R&S® PR100
Portable Receiver
Manual

Manual

ROHDE&SCHWARZ

Version history

Version	Publication date	Describes firmware version	Comment
03	2 July 2009	2.0	
04 DE	15 December 2009	2.1	
04 EN	15 December 2009	2.1	

The following abbreviations are used throughout this manual:
R&S® PR100 is abbreviated as R&S PR100.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

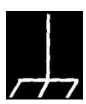
All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance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

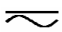
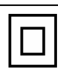
Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are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

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

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

Symbols and safety labels

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

					
ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

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

⚠ DANGER	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	indicates the possibility of incorrect operation which can result in damage to the product. In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

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

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

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

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

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

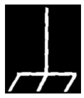
El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas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

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

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

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

Símbolos y definiciones de seguridad

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

					
Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

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

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

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

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

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

1 Content

2 Quality Certificate

Dear Customer,

Thank you for purchasing a Rohde & Schwarz product.

This product is manufactured using state-of-the-art production methods. It is developed, produced and tested in accordance with the rules of our Quality Management System. The Rohde & Schwarz Quality Management System is ISO 9001 certified.

Certified Quality System

ISO 9001

DQS REG. NO 1954-04

3 CE Certificate

Note:
The applicable CE standards are fulfilled only under the following operating conditions:

- The connecting cable for the DC supply voltage must be shorter than 3 m.
- Direct operation of the R&S PR100 from the onboard DC power supply system of an aircraft is prohibited.

The receiver may not be operated if these conditions are not fulfilled.

ROHDE&SCHWARZ

KONFORMITÄTSERKLÄRUNG gemäß dem Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)
DECLARATION OF CONFORMITY in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/EC (R&TTE Directive)

CE

Zertifikat-Nr.:/ Certificate No.: 2008-05

Hiermit wird bescheinigt, dass die Funkanlage
This is to certify that the Radio equipment

Gerätetyp Equipment Type	Materialnummer Stock No	Benennung Designation
PR100	**4071.9006.02**	**Portable Receiver 9 kHz - 7.5 GHz**

Geräteklasse: / Equipment class: 1 7 (Receive-only radio equipment)

bei bestimmungsgemäßer Verwendung den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des FTEG (Artikel 3 der R&TTE) entspricht.
complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive) when used for its intended purpose.

- Gesundheit und Sicherheit gemäß § 3 (1) 1. (Artikel 3 (1) a))
- Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a))
- Schutzanforderungen in Bezug auf die elektromagn. Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))
- Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))
- Maßnahmen zur effizienten Nutzung des Funkfrequenzspektrums
- Measures for the efficient use of the radio frequency spectrum
- Luftschnittstelle bei Funkanlagen gemäß § 3(2) (Artikel 3(2))
- Air interface of the radio systems pursuant to § 3(2) (Article 3(2))

Angewendete harmonisierte Normen: Harmonised standards applied:	EN 61010-1 : 2001 ETSI EN 301489-1 V1.6.1 (2005-09) ETSI EN 301489-22 V1.3.1 (2003-11) EN 55022:1998+A1:2000+A2:2003, Klasse B
Einhaltung der grundlegenden Anforderungen auf andere Art und Weise (hierzu verwendete Standards/Spezifikationen): Other means of proving conformity with the essential requirements (standards/specifications used):	EN 300339 V1.1.1 (1998-06)

Anbringung des CE-Zeichens ab: 2008 / Affixing the EC conformity mark as from 2008

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

München, den 6. Februar 2008
Munich, 2008-02-06

Zentrales Qualitätsmanagement MF-QZ / Radde
Central Quality Management

4 Support Center Address

Should you have any questions regarding this Rohde & Schwarz instrument, please call our Support Center hotline at Rohde & Schwarz Vertriebs-GmbH.

Our team will be happy to answer your questions and work with you to find a solution.

The hotline is open Monday to Friday between 8 a.m. and 5 p.m (Central European Time).

Should you wish to contact us outside normal business hours, please leave a voice message or send us a fax or email. We will contact you as soon as possible.

If you would like to receive information on modifications and updates for a specific instrument, please send us a short email stating which instrument. We will ensure that you regularly receive the latest information.

Support Center

Tel: +49 180 512 42 42
Fax: +49 89 41 29 137 77
Email: CustomerSupport@rohde-schwarz.com

5 Functioning of the R&S®PR100

Frontend

Starting from the antenna socket, the frequency in the signal path is limited to 8 GHz. Signal processing then takes place in three paths for three different frequency ranges. Signals from 9 kHz to 30 MHz are routed via a preamplifier directly to the A/D converter. Signals from 20 MHz to 3.5 GHz are fed to the IF section via a preselection and a preamplifier, or via an attenuator pad in the case of high signal levels. The preselection as well as the attenuator pad effectively protect the IF section against overloading. This is particularly important in this frequency range, where the maximum signal sum levels occur. Signals from 3.5 GHz to 8 GHz are fed to the IF section via a preamplifier. The three-stage IF section processes the signals from 20 MHz to 8 GHz for the subsequent A/D converter. To provide optimum instrument performance, only signals up to 7.5 GHz are processed in the subsequent stages. The uncontrolled 21.4 MHz IF can also be tapped ahead of the A/D converter via a BNC socket of the R&S®PR100 for further external processing.

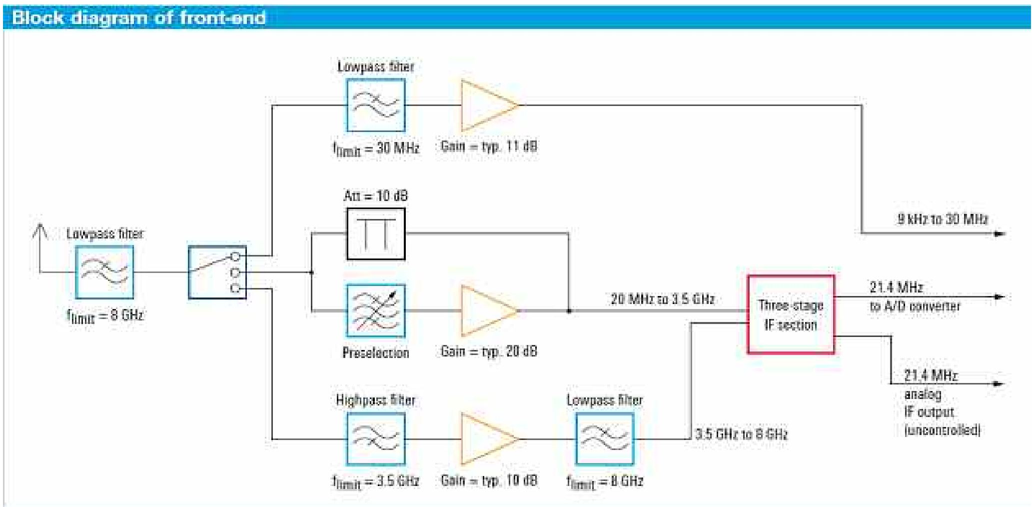


Fig. 5-1: Block diagram, frontend

Digital signal processing

Following A/D conversion of the received signal, the signal path splits: The IF spectrum is computed via a digital downconverter (DDC), a digital bandpass filter and the FFT block. The user can set the bandwidth of the bandpass filter in a range from 1 kHz to 10 MHz. Before the IF spectrum is output on the display or via the LAN interface, results are postprocessed by means of the AVERAGE, MIN HOLD or MAX HOLD function as selected by the user. The second DDC and bandpass filter are used to prepare the signal for level measurement or demodulation. To process the different signals with the optimum signal-to-noise ratio, the receiver contains IF filters with bandwidths from 150 Hz to 500 kHz, which can be selected independently of the IF bandwidth.

Prior to the level measurement, the magnitude of the level is determined and weighted by means of the AVERAGE, MAX PEAK, RMS or SAMPLE function, as selected by the user. Next, the measured level is output via the display or the LAN interface. For the demodulation of analog signals, the complex baseband data is subjected to automatic gain control (AGC) or manual gain control (MGC) after the bandpass filter. It is then fed to the AM, FM, USB, LSB, ISB, pulse or CW demodulation stage. The complex baseband data (I/Q data) representing the digitized signal is output directly following the AGC/MGC block via the LAN interface.

The results that are obtained are available in digital format and can be output as required via the LAN interface. Digital audio data are reconverted to analog signals for output via the loudspeaker.

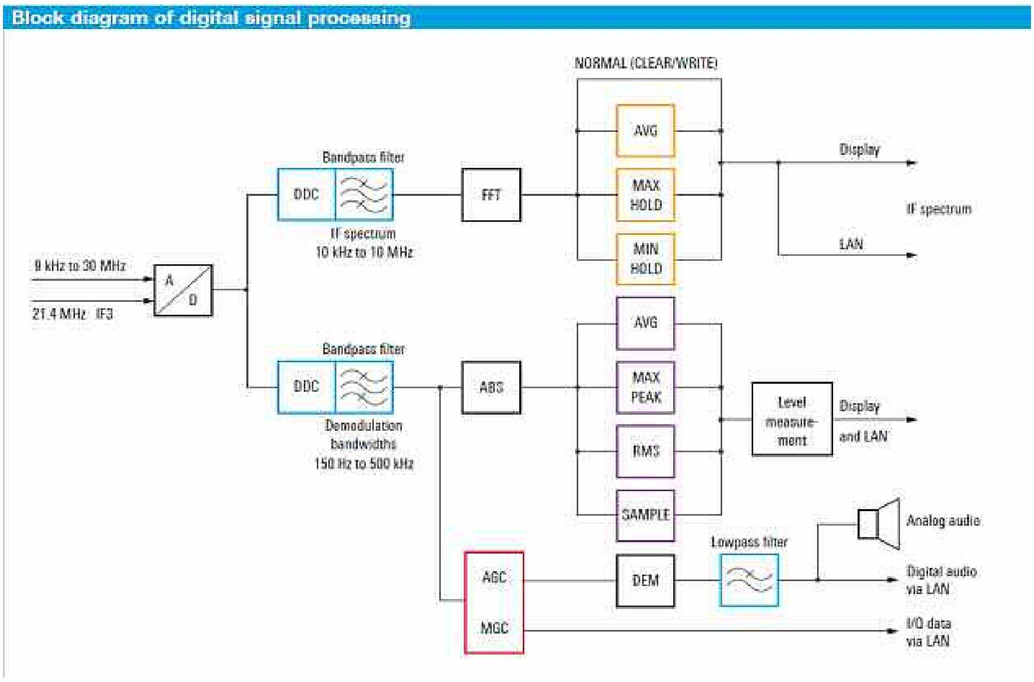


Fig. 5-2: Block diagram, digital signal processing

High receiver sensitivity, high signal resolution

The R&S® PR100 features an IF bandwidth of up to 10 MHz. This allows even very short signal pulses to be detected since the receiver displays the large bandwidth of 10 MHz in a single spectrum about the set center frequency without any scanning required. The widest IF bandwidth of 10 MHz yields the widest spectral display; the narrowest IF bandwidth of 1 kHz yields maximum sensitivity. The IF spectrum is digitally calculated by means of a fast Fourier transform (FFT). Usage of FFTs in the IF stage has a significant benefit: Significantly more sensitive and higher-resolution reception compared to conventional analog receivers with the same spectral bandwidth.

IF spectrum

For example, if the setting $B_{IF\ spectrum}$ = 10 kHz is chosen for sensitive signal reception, the following steps will occur schematically in the FFT computation of the IF spectrum: Due to the finite edge steepness of the IF filter, the sampling rate f_S must be greater than the selected IF spectrum bandwidth $B_{IF\ spectrum}$. The quotient of the sampling rate and the IF bandwidth is thus a value > 1 and is a measure of the edge steepness of the IF filter.

This relationship is expressed by the following two formulas:

$$\frac{f_s}{B_{IF-Spectrum}} = const$$

or

$$f_s = B_{IF-Spectrum} * const$$

The value of the constant is dependent on the selected IF bandwidth, i.e. it may vary as a function of the IF bandwidth. For an IF bandwidth of
$B_{IF\ spectrum}$ = 10 kHz, this constant is equal to 1.28. In order to display an IF spectrum that is 10 kHz wide, a sampling rate of f_S = 12.8 kHz is thus required. The R&S®PR100 uses a standard FFT length N of 2048 points to generate the IF spectrum. To calculate these points, the 12.8 kHz sampling band in the above example is divided into 2048 equidistant frequency slices, which are also referred to as bins (see figure "Signal processing for IF spectrum"). The bandwidth BW_{bin} of the frequency slices is obtained as follows:

$$BW_{Bin} = \frac{f_S}{2048} = \frac{12{,}8kHz}{2048} = 6{,}25Hz$$

This means that in the above example only the calculated bandwidth of 6.25 Hz for each bin has to be taken into account as the noise bandwidth in the calculation of the displayed average noise floor (DANL) in accordance with the formula below (the effect of the window function (Blackman window) of the FFT is not considered here for simplicity's sake):

DANL = –174 dBm + NF + 10 · log(BW_{bin}/Hz)

The quantity NF represents the overall noise figure of the receiver. The above example shows that, due to the use of the FFT, the actual resolution bandwidth (RBW) to be taken into account in DANL calculation is clearly smaller (i.e. BW_{bin}) than would be expected for the wide display range of 10 kHz. Another advantage of the high spectral resolution used in the FFT calculation is that signals located close together (e.g. f_1, f_2, f_3) can be detected and represented in the IF spectrum as discrete signals (see figure "Signal display in IF spectrum"). If, comparable to the operation of an analog receiver, a resolution bandwidth equal to the set IF bandwidth was selected (RBW = BWIF spectrum), a sum signal f_{sum} would be displayed instead of the three discrete signals f_1, f_2 and f_3.

