEMory:CDIRectory?

---

This command queries the current default directory. The default folder is used for all other MMEMory commands and queries.

#### Parameter

-

#### Example

```
MMEM:CDIR?
```

```
'\Public\Datasets'
```

The current default directory is '\Public\Datasets'.

#### Characteristics

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:CDIRectory**

This command sets the current default directory. The default folder is used for all other MMEMory commands and queries. If the folder does not exist, an error is generated: `.-292, "Referenced name does not exist"`.

**Parameter**

'<directory\_name>' = DOS path name

**Example**

MMEM:CDIR '\Public\Datasets'  
Selects the directory \Public\Datasets.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:COPY**

This command copies the specified source file/folder to the specified destination. If the specified source file/folder does not exist in the current folder, an error is generated: `.-292, "Referenced name does not exist"`. If the specified destination file/folder already exists in the current folder, an error is generated: `.-293, "Referenced name already exists"`. The default directory must be selected before. This command is an event and therefore has no \*RST value and no query.

**Parameter**

'<src\_name>', '<dest\_name>'

String	Description
<src_name>	source file/folder, string of characters (comma not allowed)
<dest_name>	destination file/folder, string of characters (comma not allowed)

**Example**

MMEM:COPY 'test.set','copy\_of\_test.set'

Generates the copy\_of\_test.set file which is identically to the test.set file.

#### Characteristics

- \* RST value: -
- SCPI: conform

#### Mode

-

### MMEMory:DATA

This command creates a new file or overwrites an existing one. The file carries the specified name and is filled with the binary data of <block\_data>.

This command is equivalent to the [MMEMory:FILE](#) command.

#### Parameter

'<file\_name>','<block\_data>

String	Description
<file_name>	file name, string of characters (comma not allowed)
<block_data>	binary data block with the following structure:
	character '#'
	digit for the length of the length information
	indicated number of digits as length information (number of bytes) for the binary data themselves
	binary data with the indicated number of bytes

#### Example

MMEMory:DATA 'limit.txt',#232This is the content of the file.

File name: 'limit.txt'

Next 2 characters are the length indication: #2

Number of subsequent binary data bytes: 32

32 bytes stored as binary data in the file limit.txt: This is the content of the file.

#### Characteristics

- \* RST value: -
- SCPI: conform

#### Mode

-

**MMEMory:DATA?**

This command returns the content of the file <file\_name> as <block>.

**Parameter**

<file\_name> = file name, string of characters (comma not allowed)

String	Description
<block_data>	binary data block with the following structure:
	character '#'
	digit for the length of the length information
	indicated number of digits as length information (number of bytes) for the binary data themselves
	binary data with the indicated number of bytes (block_data)
	binary data with the indicated number of bytes

**Example**

MMEM:DATA? 'limit.txt'

Transfers the content of the file limit.txt from the instrument to the control computer.

#232 This is the content of the file.

Return value: block data

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:DELeTe**

This command deletes the specified file name. If the specified file name does not exist, an error is generated: `.-292, "Referenced name does not exist"`.

**Parameter**

'<file\_name>' = DOS file name

**Example**

MMEM:DEL 'TEST01.SET'

The file TEST01.SET of the current directory is deleted.

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

### MMEMory:FILE

This command creates a new file or overwrites an existing one. The file carries the specified name and is filled with the binary data of <block\_data>. This command is equivalent to the [MMEMory:DATA](#) command.

**Parameter**

<file\_name>[,<block>]

String	Description
<file_name>	file name, string of characters (comma not allowed)
<block_data>	binary data block with the following structure:
	character '#'
	digit for the length of the length information
	indicated number of digits as length information (number of bytes) for the binary data themselves
	binary data with the indicated number of bytes

**Example**

MMEMory:FILE 'limit.txt',#232This is the content of the file.

File name: 'limit.txt'

Next 2 characters are the length indication: #2

Number of subsequent binary data bytes: 32

32 bytes stored as binary data in the file limit.txt: This is the content of the file.

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

### MMEMory:FILE:DATE

This command sets the modification date of the specified file. If the specified file does not exist, an error is generated: `.-292, "Referenced name does not exist"`. If the date is invalid, an execution error `-200,"Execution error"` is generated.

#### Parameter

'<file\_name>',<year>,<month>,<day>

String	Description
<file_name>	file: String of characters (comma not allowed)
<year>	integer number in the range [2000-2099]
<month>	integer number in the range [1,12] (1 = January, 12 = December)
<day>	integer number in the range [1,31]

#### Example

MMEMory:FILE:DATE 'test.txt',2006,12,14  
Sets the date of the file test.txt to December, 14th, 2006.

#### Characteristics

- \* RST value: -
- SCPI: conform

#### Mode

-

#### MMEMory:FILE:DATE?

This command returns the date of the specified file. If the specified file does not exist, an error is generated: `.-292, "Referenced name does not exist"`.