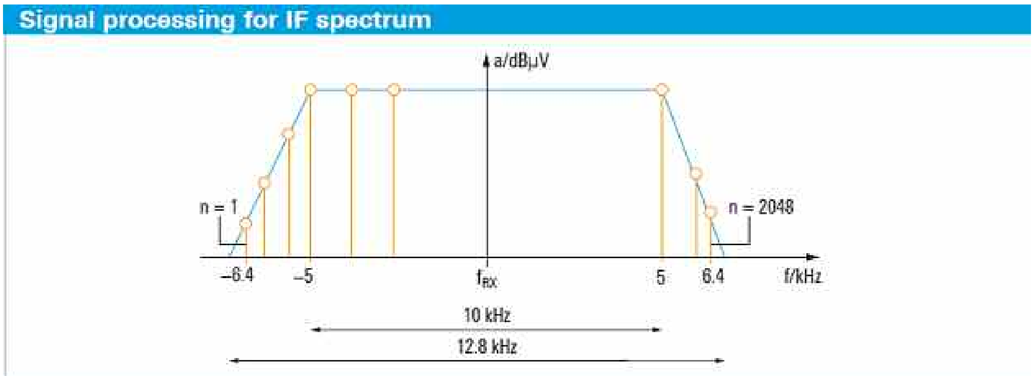


Fig. 5-3: Actual sampling bandwidth compared with selected IF bandwidth

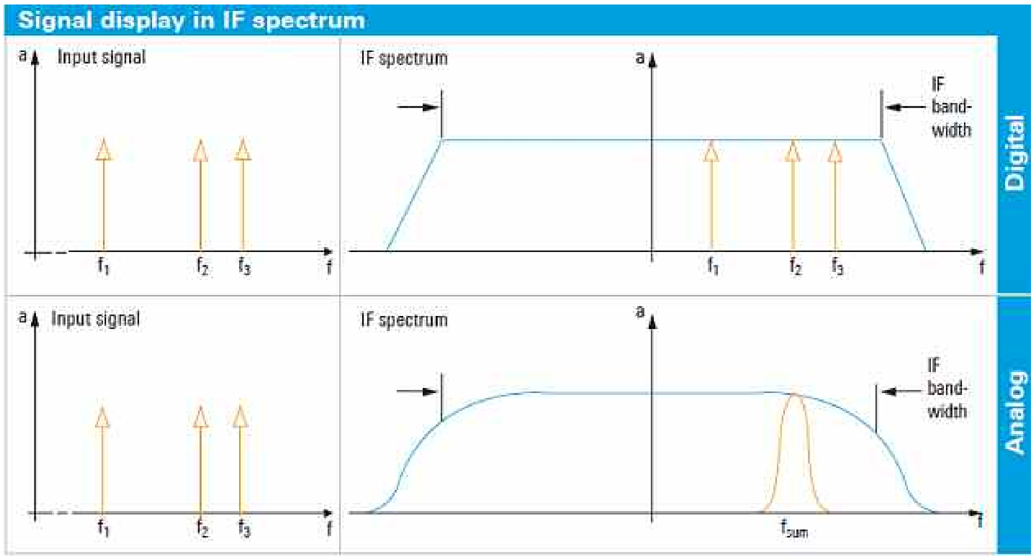


Fig. 5-4: Signal resolution in the IF spectrum with digital and analog receiver concept

Panorama scan

The receiver's maximum FFT bandwidth of 10 MHz makes it possible to perform extremely fast scans across a wide frequency range (panorama scan). For this purpose, frequency windows of max. 10 MHz width are linked in succession, and thus the complete, predefined scan range is traversed (see figure "Signal processing in panorama scan mode"). Analogous to the IF spectrum, an FFT is used to process the broad window with a finer resolution. The width of the frequency windows and the FFT length (number of FFT points) are variable and are selected by the receiver. In the panorama scan mode, the user can select among 12 resolution bandwidths from 125 Hz to 100 kHz. The resolution bandwidth corresponds to the width of the frequency slices (bin width) mentioned under "IF spectrum" above. Based on the selected bin width and the start and stop frequency, the R&S®PR100 automatically determines the required FFT length and the width of the frequency windows for each scan step. The receiver selects these internal parameters so that the optimum scan speed is achieved for each resolution bandwidth (see figure "Resolution in panorama scan mode").

In panorama scan mode, the resolution bandwidth of 100 kHz yields the maximum scan speed, while the resolution bandwidth of 125 Hz yields maximum sensitivity. The resolution bandwidth (bin width) for the panorama scan (selectable between 125 Hz and 100 kHz) therefore corresponds to the resolution bandwidth used in the DANL calculation (see "IF spectrum" above), and can thus be used for calculating the DANL for the panorama scan. Moreover, the user selects the resolution bandwidth to obtain the desired frequency resolution (see figure "Bin width and channel spacing").

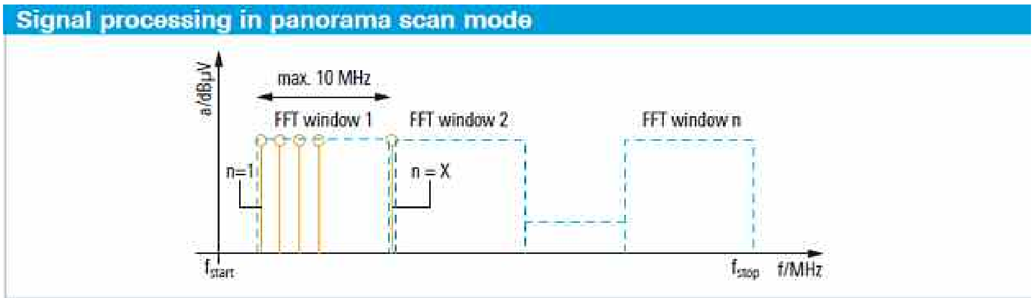


Fig. 5-5: Basic sequence of steps in fast panorama scan mode

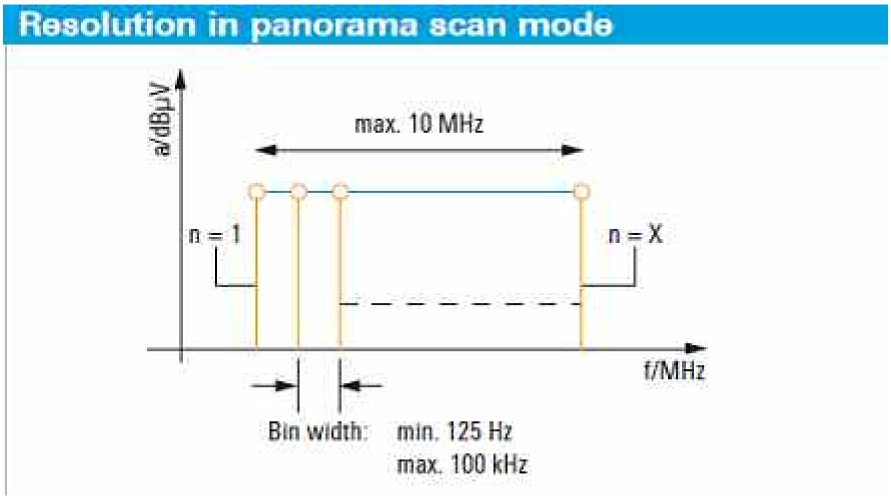


Fig. 5-6: Selection of resolution for panorama scan by varying the bin width

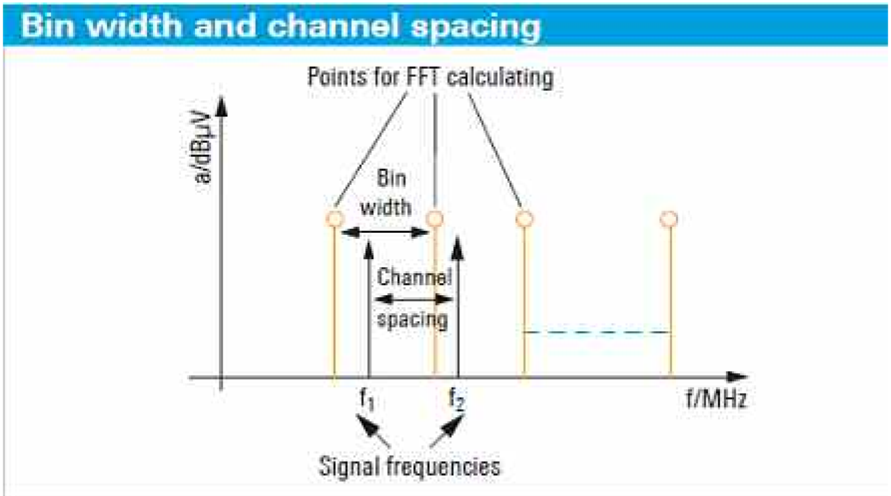


Fig. 5-7: Selection of 12.5 kHz bin width to capture a radio service using 12.5 kHz channel spacing

6 Initial Operation

Front view

Fig. 6-1: R&S PR100 front view

1 AUX2 / Ext. Ref. / IF interfaces	8 Input keys
2 LAN and USB connector	9 Unit keys
3 Softkeys	10 Cursor keys
4 Function keys	11 Keyboard lock
5 Function keys	12 Rotary knob
6 (Alpha)numeric keypad	13 Memory access keys
7 Electrical signal, rising edge / on-off switch	14 SD card slot

Top view

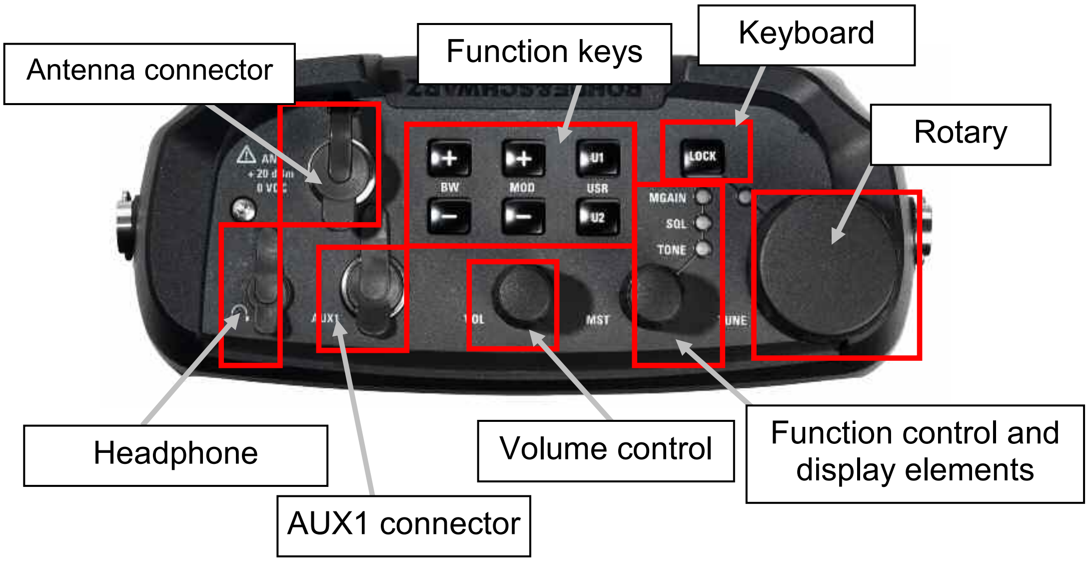


Fig. 6-2: R&S PR100 top view

The following section describes how to set up the instrument and how to connect external devices including the charger.

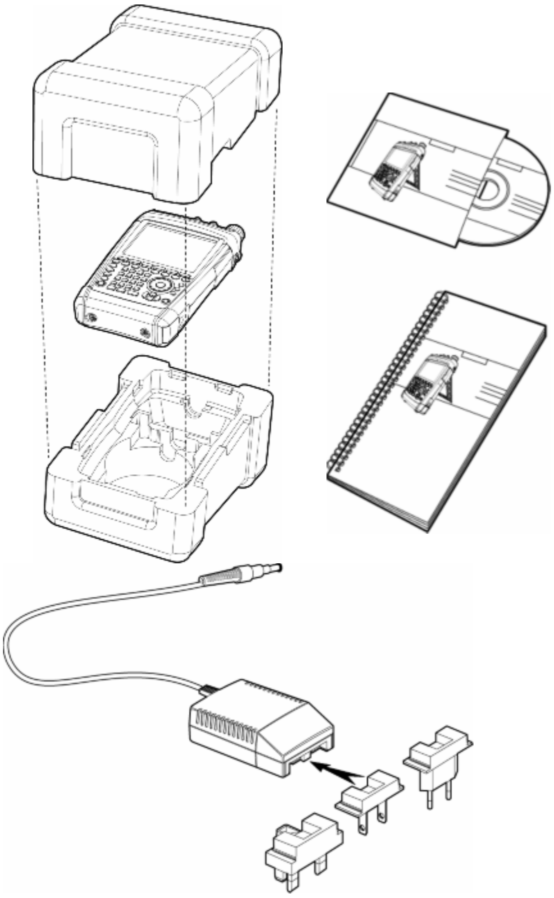
Afterwards, some typical application examples are discussed with screenshots provided for context.

Unpacking the instrument

The R&S® PR100 is shipped in a form-fitted package consisting of a top shell and a bottom shell. The two shells are held together by a sleeve around the package.

All of the supplied accessories are contained in the package.

- Open the sleeve to unpack the instrument.
- Remove the R&S® PR100 and the accessories.
- Remove the plastic film used to protect the screen.



Setting up the instrument

The R&S® PR100 portable monitoring receiver is designed for stationary operation as well as for operation in a vehicle or for especially portable operation.

For any operating scenario, the instrument can be set up for optimum operation and viewing angle of the display.

When used as a desktop instrument, the R&S® PR100 can either be placed flat on the table, or an optimal viewing angle from the front can be obtained by extending the folding support on the rear.

For portable operation, it is recommended to use the receiver with the chest carrying support. This enables good access to all of the controls as well as optimum viewing of the display.

For any operating scenario, the instrument can be set up for optimum operation and viewing angle of the display.

When used as a desktop instrument, the R&S® PR100 can either be placed flat on the table, or an optimal viewing angle from the front can be obtained by extending the folding support on the rear.

Inserting the battery

The R&S® PR100 is equipped with a lithium ion battery.

The HA-Z206 battery pack has a charging capacity of 6.75 Ah.

The battery is inserted at the bottom on the right side of the instrument.

To do this, the cover must be pulled down to release it and then lifted up to open it.

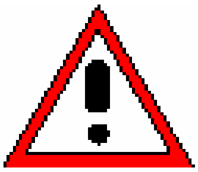
When the instrument is shipped, the battery is NOT installed in the R&S® PR100. It must be inserted into the instrument to begin operation.

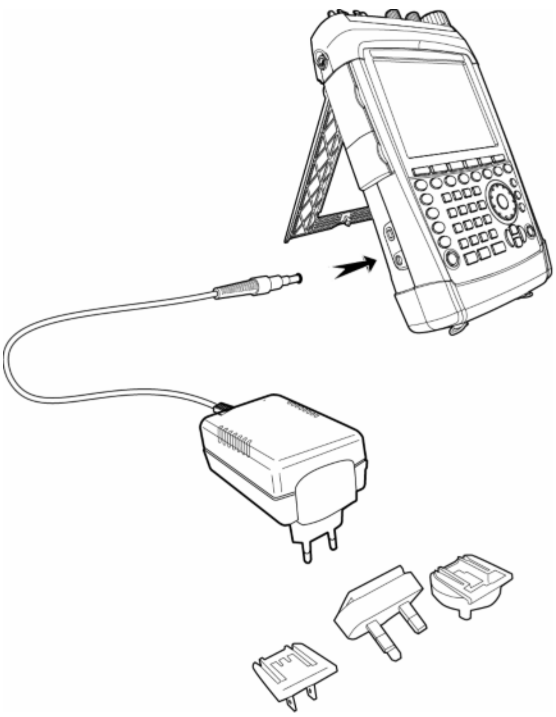
Connecting to the power supply

The R&S® PR100 can be operated using the supplied power supply or from the internal battery. When fully charged, the built-in lithium ion battery permits approx. 3.5 hours of operation. The battery provided for the R&S® PR100 might be uncharged when the instrument is received. Should you wish to use it without an AC power connection, you will therefore need to charge it. If the instrument is switched off, the charging time is approx. four hours. When powered from the AC line, the R&S® PR100 simultaneously charges the internal battery. Insert the power adapter plug into the POWER ADAPTER socket on the left-hand side of the instrument until it clicks into place. Then connect the adapter to the AC power socket..

The adapter voltage range is 100 V to 240 V AC / 50 Hz to 60 Hz.

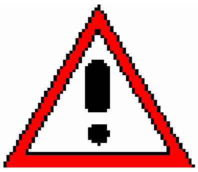
The DC voltage supply range for the R&S® PR100 is equal to +15 V DC +/-10%, max. 2 A.

Caution! 	The supplied R&S® HA-Z201 power supply may be used only for operation or for charging the battery from the AC line. Prior to usage, ensure that the AC voltage corresponds to the voltage indicated on the power supply. Attach the proper adapter to the power supply before plugging it into the AC power. The R&S® HA-Z201 power supply may be operated only within its permissible temperature range from 0°C to 40°C. Outside of this temperature range, an external DC power supply must be used. **The external DC power supply must comply with IEC / EN / UL / CSA 60950-1 or IEC / EN / UL / CSA 61010-1 (applicable current versions).**



Charging the battery

The R&S® PR100 is equipped with a lithium ion battery. With the battery fully charged at room temperature, the operating time is approx. 3.5 hours.

Caution! 	The battery is not fully charged when the R&S® PR100 is shipped from the factory. It must be charged during setup of the instrument.

When stored for a longer period of time, the battery charge will diminish on its own. Make sure to charge the battery prior to longer periods of operation without AC power.

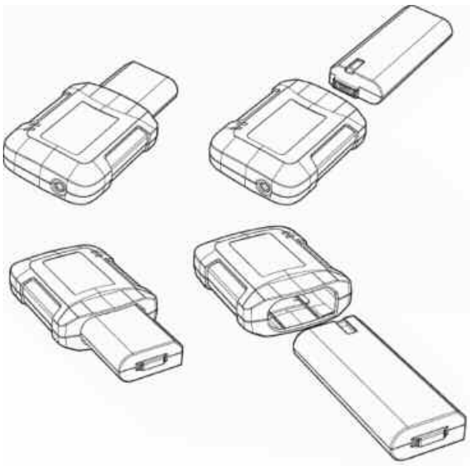
The instantaneous charge status for the battery pack is shown on the instrument's display at the top right.

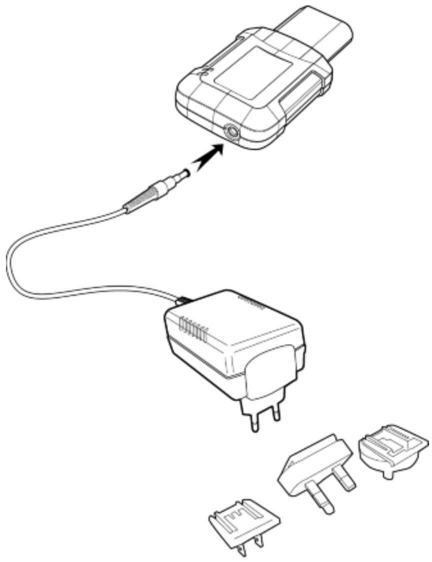
The battery is charged using the supplied power supply directly in the instrument, or with the optionally available R&S® HA-Z203 external charging adapter.

Charging takes approx. 7 hours with the device switched on.

To make sure the battery charges quickly, it is highly recommended to power off the instrument during the charging procedure (the charge time is then equal to approx. 4 hours).

During the external charging procedure, the battery is inserted into the R&S® HA-Z203 external charging adapter and supplied with power via the power supply.





This is the same R&S® HA-Z201 power supply that is used to power the instrument itself.

To extend the operating time obtained using battery power, the R&S® PR100 has a power down mode to automatically switch off the power after a selectable interval (5 minutes or 30 minutes) has elapsed since the most recent input.

The power down mode is deactivated in the default setting.

When the R&S® PR100 is powered on, it assumes the same settings as when it was last powered off.

Switching the monitoring receiver on and off

Press the gray start key (7) at the bottom left of the front panel to power on the R&S® PR100.

When the R&S® PR100 is powered on, it assumes the same settings as when it was last powered off.

Various reset actions can be executed when the instrument is powered on.
Proceed as follows:

- Switch off receiver
- Press and hold the keys indicated in the following table
- Press and release the gray start key
- Hold the keys indicated in the table for another 5 seconds and then release them

Keys	Action	Visible reaction
LOCK	Reset user settings to factory default settings. This primarily concerns the configuration settings (CONF).	Receiver boots up somewhat slower.
LOCK, '8'	Load new firmware; see section 6.1.6 (p. 49). Configuration is reset to factory default settings.	White screen with message "Firmware Update"; progress bar increments as blocks are written.
LOCK, 'F6'	Format flash memory. Configuration is reset to factory default settings. Memory and suppress lists are deleted, user presets are deleted, antenna list and K-factor tables are deleted and replaced with factory default settings. Note: This data (except for the user presets) can be exported to a PC using the supplied PRView software.	White screen with message "Formatting Flash"; progress bar with rotating bars.
LOCK, '3', '5'	Invoke 'Eboot' boot loader (only for service cases)	

To power down the receiver, briefly press the start key. The R&S PR100 will save its current settings and shut off.

In case of a problem, it might be necessary to press and hold the start key for approx. 10 seconds to perform a hardware shutdown.

Ambient and operating conditions

Reliable operation of the R&S® PR100 is ensured under the following ambient and operating conditions:

Air humidity max. 95%

Nominal operating altitude max. 4,600 m above sea level

Transport elevation max. 12,000 m above sea level

Overvoltage category 2

Pollution severity 2

Preventive maintenance

If the R&S® PR100 becomes soiled, clean it with a moist, soft cloth and a mild cleaning agent.

In case of a problem, replace the following safety-relevant accessories only with original R&S® spare parts:

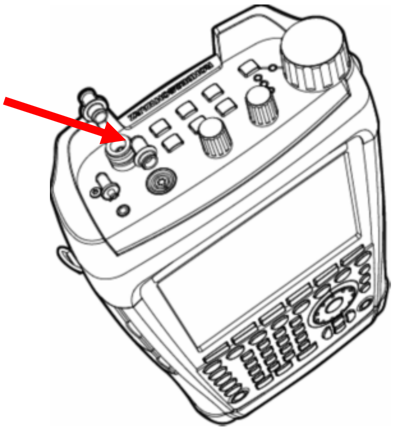
Power supply	1309.6100.00
Battery charger	1309.6123.00
Battery pack, 6-cell	1309.6149.00

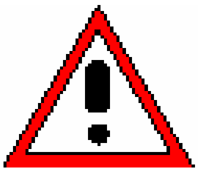
Connectors on the monitoring receiver

The R&S® PR100 has the following connectors:

RF input

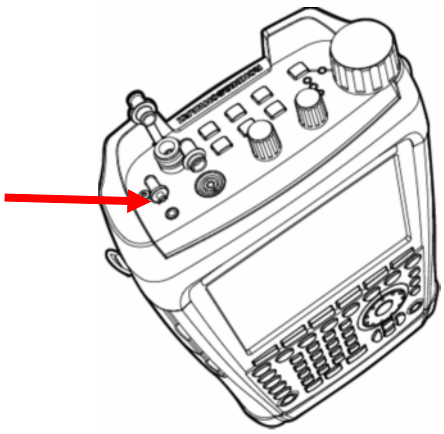
Connect the RF input to the antenna using a cable with an N connector. Make sure that the input is not overloaded.



Caution! 	The maximum permissible continuous power level to the RF input is +20 dBm (100 mW) The maximum permissible DC voltage at the RF input is 0 VDC.

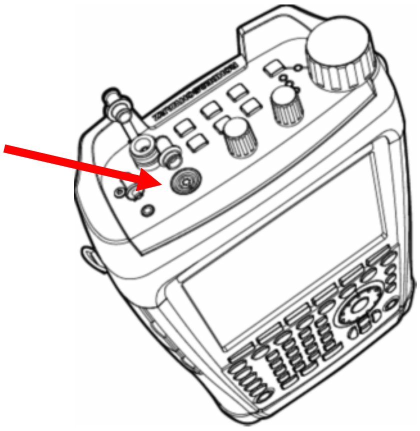
Headphone connector

A 3.5 mm stereo connector is provided for headphones. The internal impedance of the connector is approx. 100 Ohm.



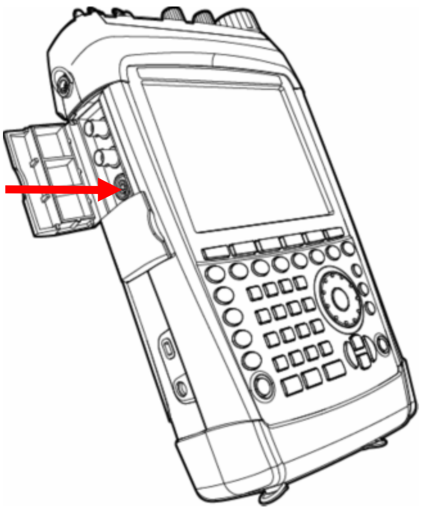
AUX1 IN/OUT (at top)

External control signals can be fed to the receiver via the AUX1 input/output, for example.



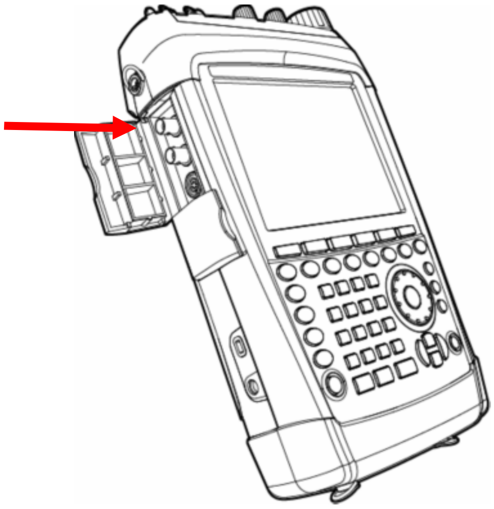
AUX2 IN/OUT

Control signals for externally triggered test procedures (e.g. for coverage measurement applications) are supplied to the receiver via the AUX2 input/output.



External reference input

A 10 MHz reference signal for frequency synchronization is supplied via the BNC socket labeled REF IN. The level of the reference signal must be greater than 0 dBm.



IF output

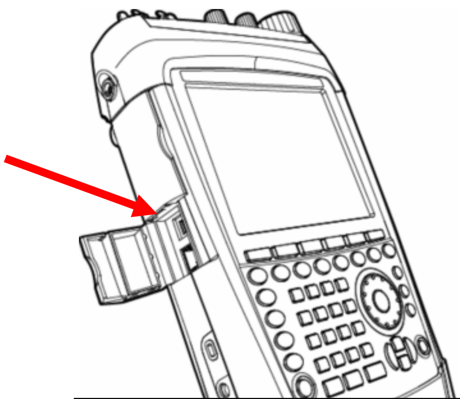
The uncontrolled 21.4 MHz IF signal is provided for external use via the BNC socket labeled IF WB.

USB interface

A USB1.1 interface is provided in the instrument for reading out data saved on the SD card.

LAN interface

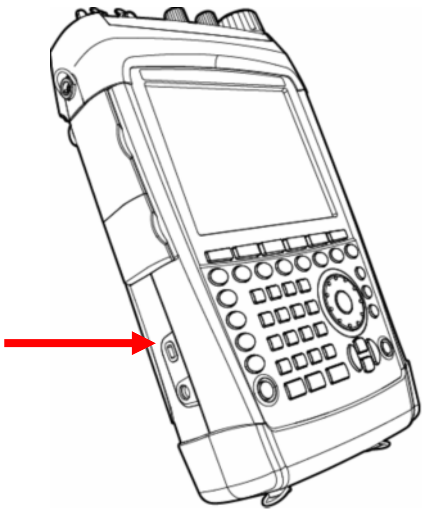
A 10/100 Base-T LAN interface is provided in the receiver for fast read-out of data saved on the SD card and also for remote operation of the receiver.



To comply with the EMC directive (R&TTE), only LAN cables having a length less than 3 m may be used (see recommended accessories).

Mechanical security for the instrument

To provide mechanical security for the R&S® PR100 on a desktop, a "Kensington Lock" can be attached to the receiver's housing.



SD memory card

The SD card for saving measurement results or user settings is inserted on the top right side of the R&S® PR100.

Description and configuration of the connectors

Voltage supply

- 15 V DC +/- 10%, max. 2 A
- DC coaxial connector on receiver, plus voltage on inner pin
- Suitable plug JSBP5 (external Ø 6.5 mm, internal Ø 4.3 mm, pin Ø 1.4 mm, shaft length 9.5 mm)
- DC cable length < 3 m
- Direct operation from the onboard DC power supply system of an aircraft is prohibited

Associated SCPI commands:
Query battery or AC power DIAGnostic[:SERVice]:ADAPter[:STATe]? 162

RF input

- N female
- Max. +20 dBm / 100 mW
- No DC component allowed
- 10 dB attenuator pad (above 30 MHz) can be enabled

Associated SCPI commands:
Switch attenuator pad on/off INPut:ATTenuation:STATe<Boolean> 187

Headphone connector

- 3.5 mm stereo connector (female)
- Impedance approx. 100 Ohm

Associated SCPI commands:
Audio mute SYSTem:AUDio:VOLumeMINimum.. 290

AUX1/AUX2 input and output

7-pin connector (female) with screw fitting
A suitable male connector can be purchased using the R&S® order number 4071.9664.00 .