#### Parameter

'<file\_name>' = file name, string of characters (comma not allowed)

#### Example

MMEMory:FILE:DATE? 'test.txt'  
Queries the date of the specified file.  
  
2006,12,14  
Return value: The file test.txt has the date December, 14th, 2006.

#### Characteristics

- \* RST value: -
- SCPI: conform

**Mode**

-

**MMEMory:FILE:TIME**

This command sets the time of the specified file. If the specified file does not exist, an error is generated: `.-292, "Referenced name does not exist"`. If the time is invalid, an execution error `-200,"Execution error"` is generated.

**Parameter**

'<file\_name>',<hours>,<minutes>,<seconds>

String	Description
<file_name>	file name, string of characters (comma not allowed)
<hours>	integer number in the range [0:23]
<minutes>	integer number in the range [0:59]
<seconds>	any number in the range [0:60]

**Example**

MMEMory:FILE:TIME 'test.txt', 22, 23, 24  
Sets the time of the test.txt file to 22:23:24.

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**MMEMory:FILE:TIME?**

This command returns the time of the specified file. If the specified file does not exist, an error is generated: `.-292, "Referenced name does not exist"`.

**Parameter**

<file\_name> = file name, string of characters (comma not allowed)

**Example**

MMEMory:FILE:TIME? 'test.txt'  
Queries the time of the specified file.  
22,23,24.000  
Return value: The time of the file test.txt is 22:23:24

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

**MMEMory:INIT**

---

This command formats the specified memory.

Note: Formatting deletes all data stored on the memory drive

This command is an event and therefore has no \*RST value and no query.

**Parameter**

<directory\_name> = string of characters (comma not allowed)

**Example**

MMEM:INIT

Formats and deletes all data from the indicated memory.

**Characteristics**

- \* RST value: -  
SCPI: conform

**Mode**

-

**MMEMory:MDIRectory**

---

This command creates a new directory in the current directory. If the specified directory name already exists in the current directory, an error is generated: .-293, "Referenced name already exists".

This command is an event and therefore has no \*RST value and no query.

**Parameter**

<directory\_name> = string of characters (comma not allowed)

**Example**

MMEM:MDIR '\Public\MyDir'

Creates the "MyDir" directory on the internal memory.

MMEM:MDIR '\Storage Card\User'

Creates the "User" directory on the storage card

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**MMEMory:MOVE**

This command renames the specified file/folder as specified in the destination name. If the specified file/folder does not exist in the current folder, an error is generated: .-292, "Referenced name does not exist". If the destination name already exists in the current folder, an error is generated: .-293, "Referenced name already exists".

This command is an event and therefore has no \*RST value and no query.

**Parameter**

'<src\_name>', '<dest\_name>'

String	Description
<src_name>	source file/folder, string of characters (comma not allowed)
<dest_name>	destination file/folder, string of characters (comma not allowed)

**Example**

MMEM:MOVE '\Public\Screen Shots', '\Public\PNGs'

Renames the directory Public\Screen Shots to Public\PNGs.

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**MMEMory:RDIRECTory**

This command deletes the specified directory in the current directory. If the specified directory does not exist in the current directory, an error is generated: -292, "Referenced name does not exist".

This command is an event and therefore has no \*RST value and no query.

**Parameter**

'<directory\_name>' = string of characters (comma not allowed)

**Example**

MMEMory:RDIRECTory '\Public\MyDir'

Deletes the "Public\MyDir" directory.

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

## 12.7 Configuring the Instrument

The following commands configure general instrument settings.

These commands are independent from the operating mode.

### 12.7.1 Mode Selection

This chapter describes all commands that select the operating mode of the R&S ETC.

**List of Commands**

- [INSTrument\[:SElect\]](#)
- [INSTrument:NSElect](#)

### 12.7.2 Controlling the GPS Receiver

This chapter describes all commands that control the GPS receiver.

**List of Commands**

- [SYSTem:POSition:GPS\[:STATe\]](#)
- [SYSTem:POSition:GPS:CONNected?](#)
- [SYSTem:POSition:GPS:CORRection:FREQuency?](#)
- [SYSTem:POSition:GPS:QUALity?](#)
- [SYSTem:POSition:GPS:SATellites?](#)
- [SYSTem:POSition:LATitude?](#)
- [SYSTem:POSition:LONGitude?](#)
- [SYSTem:POSition:VALid?](#)
- [SYSTem:GPS:SPEed?](#)
- [SYSTem:GPS:TRACkangle?](#)

**SYSTem:POSition:GPS[:STATe]**

---

This command activates and deactivates the GPS receiver (R&S HA-Z240). Note that the GPS receiver only works if a connection between the R&S ETC and a GPS signal transmitter is established.

**Parameter**

ON | OFF

**Example**

SYST:POS:GPS ON  
 Activates the GPS receiver.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:POStion:GPS:CONNected?**

This command queries if the R&S ETC is currently connected to the GPS receiver (R&S HA-Z240).