The pins for the AUX connectors are numbered as follows:

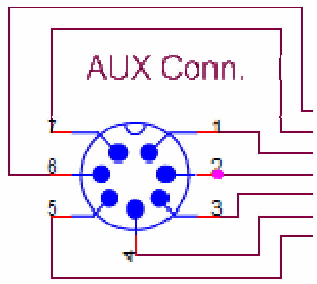


Fig. 6-3: Pin numbers for the AUX connectors (view of R&S PR100 connector)

The AUX pins are assigned as follows:

Pin	1	2	3	4	5	6	7
AUX1 (top)	5 V output max. 500 mA	I/O bit 0	I/O bit 1	GND	TxD	RxD	Sense_in
	Output	Input/output	Input/output	--	Output	Input	Input
AUX2 (side)	5 V output max. 500 mA	Squelch	Mute	GND	TxD	RxD	Trigger_in
	Output	Output	Input	--	Output	Input	Input

Table 1: Pin assignments for the AUX connectors

All of the inputs and outputs use TTL low levels,
i.e. low = 0 V to 0.8 V, high = 2.0 V to 3.3 V.

RXD and TXD form a RS232 connection (low level TTL). TxD is the data output from the R&S PR100, and RxD is the data input to the R&S PR100.

The RS232 parameters are set by the R&S PR100 firmware. For GPS devices (e.g. the GPS compass in the HE300 antenna), the settings are as follows: 19200 baud, even parity, 1 stop bit, 8 data bits.

External reference input

- BNC female
- External 10 MHz reference frequency
- Level min. 0 dBm

Associated SCPI commands:
Switch reference internal/external [SENSe]:ROSCillator:SOURceINTernal|EXTernal 273

IF output

- BNC female
- Uncontrolled IF 21.4 MHz

Associated SCPI commands:
Switch IF output on/off OUTPut:IF[:STATe]<Boolean> 211

USB interface

- USB Mini-B female
- USB 1.1
- Receiver functions only as USB slave

USB allows:

- File access to SD card
- For information about the PRView software, see section Memory system (p. 79).

LAN interface

- RJ45 female
- Tolerates crosslink cables
- 10M/100M speed
- DHCP-enabled
- IP address, subnet and gateway can be set

– Requires remote control option

LAN allows:

- SCPI remote control
- UDP data streams
- Remote firmware update using update tool
- Usage of the PRView software
- Usage of the PR100Control remote operating software

Associated SCPI commands:

LAN settings SYSTem:COMMunicate:SOCKet:ADDRess<ip-address> 295

SD memory card

- Max. capacity 32 GB (but max. file size is 4 GB)
- A class 6 card is needed for the internal recording option; see section 7.1.9 (p. 94).
- The card should be formatted by the R&S PR100 for good performance; see section 7.1.9 (p. 94).
-

Associated SCPI commands:

Format SD card MMEMory:INIT[<label>].. 207

Basic Settings

6.1.2 Screen Settings

The screen used in the R&S® PR100 consists of a 6.5" VGA display (640 x 480 pixels). The backlighting can be varied from 0% to 100% brightness.

For a good balance between operating time under battery power and display quality, it is recommended to set the backlighting only as bright is as needed.

Note: The location of the key on the instrument is indicated in parentheses after the key name hereafter
(see Fig. 6-1on p. 29), e.g. "LOCK (11) key".

Setting the brightness

- Press the CONF (5) key.
- Press the GENERAL softkey.
- Use the rotary knob (12) or the cursor keys (10) to choose the desired setting and confirm the selection by pressing the ENTER key (8).

Fig. 6-4: Setting the display brightness

Setting the color scheme

– Press the CONF (5) key.
– Press the GENERAL softkey.
– Use the rotary knob (12) or the cursor keys (10) to choose the desired setting and confirm the selection by pressing the ENTER key.

Fig. 6-5: Setting the color scheme for the display

6.1.3 Country-Specific Settings

The R&S® PR100 offers the following choice of languages for text output:

– German
– English
– French
– Portuguese
– Russian
– Spanish
– Czech

The labeling of the softkeys is always in English. The default setting (factory setting) is also English.

Setting the language

- Press the CONF (5) key.
- Press the GENERAL softkey.
- Use the rotary knob (12) or the cursor keys (10) to choose the desired setting and confirm the selection by pressing the ENTER key (8).
- The new language will not be enabled until the receiver is switched off and back on again.

Fig. 6-6: Setting the receiver's menu language

6.1.4 Setting the Date and Time

The R&S® PR100 has an internal clock which is used to provide saved data sets with a date and time of day stamp, for example. The user can reset the date and time of day if required.

Setting the date

- Press the CONF (5) key.
- Press the GENERAL softkey.
- Enter the date using the numeric keypad (6) and confirm the selection by pressing the ENTER key (8).

Fig. 6-7: Setting the date on the receiver

Setting the date format

Fig. 6-8: Setting the date format

- Press the CONF (5) key.
- Press the GENERAL softkey.
- Use the rotary knob (12) or the cursor keys (10) to choose the desired setting and confirm the selection by pressing the ENTER key (8).

6.1.5 Setting the Time of Day

– Press the CONF (5) key.
– Press the GENERAL softkey.
– Enter the time of day using the numeric keypad (6) and confirm the selection by pressing the ENTER key (8).

Invalid minute values will be displayed inverted and the user must correct them.

Fig. 6-9: Setting the time of day

Firmware update

In order to be able to use all of the features of the R&S® PR100, it is recommended to update the instrument to the latest firmware version.

The latest firmware can be downloaded from the R&S® website (www.rohde-schwarz.com, search terms PR100 firmware).

6.1.6 Firmware Update with the SD Card

This method works well if the SD card is directly accessible and no LAN connection to the PR100 is desired, or if the remote control option is not installed in the PR100.

The firmware to be installed must first be copied to an SD card (e.g. HA-Z231, order number 1309.6217.00).

The following files must be copied to the SD card:

Dateiname	Größe	Datum / Zeit
bootloader_MR_V2_00.bin	223.983	25.06.2009 17:31
osimage_MR_V2_00.bin	22.993.059	25.06.2009 17:51
splashscreen_MR.bmp	921.654	15.09.2007 18:17
updater_MR_V2_00.bin	17.508	25.06.2009 17:51

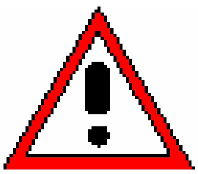
The version numbers of the individual files (e.g. V2_00) are dependent on the current firmware version.

Note!

Only one file of each type may be saved in the root directory of the SD card. The update procedure will be interrupted if two different versions of a given file type are found.

- Switch off the instrument.
- Insert the SD card into the SD card slot on the right side.
- Connect the external power supply to the R&S® PR100 (the update procedure will not start unless external power is supplied).
- While switching the R&S® PR100 back on, simultaneously press and hold the [LOCK] (11) and [8] (number pad) keys. It is necessary to keep both keys pressed for approx. 5 seconds after the R&S® PR100 is switched on.
- Follow the instructions that appear on the screen.

Caution!



THE R&S® PR100 MUST NOT BE SWITCHED OFF DURING THE FIRMWARE UPDATE!

- In order for the update to take effect, the R&S PR100 must be switched off and back on again.

- It is recommended to format the instrument's internal file system after a firmware update. Recall, however, that the format procedure will result in the loss of frequency lists (memory lists, suppress lists), antenna lists and user presets.
  To carry out the format procedure, power off the instrument. Then press and hold the [LOCK] (11) and [F6] (3, right) keys and switch the instrument back on again. Keep these keys held down for approx. 5 seconds longer after switching on the instrument and then release them.
  The format procedure takes approx. 5 minutes.

6.1.7 Firmware Update with the Firmware Upgrade Tool

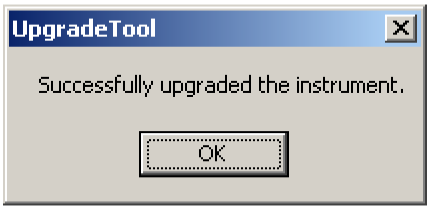
Starting with version 1.22, the firmware is supplied in the form of individual files for the SD card (see above) as well as an update program. The update program works well if the SD card or the whole receiver is inaccessible.

The update program makes it possible to update the firmware via LAN without direct access to the SD card. This is especially beneficial with the R&S EM100 since its SD card can only be accessed by opening the enclosure.

- Prior to the update
  - Connect the external power supply to the R&S® PR100 (the update procedure will not start unless external power is provided).
  - Make sure that an SD card is inserted into the **PR100**. Approx. 30 MB of storage space must be free on this card.
  - Interrupt any scans that are running since they will slow down the update procedure.
  - Set up and test a LAN connection to the **PR100**; see section 7.1.11 (p. 105).
- To perform the update, launch the update program RS_PR_UpgradeTool_<identification>.exe, e.g. RS_PR_UpgradeTool_MR_V2_0.exe

and follow the instructions that appear on the screen.
Do NOT switch off the PC or receiver during the update procedure!

Upon completion of the update, the following message will appear on the PC:



Notes:

The update program will not start if firmware version 1.21 (or earlier) is installed on the **PR100**.

The update program requires the remote control option with a LAN connection to the **PR100**.

Options

Existing options will be retained by the firmware update.

- Note: In case of a firmware update from versions 1.04 or 1.12 to a newer version, all of the option codes must be entered initially.

For a description of how to enable new options which might be present for the first time in the current firmware, see section "Option Code Activation" (p. 88).

7 Operation

Preliminary note: The following example shows how user key sequences are notated.

CONF – F2(Range) – "Level Bar Range"
means

- CONF key
- Next, softkey (on the bottom edge of the screen) F2, which is labeled "Range" on the screen
- Finally, select the text "Level Bar Range" with the front rotary knob or the up/down cursor keys.

Scan modes in the R&S PR100

The R&S PR100 always operates in one of the scan modes described hereafter.
These modes can be selected by repeatedly pressing SCAN-F1(Mode).

Scan mode	Description	RX level output	Audio output	Spectrum output
FFM, Fixed Frequency Mode	Fixed frequency, reception at a single fixed frequency, level measurement, demodulation and audio, IF spectrum around the single frequency	✓	✓	✓
FSCAN, Frequency Scan	Scan, stepping of the receive frequency with a fixed stepsize, same bandwidth, demodulation, detector and squelch for all frequency points, IF spectrum around the current single frequency	✓	✓	✓
MSCAN, Memory Scan	Scan, stepping of the receive frequency with user-selectable frequency points, bandwidth, demodulation, detector, squelch and so on individually selectable for each frequency point, IF spectrum around the current single frequency	✓	✓	✓
PSCAN, Panorama Scan	Fast scan, stepping of the receive frequency around an IF bandwidth, output of broad spectra, no level measurement, no demodulation Note: PSCAN is an option that must be purchased separately.			✓

Associated SCPI commands:
Current mode [SENSe]:FREQuency:MODE? 246

Receive section

The settings for the RF processing and the frontend are described here.

For a description of spectra and the waterfall display, please see "Spectral section" (p. 69).

7.1.1 Demodulation Path

This section describes the settings for demodulation and level measurement techniques. For a description of field strength measurements, please see section 7.1.10 (p. 100).

The demodulation section demodulates a band excerpt in the center of the IF signal using one of the available demodulation techniques and delivers a digital audio signal and a signal level at the set receive frequency. It also decides whether this level is above the squelch level.

The demodulation path and the spectral path (scanner) in the receiver are two independent signal paths; see Fig. 5-2 (p. 25). In particular, the demodulation bandwidth is entirely independent of the set IF bandwidth.

The **demodulation bandwidth** in the demodulation path can be set in 16 steps:

Bandwidths in the demodulation path (kHz)							
0.15	0.3	0.6	1.5	2.4	6	9	12
15	30	50	120	150	250	300	500

The setting is made as follows:

- The BW+ and BW- keys on the front
- The BW+ and BW- keys on the top
- Via the configuration: CONF- F1(RX) – "Bandwidth"

The set **demodulation bandwidth** can be **graphically displayed** in the spectrum as a light-gray bar; see Fig. 7-6 (p. 63). This can be enabled and disabled via the configuration:
CONF- F3(Display) – "Demodulation Bandwidth Bar".

Associated SCPI commands:

Receive bandwidth [SENSe]:BANDwidth<numeric_value> 236

The following **demodulation techniques** are available:

Demodulation technique	
AM	Amplitude modulation
FM	Frequency modulation
USB,LSB	Upper/lower sideband amplitude modulation
ISB	Independent sideband amplitude modulation
CW	Unmodulated carrier, audible with BFO
IQ	Inphase/quadrature modulation
PULSE	Amplitude modulation with automatic gain control (AGC) which is adapted to pulse sequences. At the start of a pulse, the gain is rapidly reduced; at the end, however, it is only raised back slowly. The AGC is matched to the peak level of a pulse sequence in this manner.

These techniques can be selected as follows:

- The MOD+ and MOD- keys on the front
- The MOD+ and MOD- keys on the top
- Via the configuration: CONF- F1(RX) – "Demodulation"

The selected demodulation technique is shown in the top bar of the display under "MOD".

Associated SCPI commands:
Demodulation mode [SENSe]:DEModulationAM|FM|PULSe|CW|LSB|USB|IQ|ISB|A0|A1 238

Audio output is possible using headphones or the built-in loudspeaker. It is also possible to output a digital audio stream via LAN and to digitally record the audio data (see Internal Recording Option (p. 94)).

The audio output properties are set as follows:

– Audio volume
  - Via CONF-F4(General) – "Audio Volume"
  - Using the VOL rotary knob (top left)

– Audio balance L/R
  - Via CONF-F4(General) – "Left - Right Balance"

– Audio output
  - Via CONF-F4(General) – "Audio Output"
    Only headphones or
    automatic, i.e. loudspeaker as long as no headphones are connected

– Audio mute
  - Via CONF-F4(General) – "Audio Mute"
  - Via LOCK-F3(Audio Mute)
  - Via the U1 and U2 user keys (top side) if they were assigned "Tone On/Off" in the configuration menu
    Via CONF- F4(General) –"User Key 1[2]" -"Tone On/Off".

For a description of how to output a digital audio stream via LAN, see section "Audio Streaming" (p. 357).

Associated SCPI commands:
Audio volume SYSTem:AUDio:VOLume<numeric_value>|MINimum|MAXimum...................... 290
Audio balance SYSTem:AUDio:BALance<numeric_value>|MINimum|MAXimum 287
Audio output SYSTem:AUDio:OUTPut AUTO|HPHone.. 288
Audio mute → Volume on MINIMUM
Audio stream start TRACe|DATA:UDP:FLAG[:ON]<ip-address>,<ip-port>,<flag>,<flag>.................. 339

During a **level measurement**, all of the level values within the demodulation bandwidth are evaluated by a detector and output as a level value. Depending on the selected measurement mode (periodic or continuous), level values are grouped together within a defined measurement time (periodic) or measured values for the current detector are output on an ongoing basis (continuous).