**Return value**

0	no connection to a GPS device
1	connection to a GPS device is established

**Example**

SYST:POS:GPS:CONN?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:POStion:GPS:CORRection:FREQUency?**

This command queries the frequency correction factor. This factor is calculated from a reference signal provided by the GPS receiver R&S HA-Z240. The reference signal is used to determine the deviation of the internal clock of the instrument, which can be turned into a correction factor for the measured frequency.

**Return value**

<floating point value>  
 If the GPS receiver is deactivated, this query returns 0.

**Example**

SYST:POS:GPS:CORR:FREQ?

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**SYSTem:POSition:GPS:QUALity?**

---

This command queries the quality of the GPS signal.

**Return value**

INSufficient | LOW | MEDium | HIGH | EXCellent

**Example**

SYST:POS:GPS:QUAL?

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**SYSTem:POSition:GPS:SATellites?**

---

This command queries the number of tracked satellites.

**Return value**

<number of satellites>

**Example**

SYST:POS:GPS:SAT?

**Characteristics**

- \* RST value: -  
SCPI: device-specific

**Mode**

-

**SYSTem:POSition:LATitude?**

---

This command queries the latitude of the current position of the R&S ETC.

**Return value**

<sign><degrees>,<minutes>,<seconds>

<sign>	no sign = east, negative sign (-) = west
<degrees>	degrees of longitude (integer value)
<minutes>	minutes of longitude (integer value)
<seconds>	seconds of longitude (floating point value)

**Example**

SYST:POS:LAT?

Return value would be, for example, 48,7,40.0 for 48°, 7', 40.0" in the northern hemisphere.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:POSition:LONGitude?**

This command queries the longitude of the current position of the R&S ETC.

**Return value**

<sign><degrees>,<minutes>,<seconds>

<sign>	no sign = east, negative sign (-) = west
<degrees>	degrees of longitude (integer value)
<minutes>	minutes of longitude (integer value)
<seconds>	seconds of longitude (floating point value)

**Example**

SYST:POS:LONG?

Return value would be, for example, 11,36,46.2 for 11°, 36', 46.2" East

**Characteristics**

- \* RST value: -

SCPI: device-specific

**Mode**

-

**SYSTem:POSition:VALid?**

This command queries the validity of the position information.

**Return value**

0	The position information is not valid
1	The position information is valid.

**Example**

SYST:POS:VAL?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:GPS:SPEed?**

This command queries the speed over ground in Knots as detected by the GPS.

**Return value**

< Speed over Ground in Knots >

**Example**

SYST:GPS:SPE?

Return value would be, for example, 23.8 Knots

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:GPS:TRACkangle?**

This command queries the Track Angle in degrees True as detected by the GPS.

**Return value**

<Track Angle in degrees True>

**Example**

SYST:GPS:TRAC?

Return value would be, for example, 140.1 degrees True

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

### 12.7.3 Display Configuration

This chapter describes commands to set up the display of the R&S ETC via remote control.

**List of Commands**

- [DISPlay:CMAP](#)
- [DISPlay:CMAP:DEFault](#)
- [DISPlay:DATE:FORMat](#)

#### DISPlay:CMAP

---

This command sets the color scheme of the display to either color or black and white.

**Parameters**

COLor | BW

**Example**

DISP:CMAP BW

Sets the screen colors to black and white

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

#### DISPlay:CMAP:DEFault

---

---

This command resets the screen colors of all display items to their default settings, i.e. to the color scheme.

This command is an event and therefore has no query and no \*RST value.

**Parameters**

-

**Example**

DISP:CMPPA:DEF

Restores the default screen colors

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**DISPlay:DATE:FORMat**

---

This command sets the display date format.

**Parameters**

DDMMyyyy | MMDDyyyy

**Example**

DISP:DATE:FORM DDMMyyyy

**Characteristics**

\* RST value: DDMMyyyy

SCPI: device-specific

**Mode**

-

## 12.7.4 Audio Settings

This chapter describes all commands to control the audio functions of the R&S ETC.

**List of Commands**

- [SYSTem:AUDio:VOLume](#)
- [SYSTem:BEEPer:VOLume](#)
- [SYSTem:BEEPer:KEY:VOLume](#)

**SYSTem:AUDio:VOLume**

---

This command sets the volume of the internal speaker. The range is between 0 and 1, with 1 being the maximum possible volume.

**Parameters**

0 to 1

**Example**

SYST:AUD:VOL 0.40  
Sets the volume to 40%

**Characteristics**

- \* RST value: 0.3 (30%)  
SCPI: device-specific

**Mode**

-

**SYSTem:BEEPer:VOLume**

---

This command sets the volume of the beeper, activated with [CALCulate<1|2>:LIMit<1|2>:BEEP\[:STATe\]](#). The range is between 0 and 1, with 1 being the maximum possible volume.