The following *detectors* are available for level measurements:

Max Peak	Maximum level
Average	Arithmetic average of level
RMS	Power-based averaging of levels
Sample	Current single level value

Averaging (Average and RMS) is performed based on the (linear) µV values and NOT using the (logarithmic) dBµV values.

These detectors can be selected as follows:

- Via the configuration: CONF- F1(RX) – "Level Type"
- Via the LEVEL key (field 4 in section "" (p. 29))

The selected detector is shown in the top bar of the display under "LEVEL".

The *measurement time for the detector* can be set between 500 µs and 900 s as follows:

- Via the configuration:CONF- F1(RX) – "Measure Time"
- In FFM mode via SCAN-F2(Param) – "Measure Time"
- In PSCAN mode via SCAN-F2(Param) – "Measure Time"
  Note: The measurement time also influences the averaging of the IF spectrum.

The *measurement time mode* can be switched between fixed measurement time and standard measurement time using
CONF- F1(RX) – "Measure Time Mode".

In the "Standard" mode, the measurement time is not a fixed value. Instead, it is automatically adapted to the bandwidth.

The *measurement mode* can be switched between "Continuous" and "Periodic" as follows:

- CONF- F1(RX) – "Measuring Mod Mode" or
- In FFM mode via SCAN-F2(Param) – "Measuring Mod Mode"

In "Periodic" mode, the detectors are reset to zero at the end of the selected measurement time; the summarized level value is output. The "Sample" detector returns the single level value at the end of the measurement time.

In "Continuous" mode, for "Average" and "RMS" the selected measurement time is interpreted as a time constant for an RC filter so that a sort of sliding averaging is performed. For "Max-Peak", the settings are configured so the rise time constant = 0 and the decay time constant = measurement time. This means that new peak values are immediately accepted and then decay with the set measurement time.
To avoid long setting times, the sliding average value is preset to the average value ("Average" and "RMS") or the peak value ("Max-Peak") for a measurement time interval as soon as other receive parameters are set, e.g. for each step in MSCAN and FSCAN.

In "Continuous" mode, the current detector value is read out and displayed every 200 ms.

Note: To perform correct level measurements, the demodulation bandwidth of the receiver must also be set appropriately for the signal. For example, a level measurement involving a signal with a width of 120 kHz must be performed with the demodulation bandwidth set to a value of at least 120 kHz or larger.

Associated SCPI commands:
Detector [SENSe]:DETector[:FUNCtion]AVG|FAST|PEAK|RMS 240
Measurement mode MEASure:MODE CONTinuous|PERiodic 188
Measurement time + measurement time mode
MEASure:TIME <numeric_value>|MINimum|MAXimum|DEFault 188

The magnitude of the level can also be output audibly using a **level tone**.
The higher the level, the higher the tone. The level pitch can be enabled/disabled via:

- RX – F5(Tone)
- In the configuration via CONF- F1(RX) –"Tone"

The level tone properties can be set via the configuration as follows:

- CONF- F1(RX) –"Tone Mode" Only tone or audio + tone
- CONF- F1(RX) –"Tone Gain" Tone pitch change in relation to Level change

The tone threshold, i.e. the level value which is assigned to a tone at 400 Hz can be set between -14 dBµV and +94 dBµV.

- Via the configuration: CONF- F1(RX) – "Tone Threshold"
- Via the "MST" rotary knob (top center) if the level tone was enabled immediately beforehand via RX- F5(Tone).
  In this case, the green "TONE" LED on the top will light up;
  the TONE field in the bottom bar is enabled (green) and the level value for the tone threshold is displayed at the top right.

  Press in on the MST rotary knob to toggle the function of the knob between MGAIN, squelch and tone. The current setting is indicated by the green LEDs on the top side.

For a description of how to output a level stream via LAN, see section "CW streaming" (p. 362).

Associated SCPI commands:
Tone on / off OUTPut:TONE[:STATe]<Boolean> 217
Only tone / with audio OUTPut:TONE:CONTrol ONLY|WITHaf 215
Tone threshold OUTPut:TONE:THReshold<numeric_value>|UP|DOWN|MINimum|MAXimum 218
Tone gain OUTPut:TONE:GAIN<numeric_value>|MINimum|MAXimum|UP|DOWN 216
Level stream start TRACe|DATA:UDP:FLAG[:ON]<ip-address>,<ip-port>,<flag>,<flag> 339

The **squelch** can be enabled and disabled as follows:

- Via RX – F4 (SQL)
- Via the configuration: CONF – F1(RX) – "Squelch"
- Via the U1 and U2 user keys (top side) if they were assigned "Squelch SQL On/Off" in the configuration menu
  via CONF- F4(General) –"User Key 1[2]" -"SQL On/Off".

The *squelch level* can be set between -30 dBµV and +110 dBµV.

- Via the configuration: CONF- F1(RX) – "Squelch Level"

- Via the "MST" rotary knob (top side center) if the squelch was enabled immediately beforehand via RX- F4(SQL).
  In this case, the green "SQL" LED on the top will light up;
  the SQL field in the bottom bar is enabled (green) and the SQL value is displayed at the top right; see Fig. 7-1 (p. 56).

  Press in on the MST rotary knob to toggle the function of the knob between MGAIN, squelch and tone. The current setting is indicated by the green LEDs on the top side.

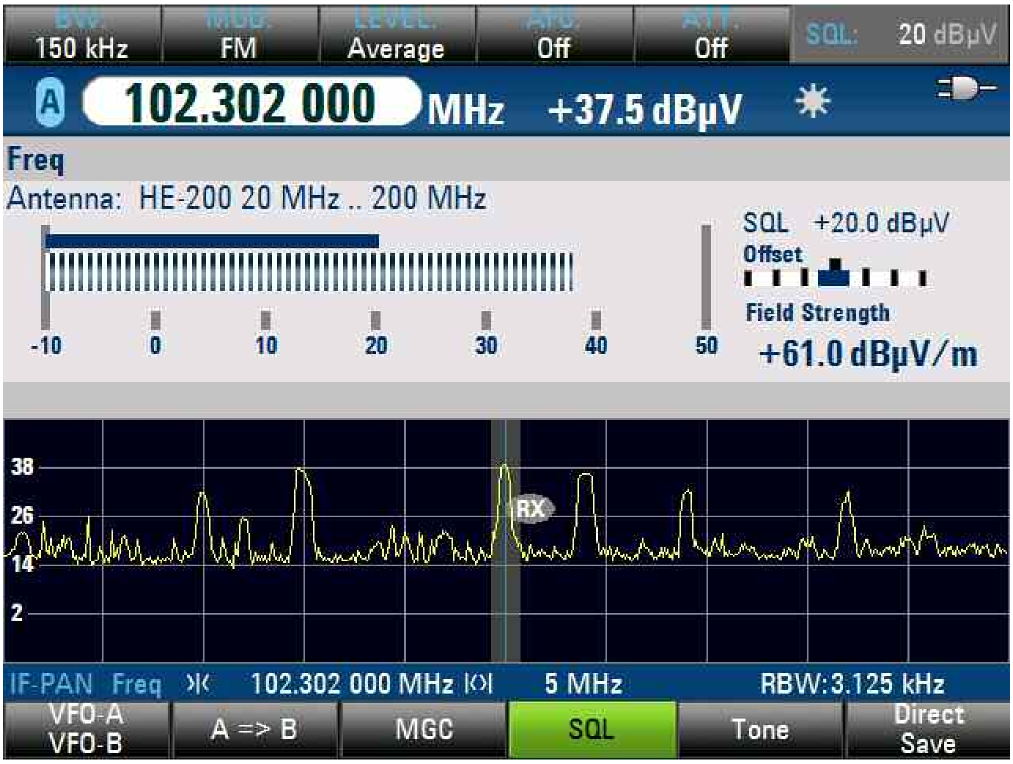


Fig. 7-1: Squelch level adjusted with rotary knob

Associated SCPI commands:
Switch squelch on/off OUTPut:SQUelch[:STATe]<Boolean> 212
Squelch level OUTPut:SQUelch:THReshold[:UPPer]<numeric_value> 213

7.1.2 FFM, Fixed Frequency Mode

The results for the fixed frequency mode (assuming they were generated in the receive section) are shown in the RX display; see Fig. 7-2, (p. 57).

The **RX display** can be presented either as subwindow (see Fig. 7-6 (p. 63)) or as a full screen as shown here in Fig. 7-2 (p. 57).

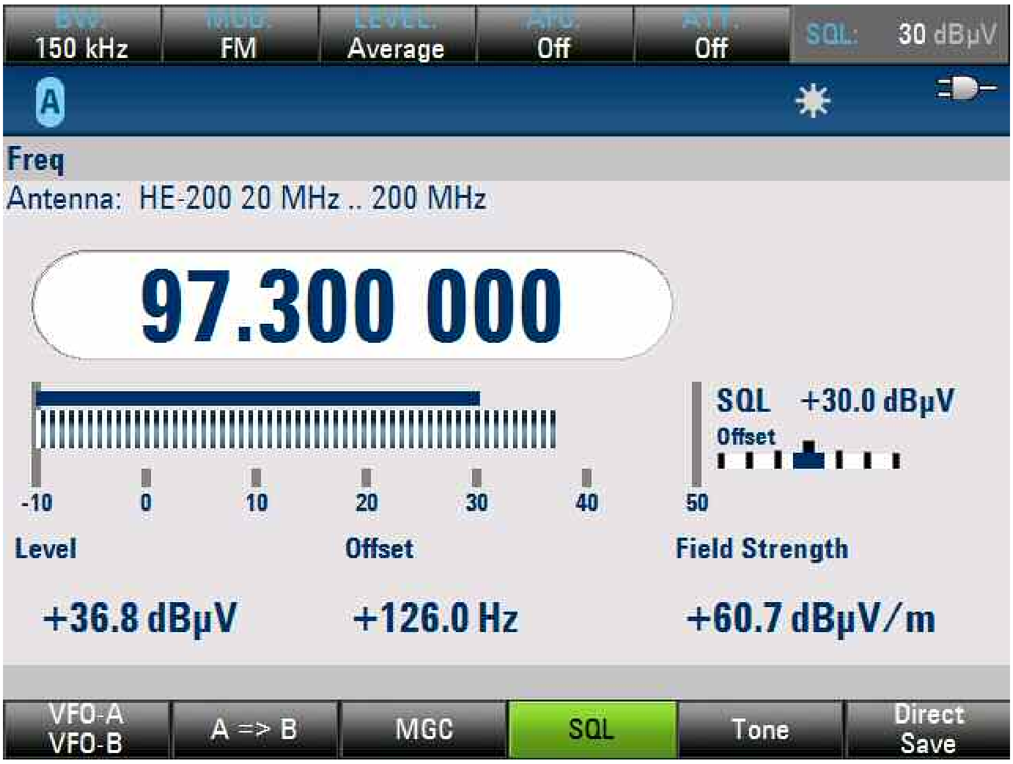


Fig. 7-2: RX display

The RX display can be presented using the full screen with DISP-F1(Display Mode)-"RX".

The RX display contains the following information (from top to bottom):

- Activated antenna (HE-200 20 MHz to 200 MHz)
- Receive frequency (97.3 MHz)
- Selected squelch value, graphically (dark-blue bar)
- Selected squelch value, numerically (+30.0 dBµV)
- Current level, graphically (striped bar)
- Frequency offset, graphically ("Offset" bar)
- Current level, numerically (+39.1 dBµV)
- Frequency offset, numerically
- Field strength (+63.0 dBµV/m)

Note: The field strength is displayed only if the field strength option is installed; see section "Field Strength" (p. 100).

The *frequency offset* indicates the location of the spectral maximum within the selected demodulation bandwidth; see Fig. 7-3 (p. 58).

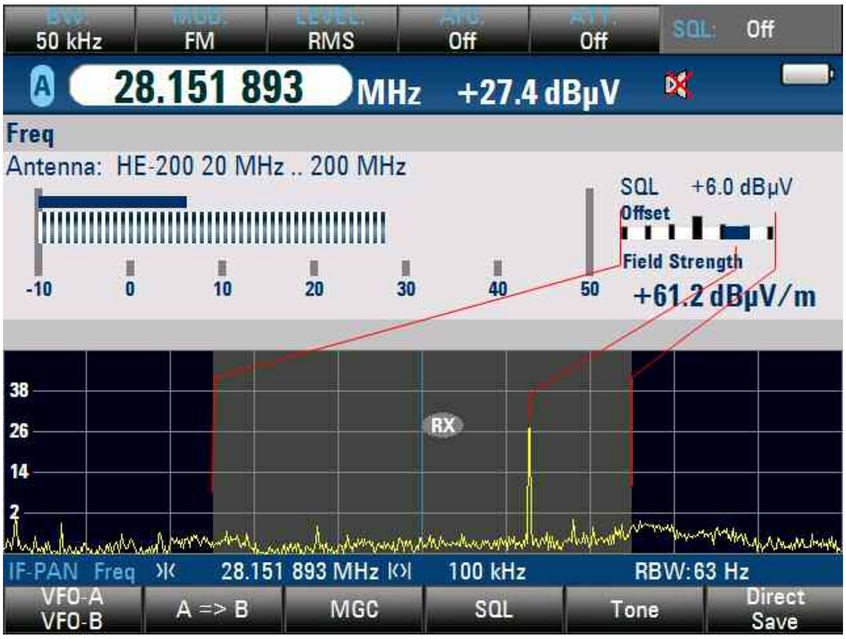


Fig. 7-3: Frequency offset

Associated SCPI commands:
Enable level measurement [SENSe]:FUNCtion[:ON]?... 256
Enable level stream TRACe|DATA:UDP:DEFault:FLAG[:ON]<ip-address> 335

In FFM mode, two independent **sets of parameter settings** (frequency, squelch, bandwidth, demodulation mode, etc.) can be saved so the user can quickly switch between the different settings. These sets are known as A and B. The set that is currently enabled is

indicated using the  and  icons in the top left part of the display.

The user can toggle between set A and B with
RX-F1(VFA-A/VFO-B).
This makes it possible to quickly toggle between two parties engaged in a voice conversation, for example.

One data set can also be copied to the other using
RX-F2(A=>B);
the active data set is always copied to the inactive data set in this manner.