**Parameters**

0 to 1

**Example**

SYST:BEEP:VOL 0.50  
Sets the volume of the beeper to 50%

**Characteristics**

- \* RST value: 0.6 (60%)  
SCPI: conform

**Mode**

-

**SYSTem:BEEPer:KEY:VOLume**

---

This command sets the volume of the keyboard clicking. The range is between 0 and 1, with 1 being the maximum possible volume.

**Parameters**

0 to 1

**Example**

SYST:BEEP:KEY:VOL 0.10  
Sets of keyboard clicking volume to 10%

**Characteristics**

- \* RST value: 0.3 (30%)
- SCPI: conform

**Mode**

-

## 12.7.5 Setting up a Network Connection

This chapter describes all commands that are used if the R&S ETC is part of a network.

**List of Commands**

- [SYSTem:COMMunicate:LAN:ETHernet?](#)
- [SYSTem:COMMunicate:LAN:SUBMask](#)
- [SYSTem:COMMunicate:SOCKet:ADDRess](#)
- [SYSTem:COMMunicate:SOCKet:DHCP\[:STATe\]](#)
- [SYSTem:COMMunicate:SOCKet:PORT](#)

**SYSTem:COMMunicate:LAN:ETHernet?**

---

This command queries the MAC address of the R&S ETC.  
This command is a query and therefore has no \*RST value.

**Parameters**

-

**Example**

SYST:COMM:LAN:ETC?  
Returns the MAC address

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:COMMunicate:LAN:SUBMask**

---

---

This command sets the IP address of the R&S ETC.

**Parameters**

<string> = subnet mask address

**Example**

```
SYST:COMM:LAN:SUBM '255.255.255.0'
```

Sets the subnet mask address to 255.255.255.0

**Characteristics**

- \* RST value: 255.255.255.0
- SCPI: device-specific

**Mode**

-

**SYSTem:COMMunicate:SOCKet:ADDRess**

---

This command sets the IP address of the R&S ETC.

**Parameters**

<string> = IP address

**Example**

```
SYST:COMM:SOCK:ADDR '172.76.68.30'
```

Sets the IP address of the R&S ETC to 172.76.68.30.

**Characteristics**

- \* RST value: 172.76.68.24
- SCPI: device-specific

**Mode**

-

**SYSTem:COMMunicate:SOCKet:DHCP[:STATe]**

---

This command activates and deactivates the Dynamic Host Configuration Protocol (DHCP).

**Parameters**

ON | OFF

**Example**

SYST:COMM:SOCK:DHCP ON  
 Activates DHCP.

**Characteristics**

- \* RST value: ON
- SCPI: device-specific

**Mode**

-

**SYSTem:COMMunicate:SOCKet:PORT**

---

This command sets the port number for the connection.

**Parameters**

<port\_number>

**Example**

SYST:COMM:SOCK:PORT 1000  
 Sets the port number to 1000.

**Characteristics**

- \* RST value: 5555
- SCPI: device-specific

**Mode**

-

## 12.7.6 System Settings

This chapter describes all commands that define or query general system settings.

**List of Commands**

- [SENSe:]ROSCilator:SOURce
- SYSTem:BNC<1...2>:MODE
- SYSTem:DATE
- SYSTem:ERRor[:NEXT]?
- SYSTem:ERRor:ALL?
- SYSTem:ERRor:CODE[:NEXT]?
- SYSTem:ERRor:CODE:ALL?
- SYSTem:ERRor:COUNt?
- SYSTem:FORMat:IDENT
- SYSTem:HELP:HEADers?
- SYSTem:HELP:SYNTax?
- SYSTem:LANGuage

- [SYSTem:LANGUage:CATalog?](#)
- [SYSTem:POWer:SOURce?](#)
- [SYSTem:POWer:STATus?](#)
- [SYSTem:PRESet:FACTory](#)
- [SYSTem:TIME](#)
- [SYSTem:VERSion?](#)

### **[SENSe:]ROSCilator:SOURce**

---

This command selects the source of the frequency reference oscillator .  
If you use an external reference signal, make sure to connect the signal to the Ext Ref BNC connector of the R&S ETC.

#### **Parameters**

INTernal | EXTernal

#### **Example**

ROSC:SOUR EXT  
Activates external source as reference signal.

#### **Characteristics**

- \* RST value: internal
- SCPI: device-specific

#### **Mode**

-

### **SYSTem:BNC<1...2>:MODE**

---

This command selects the function the BNC socket indicated by the numeric suffix is used for.

#### **Parameters**

REFerence | TRIGger | BIAS | IF3 | IFDac

#### **Example**

SYST:BNC2:MODE BIAS  
Sets the seconds BNC socket to BIAS.

#### **Characteristics**

- \* RST value: BNC 1: TRIGger, BNC 2: IF3
- SCPI: device-specific

#### **Mode**

-

**SYSTem:DATE**

---

This command sets the date for the internal calendar.  
The sequence of entry is year, month, day.

**Parameters**

1980 to 2099, 1 to 12, 1 to 31

**Example**

SYST:DATE 2000,6,1

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:ERRor[:NEXT]?**

---

This command queries the earliest error queue entry and deletes it. The entry consists of an error number and a short description of the error.  
Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.  
This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

STAT:ERR?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:ERRor:ALL?**

---

This command retrieves all entries in the error queue. The entry consists of the error number only.  
Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0

---

is returned.

This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

SYST:ERR:ALL?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:ERRor:CODE[:NEXT]?**

---

This command queries the earliest error queue entry and deletes it. The entry consists of the error number only.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

STAT:ERR:CODE?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:ERRor:CODE:ALL?**

---

This command retrieves all entries in the error queue. The entry consists of the error number only.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.

---

This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

SYST:ERR:CODE:ALL?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:ERRor:COUNT?**

---

This command queries the number of errors currently in the error queue.  
This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

SYST:ERR:COUN?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:FORMat:IDENT**

---

This command sets the response format to the \*IDN? query. This function is intended for re-use of existing control programs together with the R&S ETC.  
This command is a query and therefore no \*RST value.

**Parameters**

LEGacy A \*IDN? returns for example 'Rohde&Schwarz,ETC,105345/014,3.10'  
NEW A \*IDN? returns for example  
'Rohde&Schwarz,ETC,2114.1508K14/105345,3.10'

**Example**

SYST:FORM:IDEN NEW

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:HELP:HEADers?**

---

This command returns a list of all common commands and instrument-control commands and queries implemented in the instrument. This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

SYST:HELP:HEAD?

Returns the syntax of all available commands.

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:HELP:SYNTax?**

---

This command returns the full syntax and all parameters of the specified command. This command is a query and therefore no \*RST value.

**Parameters**

<string> = syntax of command

**Example**

SYST:HELP:SYNT? 'SYST:ERR?'

Returns the full syntax. In this case: 'SYSTem:ERRor[:NEXT]'.

**Characteristics**

- \* RST value: -

SCPI: device-specific

**Mode**

-

**SYSTem:LANGUage**

---

This command queries the remaining power of the battery.  
This command is a query and therefore has no \*RST value

**Parameters**

<language> = string of the language

**Example**

SYST:LANG 'English'  
Sets the system language to English

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:LANGUage:CATalog?**

---

This command lists all available system languages.  
This command is a query and therefore no \*RST value.

**Parameters**

-

**Example**

SYST:LANG:CAT?

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:POWer:SOURce?**

---

---

This command queries whether R&S ETC is battery-powered or line-powered. This command is a query and therefore has no \*RST value.

#### Return value

ADAP	R&S ETC is powered by the mains adapter.
BATT	R&S ETC is powered by the battery.

#### Example

SYST:POW:SOUR?

#### Characteristics

- \* RST value: -
- SCPI: conform

#### Mode

-

#### SYSTem:POWer:STATus?

---

This command queries the remaining power of the battery. This command is a query and therefore has no \*RST value

#### Parameters

-

#### Example

SYST:POW:STAT?

#### Characteristics

- \* RST value: -
- SCPI: conform

#### Mode

-

#### SYSTem:PRESet:FACTory

---

This command initiates an instrument reset back to factory settings.

#### Parameters

-

**Example**

SYST:PRES:FACT

Resets the R&S ETC to its factory settings.

**Characteristics**

- \* RST value: -
- SCPI: device-specific

**Mode**

-

**SYSTem:TIME**

---

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no \*RST value.

**Parameters**

0 to 23, 0 to 59, 0 to 59

**Example**

SYST:TIME 12,30,30

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**SYSTem:VERSion?**

---

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no \*RST value.

**Parameters**

-

**Example**

SYST:VERS?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

## 12.8 Status Reporting System

The status reporting system (Fig. 12-2) stores all information on the present operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via Ethernet.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUEStionable which are defined by SCPI and contain detailed information on the instrument.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB.

### 12.8.1 Structure of an SCPI Status Register

Each standard SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (Fig. 12-1). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number that applies to all five parts. For example, bit 0 of the STATus:OPERation register is assigned to the calibration status of the R&S ETC. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.

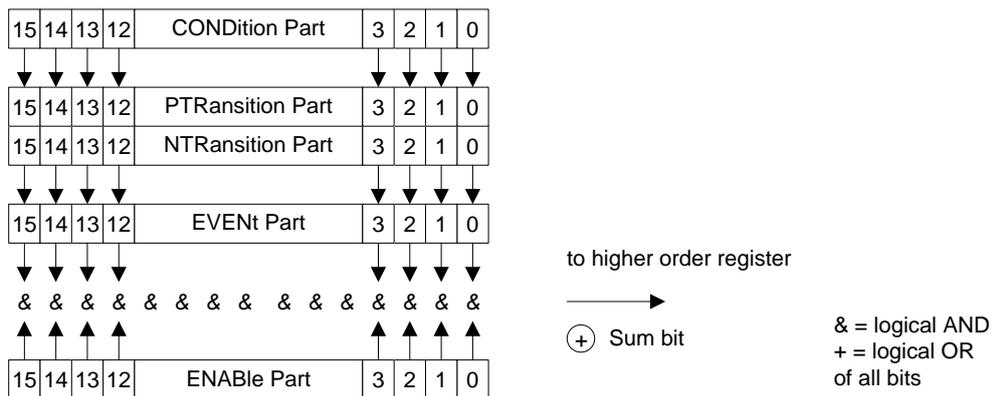


Fig. 12-1: The status-register model

**CONDition part**

The CONDition part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

**PTRansition part**

The positive TRansition part acts as an edge detector. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENT bit is set to 1.