Moreover, it is also possible to copy the data sets for MSCAN (see "Memory system" (p. 79)) to set A or B as follows:

- Enable MSCAN mode; press SCAN-F1 repeatedly
  until "Mode MSCAN" appears.
- Select the desired MSCAN data set using the front rotary knob
  or by making a numeric entry
- Copy the data set to A or B with
  RX-F1(M => A) or
  RX-F1(M => B).

The downconverter provides an intermediate frequency band with a max. width of 10 MHz around the selected RX frequency.

The **RX frequency** can be set interactively in three different ways:

- Numeric entry on the keypad
- Front rotary knob (field 12 in section "" (p. 29))
- Top rotary knob (flywheel top right)

The two rotary knobs behave differently:

The front rotary knob is display-oriented so that latching shifts the image by one pixel; 20 revolutions shift the image by the entire image width (640 pixels). The frequency step per latching is thus dependent on the selected IF bandwidth; in PSCAN mode it is dependent on the entire frequency range that is covered.

The top rotary knob is set for fixed frequency steps, independent of the displayed frequency excerpt. This frequency step can be set in the configuration menu using the key sequence CONF - F4(General) - "Flywheel Stepsize" in the range between 1 Hz and 500 MHz per step.

Associated SCPI commands:

Set RX frequency [SENSe]:FREQuency<numeric_value> 243
Set flywheel stepsize [SENSe]:FREQuency:STEP<numeric_value> 244

Automatic frequency control (AFC) can be switched on and off as follows:

- Via the AFC key (field 4 in section "" (p. 29))
- Via the configuration: CONF- F1(RX) – "Automatic Frequency Control"

The AFC status on/off is shown in the top bar of the display under "AFC".

Associated SCPI commands:

Switch AFC on/off [SENSe]:FREQuency:AFC<Boolean>... 241

The **IF bandwidth** (IF span) can be set as follows: Activate the zoom mode via the key sequence DISP-F4(Zoom) (Fig. 7-4) (p. 29) and adjust the bandwidth using the up/down cursor keys (field 10 in section "") (p. 29).

IF bandwidths between 10 MHz and 1 KHz can be set in steps of 10-5-2.

The IF bandwidth also indirectly sets the visible frequency resolution (IF bandwidth / 640 pixels) and the frequency resolution of the saved IF data (IF bandwidth / 1600 frequency points). This means that with a 1 kHz IF bandwidth, a frequency resolution of 0.625 Hz can be obtained.

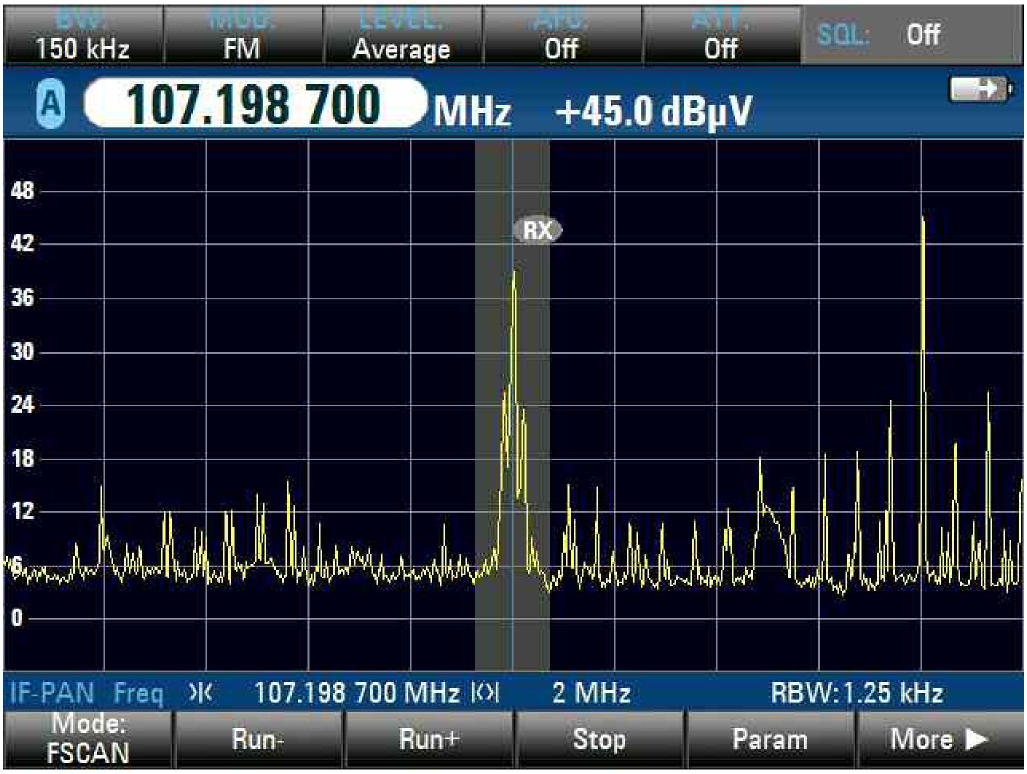


Fig. 7-4: Zoom of the IF bandwidth / frequency resolution

Associated SCPI commands:
Set IF bandwidth [SENSe]:FREQuency:SPAN<numeric_value>|UP|DOWN|MINimum|MAXimum.. 250

The **gain control** can be switched between automatic gain control (AGC) and manual gain control (MGC). This only influences the demodulation and the output of I/Q data. In MGC mode, full-scale deflections between -30 dBµV and +110 dBµV are available regardless of whether the attenuator pad is enabled.

The user can toggle between manual and automatic gain control as follows:

- Via the configuration: CONF- F1(RX) – "Manual Gain Control"
- Via the RX menu: RX- F3(MGC)
- In addition, the U1 and U2 user keys (top side) can be assigned with "MGC On/Off" in the configuration menu
  via CONF- F4(General) –"User Key 1[2]" -"MGC On/Off".

The MGC full-scale deflection can be set as follows:

- Via the configuration: CONF- F1(RX) – " Manual Gain"
- Via the "MST" rotary knob (top side center) if manual gain control was enabled immediately beforehand via RX- F3(MGC).
  In this case, the green "MGAIN" LED on the top will light up;
  the MGC field in the bottom bar is enabled (green) and the MGC value is displayed at the top right; see Fig. 7-5 (p. 29).

  Press in on the MST rotary knob to toggle the function of the knob between MGAIN, squelch and tone. The current setting is indicated by the green LEDs on the top side.

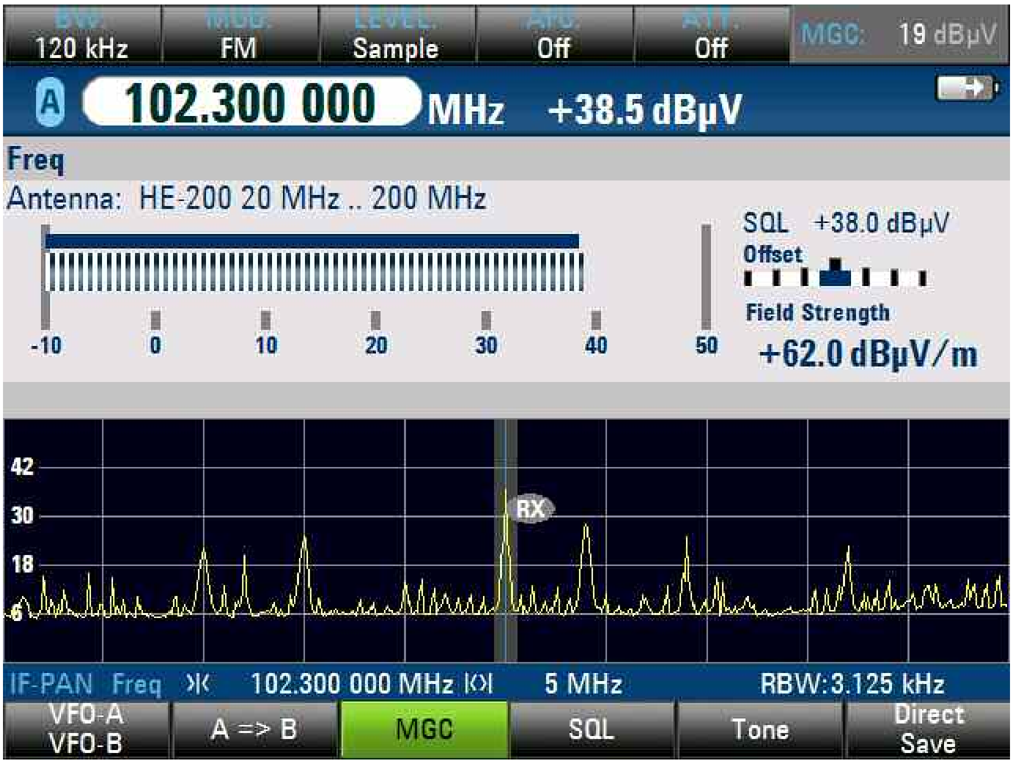


Fig. 7-5: Manual gain control activated

Associated SCPI commands:

Toggle AGC/MGC: [SENSe]:GCONtrol:MODEFIXed|MGC|AUTO|AGC 259
Set MGC gain: [SENSe]:GCONtrol:MGC <numeric_value> 257

Reference frequency – The 10 MHz reference frequency in the receiver can be generated internally or obtained from an external source (BNC female connector "REF IN" on left side of receiver; see "

External reference input" (p. 40)). The level of the external reference signal must be greater than 0 dBm.

Internal/external toggling as follows:

CONF – F1(RX) – "Frequency Reference"

Associated SCPI commands: [SENSe]:ROSCillator:SOURceINTernal|EXTernal 273

IF output – The uncontrolled IF (21.4 MHz) is available on the BNC female connector "IF WB" (on left side of receiver; see "IF output" (p. 40)). It can be switched on and off as follows:
CONF – F1(RX) – "Frequency Reference"

Associated SCPI commands:
Switch IF output on/off OUTPut:IF[:STATe]<Boolean> 211

In the lower frequency range, the R&S PR100 makes use of **direct reception**, i.e. no frequency conversion in the downconverter. The switchover point between direct reception and frequency conversion can be set in the range between 20 MHz and 30 MHz:

CONF – F1(RX) – "Direct Conversion Threshold".

Associated SCPI commands:

Direct conversion threshold [SENSe]:FREQuency:CONVersion:THReshold<numeric_value> 242

The frequency of the **beat frequency oscillator** (BFO; used to listen to unmodulated CW carriers) can be set between 0 Hz and 8000 Hz:

CONF – F1(RX) – "BFO Frequency"

Associated SCPI commands:
BFO oscillator frequency [SENSe]:DEModulation:BFO:FREQuency<numeric_value> 239

Attenuator pad – A 10 dB attenuator pad can be enabled in the R&S PR100 which simultaneously switches off the 20 dB preamplifier, resulting in 30 dB lower input sensitivity. The attenuator pad works up to 3.5 GHz, but not in the direct reception path.

The attenuator pad is switched on/off as follows:

- Using the ATT key (field 4 in section "" (p. 29))
- Via CONF – F1(RX) – "Attenuator"

The current status of the attenuator pad is shown in the top bar of the display under "ATT".

Associated SCPI commands:
Switch input attenuation on/off INPut:ATTenuation:STATe <Boolean> 187

Overload – An overload is indicated with a red arrow at the top right of the display;
see Fig. 7-6 (p. 63).

A maximum input level of +20 dBm (100 mW) is permissible at the RF input. No DC component is allowed in the input signal.

Without the attenuator pad enabled, an overload is displayed
starting at a level of approx. 85 dBµV / -22 dBm. With the attenuator pad, the corresponding values are approx. 115 dBµV / +8 dBm.

Even before reaching the overload level, strong signal distortions can be encountered as seen in Fig. 7-6 (p. 63).

Fig. 7-6: Overload indication

7.1.3 FSCAN

Characteristics

FSCAN mode scans a selectable frequency range using a selectable frequency grid by setting the receive frequency step-by-step to the next relevant frequency point. All of the settings described for fixed frequency mode are thus also usable here and apply globally to the entire scan. They can be modified dynamically during the FSCAN procedure. Settings that influence the scan procedure are new.

FSCAN is activated as follows:

Press SCAN-F1(Mode) repeatedly until FSCAN mode appears.

F3 (Run+) or F2 (Run-) initiates the scan in the up or down direction.

The **observation duration for a frequency point** depends on whether a signal is detected during it. A signal is considered to be detected if its level is above the squelch threshold. If the squelch is switched off, then every frequency point is considered to be detected.
If no signal is detected, the receiver switches immediately to the next frequency point. In case of a constant signal, the observation duration is determined by the *dwell time*. If a signal is detected which is then interrupted within the dwell time, the current frequency point is maintained if the interruption(s) is (are) shorter than the *no signal time*. The *no signal time* always begins anew at the start of each interruption. Interruptions that are longer than the *no signal time* result in a switch to the next frequency point as soon as the *no signal time* has elapsed (but at the latest at the end of the dwell time).

The *dwell time mode* can be used to set a finite or infinite dwell time.
In case of an infinite dwell time (and constant signal), the receiver remains on the first signal it finds. In this case, the scan can be continued either in the up or down direction using F3(Run+) or F2(Run-).

The term "scan movement" is used hereafter. The receiver is in a scan movement if a scan is performed in FSCAN or MSCAN mode and the receiver is currently not in the dwell time or the no signal time.

The parameters dwell time, dwell time mode, no signal time and no signal time mode (which disables the no signal time, i.e. every interruption switches to the next frequency point) can be set via the configuration as follows:

CONF-F2(Scan) -<Parameter name>.

In addition, the *number of sweeps* can be set here and the user can select whether to use a finite or infinite number of sweeps
(*Scan Cycle Mode*).

The times mentioned above and the number of sweeps can be set within the following limits:

Parameter	min	max	Resolution	Comment
Dwell time	0 s	60 s	0.1 s	Infinite also possible
No signal time	0 s	60 s	0.1 s	Can be switched off
Sweeps	0	1000	1	Infinite also possible

Influence of the measurement time

For each frequency point, at least one measurement is performed. Not until then it is possible to make a "signal / no signal" decision. In other words, with long measurement times even bands without any signals cannot be swept quickly.

This first measurement is part of the scan movement and is not contained in the dwell time.
Accordingly, at frequency points with a signal, the following relationship holds:
Total dwell time = Measurement time + Dwell time
If necessary, the last measurement time is shortened.

Example: Measurement time 5 s, Dwell time 6 s → Total dwell time 11 s

Output during the scan procedure

Level and frequency values as well as spectra (around the current receive frequency) are output during the scan on an ongoing basis.

If a signal was detected, it can be output during the dwell time via the loudspeaker and via LAN in the form of a trace, audio or I/Q stream. During a scan movement, no streams and no audio are output.

Suppress list

FSCAN execution is influenced by the above settings as well as by a suppress list containing frequency ranges to be skipped.

Each frequency range in the suppress list contains a start frequency, an end frequency and an optional descriptive text. Frequency points in the FSCAN frequency grid which lie within one of these ranges are skipped.

For more details on the suppress list, please see section "Memory system" (p. 79).

Suppress frequency ranges can also be copied with a single keypress from the current receiver settings as long as no scan movement is underway:

SCAN-F1(FSCAN). [Activate FSCAN mode] – F6(More)-F2(Suppress).

The current bandwidth around the current receive frequency is copied as the suppress range. It is possible to eliminate emitters of no interest from the current FSCAN and also to suppress signals by setting the frequency manually.

If it is desired to reenable a currently suppressed frequency range, it can be set to inactive or deleted in the editor for the suppress list.

Note: The (receive) bandwidth and the FSCAN stepsize are two independent quantities and can be set independently of one another.

Memory list

Current frequency points can also be copied with a keypress to the memory list (see "Memory system" (p. 79)) which serves as a basis for the MSCAN. Proceed as follows:

SCAN-F1(FSCAN), [Activate FSCAN mode] – F6(Next)-F3(Memory List)

The captured frequency points are written by default starting at position 600 in the list.

Here too, it is not possible to copy the frequency point during a scan movement.

Configuration

The following **FSCAN-specific settings** can be copied. It is assumed here that the receiver is already in FSCAN mode.

The scan start frequency, scan stop frequency and FSCAN stepsize can be set as follows:

- SCAN-F5(Param) -
  "Scan Start Frequency" / "Scan Stop Frequency" / "Freq Scan Stepsize"
- Or via the configuration menu:
  CONF- F2(Scan) -
  "Scan Start Frequency" / "Scan Stop Frequency" / "Freq Scan Stepsize"

The remaining FSCAN settings control the movement from one frequency point to the next.

Associated SCPI commands:

FSCAN mode on (SWEEP = FSCAN)
    [SENSe]:FREQuency:MODE CW|FIXed|SWEep|MSCan|PSCan 245

7.1.4 MSCAN

Characteristics

Like FSCAN mode, MSCAN mode scans individual frequency points. However, unlike FSCAN mode the parameters for the different points can be set individually, including the frequency.

These points are saved in the memory list, which is accessible via
MEM-F4(Edit Memory).
For more details on the memory list, please see section "Memory system" (p.79).

The parameters for a MSCAN point are listed in Table 1 (p. 66).

RX frequency	1	Demodulation	2
Bandwidth	3	Attenuator pad	4
Squelch on/off	5	Squelch level	6
Antenna number	7	AFC on/off	8
Frequency point active		Descriptive text	10

Table 1: Parameters for an MSCAN point

The numbers in this table refer to Fig. 7-7 (p. 68).

MSCAN is activated as follows:

- Press SCAN-F1(Mode) repeatedly until MSCAN mode appears.
- Or press the Freq/Mem key (below F6).

F3 (Run+) or F2 (Run-) initiates the scan in the up or down direction.

Configuration

The following MSCAN-specific settings can be made. It is assumed here that the receiver is already in MSCAN mode.

First memory location for scan

- Via the configuration: CONF-F2(Scan) –"Scan Start Line"

Last memory location for scan

- Via the configuration: CONF-F2(Scan) –"Scan Stop Line"
- Via SCAN – F5 (Param) - "Scan Stop Line"

The MSCAN sweeps across all of the frequency points between the first and last memory locations that are activated.

Usage of the squelch parameters saved for the frequency point

- Via the configuration: CONF-F2(Scan) –"Use Squelch From Memory"
- Via SCAN – F5 (Param) - "Use Squelch From Memory"

If "Use Squelch From Memory" is activated, the squelch level as well as the squelch on/off setting is taken from the saved frequency point; otherwise, the receiver's current squelch settings are used. In this case, the squelch settings can be dynamically modified by the user during the scan.

Besides these settings, for MSCAN the parameters dwell time, dwell time mode, no signal time and no signal time mode as well as the number of sweeps can also be set via the configuration as follows:

CONF-F2(Scan) -<Parameter name>.

The timing logic for the frequency stepping, the influence of the measurement time and the outputs during the scan procedure are the same for MSCAN as was previously described for FSCAN.

Note, however, that frequency points are skipped if their antennas are not included; see MSCAN **antenna list** (p. 102).

Operation

MSCAN operation will now be discussed based on Fig. 7-7 (p. 68).

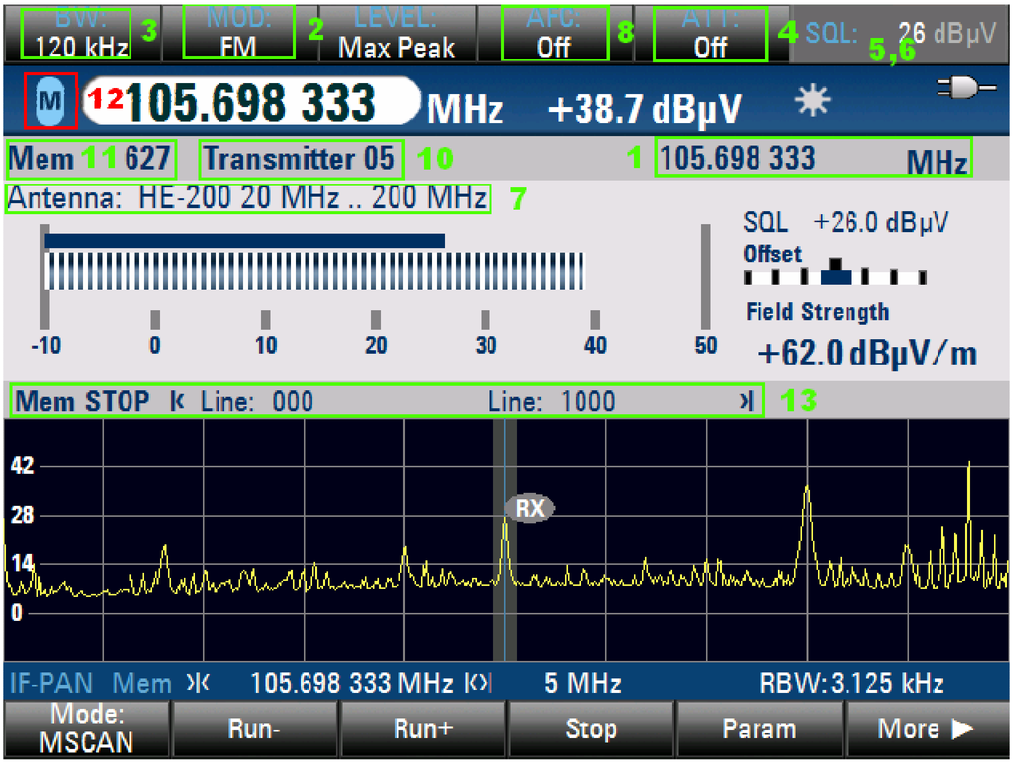


Fig. 7-7: MSCAN screen

In MSCAN mode, the display contains at the top left an "M" with a blue background (12, red in Fig. 7-7) (p. 68). In this mode, the front rotary knob and the numeric keypad are not used to adjust the frequency. Instead, they control the list position in the memory list, i.e. they select the currently valid frequency point in the list. As always, the top rotary knob controls the RX frequency.

The data relevant to the frequency point has been numbered in Fig. 7-7 (p. 68); see also Table 1 (p. 66).
Field 11 is the name of the frequency point in the memory list.
Field 13 shows whether a scan is running along with the first and last memory locations set by the user.

The data for the current frequency point can be modified, but not during a scan movement as before.
The detector can be changed using the LEVEL key even during a scan movement.
The squelch parameters (squelch level and squelch on/off) can be modified during a scan movement only if interactive squelch was selected as follows:
F5(Param) – "Use Squelch From Memory" → Off

The current settings (even after a modification) can be saved in the current frequency point using F6(More) – F3(Direct Save) except during a scan movement.

Suppression of frequency points at a keypress is possible outside of a scan movement as follows: F6(More) - F2(Suppress).
The affected frequency point is deactivated in the memory list and can be reactivated using the memory list; see Memory system (p. 79). In other words, in MSCAN mode "Suppress" affects the memory list and not the suppress list.

Associated SCPI commands:

Spectral section

Besides levels, the R&S PR100 can also display spectra ("traces"). These traces are generated using a fast Fourier transformation (FFT) as shown in Fig. 5-2 (p. 25). In FFM, FSCAN and MSCAN modes, the IF bandwidth around the current receive frequency is displayed. In PSCAN mode (see section "Panorama Scan Option " (p. 88)), a spectrum can be displayed across multiple IF bandwidths. The receiver normally generates a spectrum every 50 ms. The spectra are displayed directly, or they undergo averaging or similar processing.

The parameters that influence the content of the spectrum are discussed below. For information on the display and evaluation of the spectrum, please see section "

Display and evaluation" (p. 71).

The following parameters influence the content of the spectrum:

IF bandwidth	In steps between 10 MHz and 1 kHz
Measurement time	Also used by RX
IF display mode	Normal, MIN HOLD, AVG, MAX HOLD
Measurement mode	Periodic/continuous, for receive and spectral sections respectively

RX stands for FFM, FSCAN and MSCAN in the table.

The *IF bandwidth* indirectly influences the spacing between two frequency points (resolution bandwidth, RBW) since the bandwidth of an IF is always broken down into 1600 frequency intervals.

Measurement time: In FFM, FSCAN and MSCAN modes, the spectrum display is normally updated every 50 ms. In PSCAN mode, a new IF block is added to the spectrum after the measurement time elapses. This measurement time is also used in the receive section.

IF display mode has the following possibilities:

Normal – Display the current spectrum. In PSCAN mode, the current spectrum at the end of the measurement time is used.

AVG – Form the average value over the measurement time. This is a sliding average value (time constant = measurement time) for FFM, FSCAN and MSCAN. In PSCAN mode, at the end of the measurement time the average value for all of the IF spectra within the measurement time is computed and added to the display.

MIN HOLD, MAX HOLD – Analogous to AVG; the minimum or maximum value within the measurement time is displayed for each frequency point.

The *measurement mode* determines whether measured values are delivered at the end of a measurement time (periodic) or also during the measurement time (continuous). This can be set separately for spectra and level values.

7.1.5 Settings in FFM, FSCAN and MSCAN

In FFM, FSCAN and MSCAN modes, the parameters listed above can be set as follows:

IF bandwidth

- DISP-F4(Zoom) – Cursor keys up / down (beside lock button)

Measurement time

- Previously described under measurement *time* (p. 54).

IF display mode

- Via the configuration: CONF-F3(Display)-"IF-PAN Display Mode"
- Via DISP-F2(Range)- "IF-PAN Display Mode"

Note: IF panorama = IF spectrum from FFM, FSCAN, MSCAN
RF panorama = PSCAN spectrum

Measurement mode

- CONF- F1(RX) – "Measuring Trace Mode" or
- (only FFM) SCAN-F2(Param)- "Measuring Trace Mode"

Associated SCPI commands:

IF bandwidth [SENSe]:FREQuency:SPAN<numeric_value>|UP|DOWN|MINimum|MAXimum 250
Measurement time MEASure:TIME <numeric_value>|MINimum|MAXimum|DEFault................ 188
Measurement mode MEASure:MODE CONTinuous|PERiodic 188
Display mode
CALCulate:IFPan:AVERage:TYPEMINimum|MAXimum|SCALar|OFF 158
CALCulate:PSCan:AVERage:TYPEMINimum|MAXimum|SCALar|OFF 160

7.1.6 Configuring the Input and Output

This section describes how to configure the input and output controls on the R&S PR100, meaning the keypad, rotary knobs and loudspeaker. For a description of how to configure the display, please see section "

Display and evaluation" (p. 71).

The front **keypad** and the front **rotary knob** can be **disabled** as follows:
LOCK – F2(Lock Front)

The front and top keypad and all of the rotary knobs/flywheels can be disabled as follows:
LOCK – F1(Lock All)

Unlock as follows:
LOCK – F6(Unlock).
The top rotary knob can be separately disabled and enabled using the top LOCK key.

The volume of the **keyclicks** can be set using CONF – F4(General)- "Keyclicks". The volume of the **system beeper** used to warn about illegal user input, for example, is set as follows:
CONF – F4(General)- "System beeper"

These signals as well as the **audio** output can be **muted** as follows:

- CONF – F4(General)- "Audio Mute" or with
- LOCK-F3(Audio Mute)

The function of the top **user keys U1** and **U2** can be configured as follows:
CONF- F4(General) –"User Key 1[2]".

The function of the **MST rotary knob** on the top side cannot be configured since it is dependent on the preceding operation. The MST rotary knob controls one of these functions:

- MGC gain
- Squelch level
- Tone threshold

The function that is currently activated is indicated by the green LEDs on the top side. The function can be toggled by pressing in on the MST rotary knob.

Switching on the MGC gain, squelch level and tone threshold via

- RX-F3(MGC)
- RX-F4(SQL)
- RX-F5(Tone)

also causes toggling to the most recently activated function.

Associated SCPI commands:

Display and evaluation

This section describes settings and procedures involved in displaying and evaluating results. Further PSCAN-specific display information can be found in section "Panorama Scan Option " (p. 88).

Characteristics

Three different display types are available for presenting results:

- RX
- Spectrum
- Waterfall

They can be displayed individually and (in some cases) also combined as follows:
DISP-F1(Display Mode)

Fig. 7-8 (p. 72) and Fig. 7-9 (p. 73) show examples of the display modes "RX+Spectrum" and "Spectrum+Waterfall". Each has two displays.
The RX display has already been described in detail in Fig. 7-2 (p. 57) and Fig. 7-3 (p. 58).