PTR bit =1: the EVENT bit is set.

PTR bit =0: the EVENT bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

**NTRansition part**

The negative TRansition part also acts as an edge detector. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENT bit is set to 1.

NTR-Bit = 1: the EVENT bit is set.

NTR-Bit = 0: the EVENT bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENT part.

**EVENT part**

The EVENT part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.

**ENABLE part**

The ENABLE part determines whether the associated EVENT bit contributes to the sum bit (see below). Each bit of the EVENT part is ANDed with the associated ENABLE bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an OR function (symbol '+').

ENABLE-Bit = 0: the associated EVENT bit does not contribute to the sum bit

ENABLE-Bit = 1: if the associated EVENT bit is "1", the sum bit is set to "1" as well.

This part can be written into and read by the user at will. Its contents is not affected by reading.

### Sum bit

As indicated above, the sum bit is obtained from the EVENT and ENABLE part for each register. The result is then entered into a bit of the CONDITION part of the higher-order register.

The instrument automatically generates the sum bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request throughout all levels of the hierarchy.



The service request enable register SRE defined in IEEE 488.2 can be taken as ENABLE part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABLE part of the ESR.

---

## 12.8.2 Overview of the Status Register

The following figure shows the status registers used by the R&S ETC base unit. The status registers used by the R&S ETC options are described in separate sections at the end of this chapter.

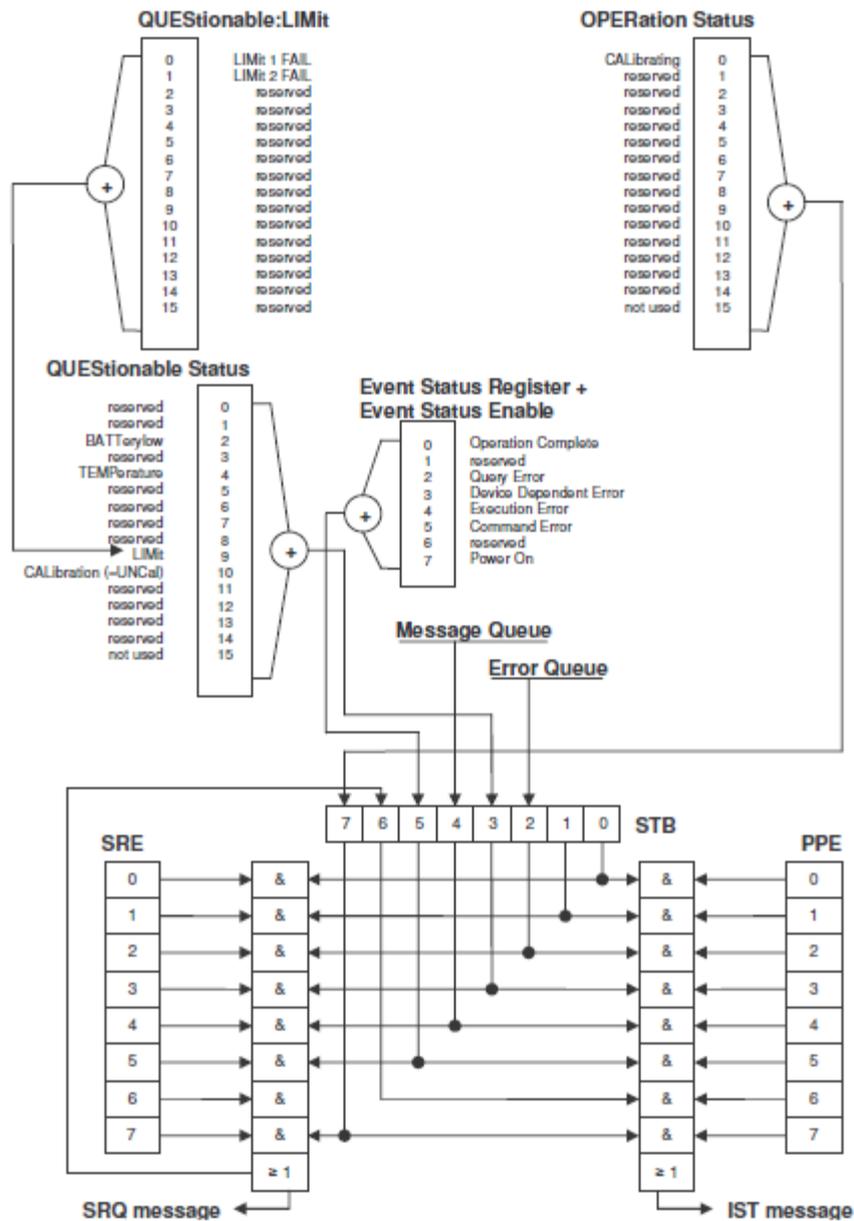


Fig. 12-2: Overview of the status registers

### 12.8.3 Status Byte (STB) & Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDITION part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STATUS BYTE is read using the command `"*STB?"` or a serial poll.

The STB is linked to the SRE. The latter corresponds to the ENABLE part of the SCPI registers in its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there. The SRE can be set using the command "**\*SRE**" and read using the command "**\*SRE?**"

**Table 12-1: Meaning of the bits used in the Status Byte**

Bit No.	Meaning
0 to 1	Not used
2	<p>Error Queue not empty</p> <p>The bit is set when an entry is made in the error queue.</p> <p>If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.</p>
3	<p>QUESTIONable status sum bit</p> <p>The bit is set if an EVENT bit is set in the QUESTIONable: status register and the associated ENABLE bit is set to 1.</p> <p>A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUESTIONable status register.</p>
4	<p>MAV bit (message available)</p> <p>The bit is set if a message is available in the output buffer which can be read.</p> <p>This bit can be used to enable data to be automatically read from the instrument to the controller.</p>
5	<p>ESB bit</p> <p>Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register.</p> <p>Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.</p>
6	<p>MSS bit (master status summary bit)</p> <p>The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.</p>
7	<p>OPERation status register sum bit</p> <p>The bit is set if an EVENT bit is set in the OPERation status register and the associated ENABLE bit is set to 1.</p> <p>A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.</p>

## 12.8.4 Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENT part of a SCPI register. The event status register can be read out using command \*ESR?.

The ESE is the associated ENABLE part. It can be set using the command \*ESE and read using the command \*ESE?.

**Table 12-2: Meaning of the bits in the event status register**

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	Not used
7	Power On (supply voltage on) This bit is set on switching on the instrument.

### 12.8.4.1 STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENT part, information on which actions the

instrument has executed since the last reading. It can be read using the commands `STATus:OPERation:CONDition?` or `STATus:OPERation[:EVENT]?`.

**Table 12-3: Meaning of the bits in the STATus:OPERation register**

Bit No.	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 14	Not used
15	This bit is always 0.

### 12.8.4.2 STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands `STATus:QUEStionable: CONDition?` and `STATus:QUEStionable[:EVENT]?`.

**Table 12-4: Meaning of bits in STATus:QUEStionable register**

Bit No.	Meaning
0 to 1	These bits are not used.
2	BATTERY LOW If the instrument is running without any external power supply and the charging level of the internal battery is approximately lower than 5% this bit is set to indicate that the system will be shut down automatically in approx. 5 minutes.
3	Not used
4	TEMPerature This bit is set if a questionable temperature occurs.
5 to 8	Not used
9	LIMit (device-specific) This bit is set if a limit value is violated
10	CALibration The bit is set if a measurement is performed unaligned (label UNCAL)
11 to 14	Not used
15	This bit is always 0.

### 12.8.4.3 STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read using the commands STATus:QUEStionable:LIMit:CONDition? and STATus:QUEStionable:LIMit[:EVENT]?

**Table 12-5: Meaning of bits in STATus:QUEStionable:LIMit register**

Bit No.	Meaning
0	<b>LIMit 1 FAIL.</b> This bit is set if limit line 1 is violated.
1	<b>LIMit 2 FAIL.</b> This bit is set if limit line 2 is violated.
2 to 14	Not used
15	This bit is always 0.

### 12.8.5 Application of the Status Reporting Systems

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following.

#### Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from Fig. 1-4, an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The ENABLE parts of the status registers can be set so that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

#### Example

*Use of the \*OPC command to generate an SRQ at the end of a sweep.*

```
CALL InstrWrite(analyzer, "*ESE 1")
```

```
'Set bit 0 in the ESE (Operation Complete)
```

```
CALL InstrWrite(analyzer, "*SRE 32")
```

```
'Set bit 5 in the SRE (ESB)?
```

*After its settings have been completed, the instrument generates an SRQ.*

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument in a way that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

### **Serial Poll**

In a serial poll, just as with command \*STB, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is IBRSP(). Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

### **Query by Means of Commands**

Each part of any status register can be read by means of queries. The individual commands are listed in the description of the STATus Subsystem. The returned value is always a number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

### **Error Queue Query**

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages that can be displayed via manual operation using the setup menu or queried via remote control using the command SYSTem:ERRor?. Each call of SYSTem:ERRor? provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

## 12.8.6 Reset Values of the Status Reporting System

Table 12-6 contains the different commands and events causing the status reporting system to be reset. None of the commands, except \*RST and SYSTem:PRESet, influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 12-6: Resetting the status reporting system

Event	Switching on supply voltage		SCL, SDC			
	0	1				
Effect	Power-on-status-clear		(Device clear, selected device clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Clear STB,ESR	0	1	---	---	---	yes
Clear SRE,ESE	---	yes	---	---	---	---
Clear PPE	---	yes	---	---	---	---
Clear EVENT parts of the registers	---	yes	---	---	---	yes
Clear ENABLE parts of all OPERation and QUEStionable registers; Fill ENABLE parts of all other registers with "1".	---	yes	---	---	yes	---
Fill PTRansition parts with "1"; Clear NTRansition parts	---	yes	---	---	yes	---
Clear error queue	yes	yes	---	---	---	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	---	---	---

1) Every command being the first in a program message, i.e., immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

## 12.8.7 Remote Commands of the Status Reporting System

The following commands control the status-reporting system. \*RST does not influence the status registers.

The OPERation status register contains information about the calibration status of the instrument.

The QUEStionable status register contains information about the status of the reference and local oscillator, possible overloads of the instrument and the status of limit checks and limit margins.

The commands are independent from the operating mode.

### List of Commands

- STATus:PRESet
- STATus:QUEue[:NEXT]
- STATus:OPERation[:EVENT]?
- STATus:OPERation:CONDition?
- STATus:OPERation:ENABle
- STATus:OPERation:NTRansition
- STATus:OPERation:PTRansition
- STATus:QUEStionable[:EVENT]?
- STATus:QUEStionable:CONDition?
- STATus:QUEStionable:ENABle
- STATus:QUEStionable:NTRansition
- STATus:QUEStionable:PTRansition

### STATus:PRESet

This command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABle part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e. all events in these registers are not passed on.

#### Parameters

-

#### Example

STAT:PRES

#### Characteristics

\* RST value: -

SCPI: conform

#### Mode

-

### STATus:QUEue[:NEXT]

This command returns the earliest entry to the error queue and deletes it. Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "no error", is returned. This command is identical with the command SYSTem:ERRor.

**Parameters**

-

**Example**

STAT:QUE?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**STATus:OPERation[:EVENT]?**

---

This command queries the contents of the EVENT section of the STATus:OPERation register. The contents of the EVENT section are deleted after readout.

**Parameters**

-

**Example**

STAT:OPER?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**STATus:OPERation:CONDition?**

---

This command queries the CONDition section of the STATus:OPERation register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

**Parameters**

-

**Example**

STAT:OPER:COND?

**Characteristics**

- \* RST value: -

SCPI: conform

**Mode**

-

**STATus:OPERation:ENABLE**

---

This command sets the bits of the ENABLE section of the STATus:OPERation register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

**Parameters**

0 to 65535

**Example**

STAT:OPER:ENAB 65535

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**STATus:OPERation:NTRansition**

---

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

**Parameters**

0 to 65535

**Example**

STAT:OPER:NTR 65535

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**STATus:OPERation:PTRansition**

---

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

**Parameters**

0 to 65535

**Example**

STAT:OPER:PTR 65535

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**STATus:QUEStionable[:EVENT]?**

---

This command queries the contents of the EVENT section of the STATus:QUEStionable register. The contents of the EVENT section are deleted after readout.

**Parameters**

-

**Example**

STAT:QUES?

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

**STATus:QUEStionable:CONDition?**

---

This command queries the CONDition section of the STATus:QUEStionable register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

**Parameters**

-

**Example**

STAT:QUES:COND?

**Characteristics**

- \* RST value: -

SCPI: conform

**Mode**

-

**STATus:QUEStionable:ENABle**

---

This command sets the bits of the ENABle section of the STATus:QUEStionable register. The ENABle register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

**Parameters**

0 to 65535

**Example**

STAT:QUES:ENAB 65535

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**STATus:QUEStionable:NTRansition**

---

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 1 to 0 for the transitions of the CONDition bit.

**Parameters**

0 to 65535

**Example**

STAT:QUES:NTR 65535

**Characteristics**

\* RST value: -

SCPI: conform

**Mode**

-

**STATus:QUEStionable:PTRansition**

---

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for the transitions of the CONDition bit.

**Parameters**

0 to 65535

**Example**

STAT:QUES:PTR 65535

**Characteristics**

- \* RST value: -
- SCPI: conform

**Mode**

-

# 13 Conventions Used in the Documentation

The following conventions are used throughout the R&S ETC User Manual:

## Typographical conventions

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

## Other conventions

- **Remote commands:** Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.
- **Procedure descriptions:** When describing how to operate the device, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described, where available. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the keys on the device or the on-screen keyboard is only described if it deviates from the standard operating procedures as described in the Quick Start Guide under "Basic Operations".

The terms "**select**" and "**press**" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, or a key on the device or on a keyboard.

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