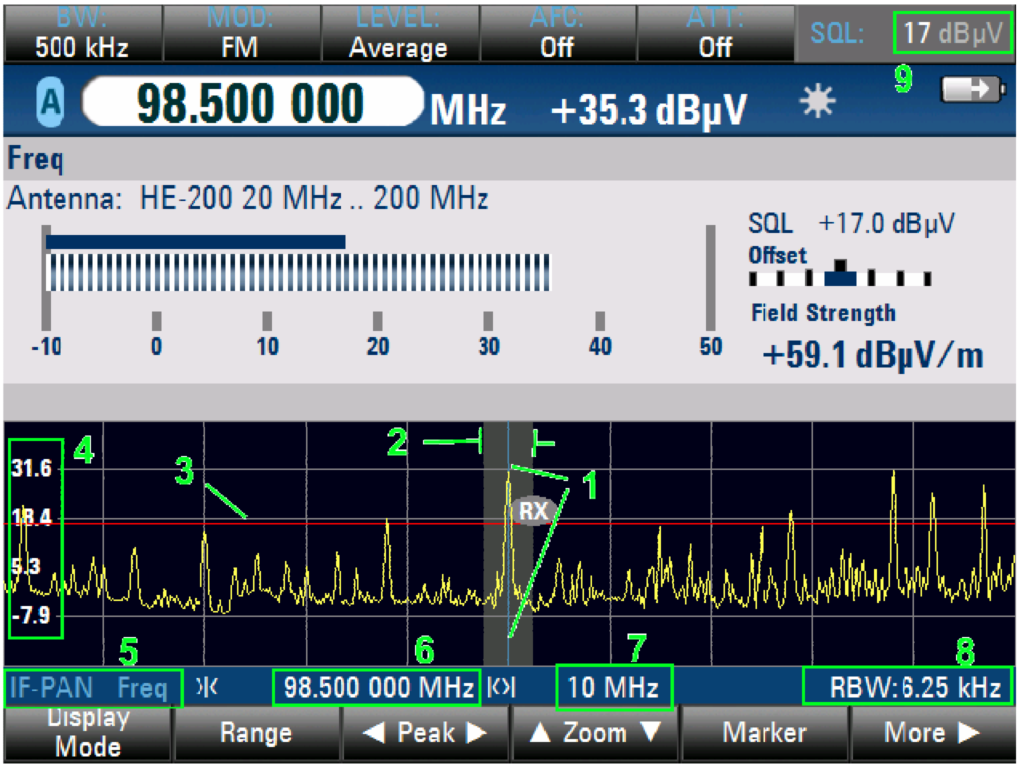


Fig. 7-8: Display of RX and spectrum

The spectrum display will be discussed based on Fig. 7-8 (p. 72) in the following table.

No.	Explanation
1	Set RX frequency. Always the current center frequency in FFM, FSCAN and MSCAN. In PSCAN, the RX frequency is independent of the set PSCAN limits; see "Access to the receive section" in the "Panorama Scan Option " section (p. 88).
2	Demodulation window; set bandwidth of the receive section (500 kHz in figure)
3	Set squelch level (see field 9). Displayed only if the squelch is enabled.
4	Level in the currently selected unit (dBµV or dBm)

5	Spectrum type. IF-PAN = IF spectrum, RF-PAN = PSCAN spectrum
6	Current IF center frequency = Set RX frequency
7	Current IF bandwidth for the receive section
8	Resolution bandwidth (bin width) of the spectrum; RBW = IF bandwidth / 1600
9	Set squelch level for the receive section

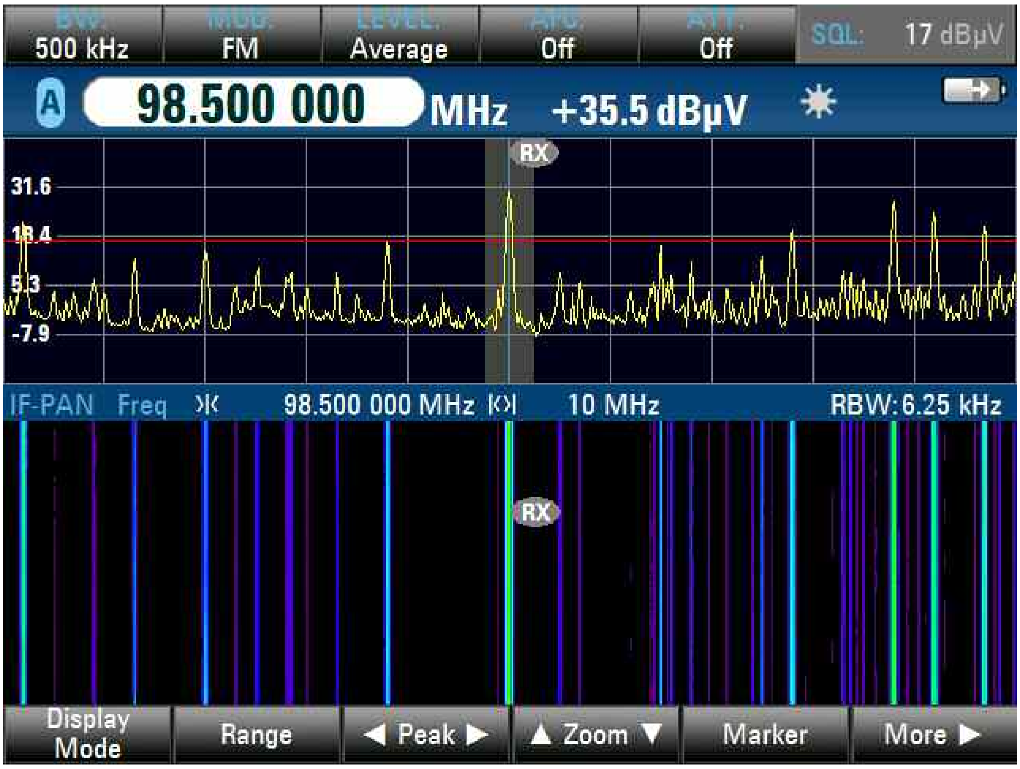


Fig. 7-9: Display of spectrum and waterfall

The waterfall display appears in Fig. 7-9 (p. 73) in the lower half of the image. The waterfall shows the behavior vs. time of the spectrum. Its horizontal axis represents the spectrum's frequency axis and its vertical axis represents time. The latest spectra appear at the top edge. The level is color-coded.

Note: The waterfall display requires significant computing power and is thus disabled under certain operating circumstances, e.g. when recording data or when outputting data streams via LAN.
The waterfall can only be used for PSCAN spectra.

Configuration

Configuration **in general**:

The *display unit* can be toggled between dBµV and dBm as follows:
CONF-F3(Display)-"Level Unit".

The *display brightness* is set using CONF-F4(General)-"Display Backlight". If the backlighting was set to 0% (display unreadable), it can be reactivated as described in "Troubleshooting" (p. 114).

The *color scheme* for the entire display can be toggled using
CONF-F4(General)-"Display Color Scheme"
between interior (subdued colors), exterior (high-contrast colors) and black & white. The waterfall color scheme must be switched separately (see below).

Configuring the **RX display**:

The scaling of the level bar is set as follows:
DISP - F2(Range)-"Level Bar Low Limit"
DISP - F2(Range)-"Level Bar Range"
and
CONF- F3(Display)-"Level Bar Low Limit"
CONF - F3(Display)-"Level Bar Range"

Moreover, the autorange function can be used for the level bar as follows:
DISP-F2(Range)-"Level Bar Auto Range"

Configuring the **spectrum display**:

Display of the *demodulation window* (tag 2 in Fig. 7-8 (p. 72)) can be switched on and off as follows:
CONF-F3(Display)-"Demodulation Bandwidth Bar"

The red line for the *squelch level* (tag 3 in Fig. 7-8 (p. 72)) can be switched on and off as follows:
CONF-F3(Display)-"Squelch Line"

The *scaling* for the PSCAN spectrum and the IF spectrum (FFM, FSCAN and MSCAN) can be set separately with no mutual influence between the settings.

For the IF spectrum in FFM, FSCAN and MSCAN, the scaling can be set as follows:

DISP - F2(Range)-"IF-PAN Level Ref"
DISP - F2(Range)-"IF-PAN Level Range"
and
CONF- F3(Display)-" IF-PAN Level Ref"
CONF - F3(Display)-"IF-PAN Level Range"

In addition, the autorange function can be used for the IF spectrum as follows:
DISP-F2(Range)-" IF-PAN Autorange"

The following applies analogously to the PSCAN spectrum:

DISP - F2(Range)-"RF-PAN Level Ref"
DISP - F2(Range)-"RF-PAN Level Range"
and
CONF- F3(Display)-" RF-PAN Level Ref"
CONF - F3(Display)-"RF-PAN Level Range"

In addition, the autorange function can be used for the RF spectrum as follows:
DISP-F2(Range)-" RF-PAN Autorange"

Configuring the **waterfall**:

The *color scheme* for the waterfall can be adjusted as follows:

- CONF-F3(Display)-"Waterfall Color Table"

- DISP-F2(Range)-"Waterfall Color Table"

The waterfall *speed* can be varied using
 CONF-F3(Display)- "Waterfall Speed"
between 20 lines/s and 0.1 lines/s. For full-screen display, this corresponds to times between 21 s and 1 h 10 min per screen pass.

The *level scaling* of the waterfall, which matches the color spectrum to the level range, can be set as follows:

 DISP - F2(Range)-" Waterfall Level Ref"
 DISP - F2(Range)-" Waterfall Level Range"
and
 CONF- F3(Display)-" Waterfall Level Ref"
 CONF - F3(Display)-" Waterfall Level Range"

In addition, the autorange function can be used for the waterfall as follows:
 DISP-F2(Range)-"Waterfall Autorange"

Associated SCPI commands:

Display brightness DISPlay:BRIGhtness<numeric_value>|MINimum|MAXimum............... 163
Color scheme for the display DISPlay:CMAPINDoor|OUTDoor|BW.. 164

RX scaling
DISPlay:LEVel:LIMit:MINimum<numeric_value>|MINimum|MAXimum 170
DISPlay:LEVel:RANGe<numeric_value>|MINimum|MAXimum... 171

RX autorange DISPlay:LEVel:AUTO.. 169

Scaling for PSCAN spectrum
DISPlay:PSCan:LEVel:RANGe<numeric_value>|MINimum|MAXimum 172
DISPlay:PSCan:LEVel:REFerence<numeric_value>|MINimum|MAXimum 173

Autorange for PSCAN spectrum DISPlay:PSCan:LEVel:AUTO 172

Scaling for RX spectrum
DISPlay:IFPan:LEVel:RANGe<numeric_value>|MINimum|MAXimum 167
DISPlay:IFPan:LEVel:REFerence<numeric_value>|MINimum|MAXimum 168

Autorange for RX spectrum DISPlay:IFPan:LEVel:AUTO 167
Waterfall color scheme DISPlay:WATerfall:CMAP<color_map> 174
Waterfall speed DISPlay:WATerfall:SPEed<numeric_value>|MINimum|MAXimum . 179

Level scaling for waterfall

DISPlay:WATerfall:CMAP:RANGe<numeric_value>|MINimum|MAXimum 176
DISPlay:WATerfall:CMAP:THReshold<numeric_value>|MINimum|MAXimum 177

Operation

Full-screen display for the spectrum and waterfall can be switched on and off as follows:
 DISP-F6(More)-F2(Full Screen).

The waterfall can be paused and restarted using
DISP-F6(More)-F4(Hold). The spectrum is not paused by this action.

It is possible to *hop from peak to peak* in the spectrum as follows:

- Enable the peak function using DISP-F3(Peak)
- Use the cursor keys (< and >) to hop to the adjacent peak; the receive (RX) frequency is set to the next peak accordingly.

If the squelch is activated, the next peak above the squelch level will be taken into account; see Fig. 7-10 (p. 76).

If the squelch is not activated, the receiver will attempt to find the next peak based on the shape of the spectrum it sees.

This type of peak hopping is possible in the current IF spectrum for FFM, FSCAN and MSCAN and also in the current or paused spectrum for PSCAN.

In the PSCAN dual screen, the hopping occurs in the (upper) IF spectrum and not in the PSCAN spectrum. Since no IF spectrum is displayed in the current PSCAN, peak hopping is possible in this display mode only if the PSCAN is paused.

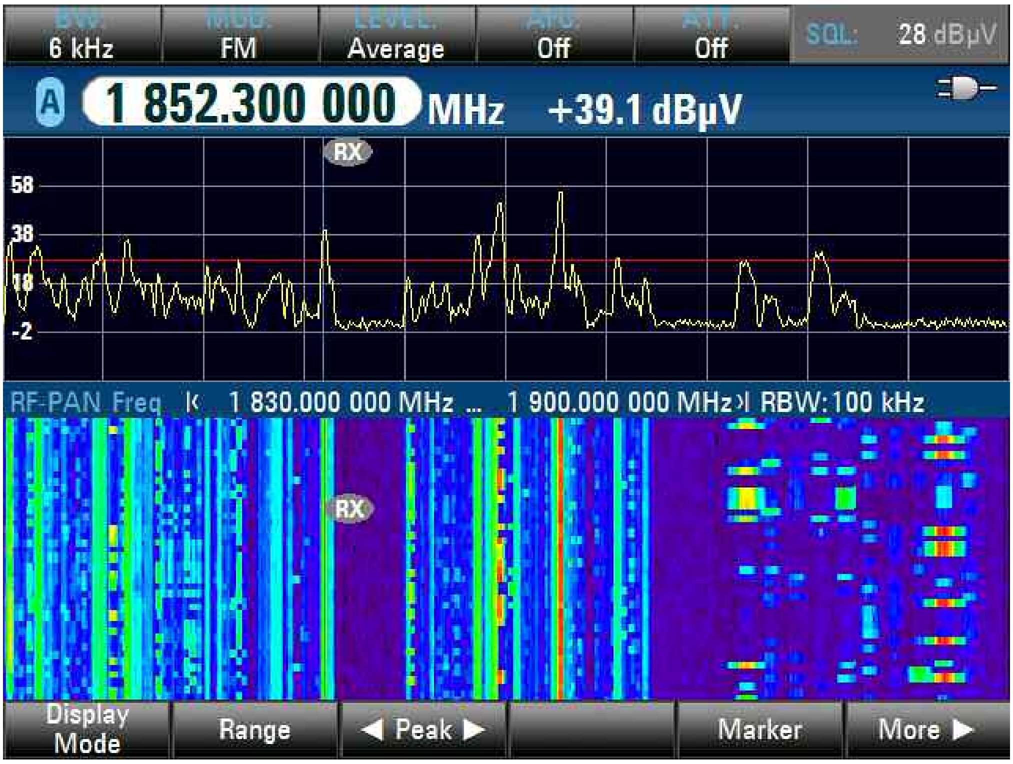


Fig. 7-10: Peak hopping with the squelch activated

In the IF spectrum, *frequency zooming* is possible as follows:

- Enable the peak function with DISP-F4(Zoom)
- Use the cursor keys (^ and v) to adjust the IF bandwidth

This zoom does not affect the PSCAN spectrum. In precise terms, this is not a display function. Instead, it represents an adjustment of the frontend; past values cannot be zoomed using this function.

The spectrum and waterfall can be analyzed in greater detail using *markers*. The marker screen (Fig. 7-11 (p. 77)) is accessed as follows:
DISP-F5(Marker)

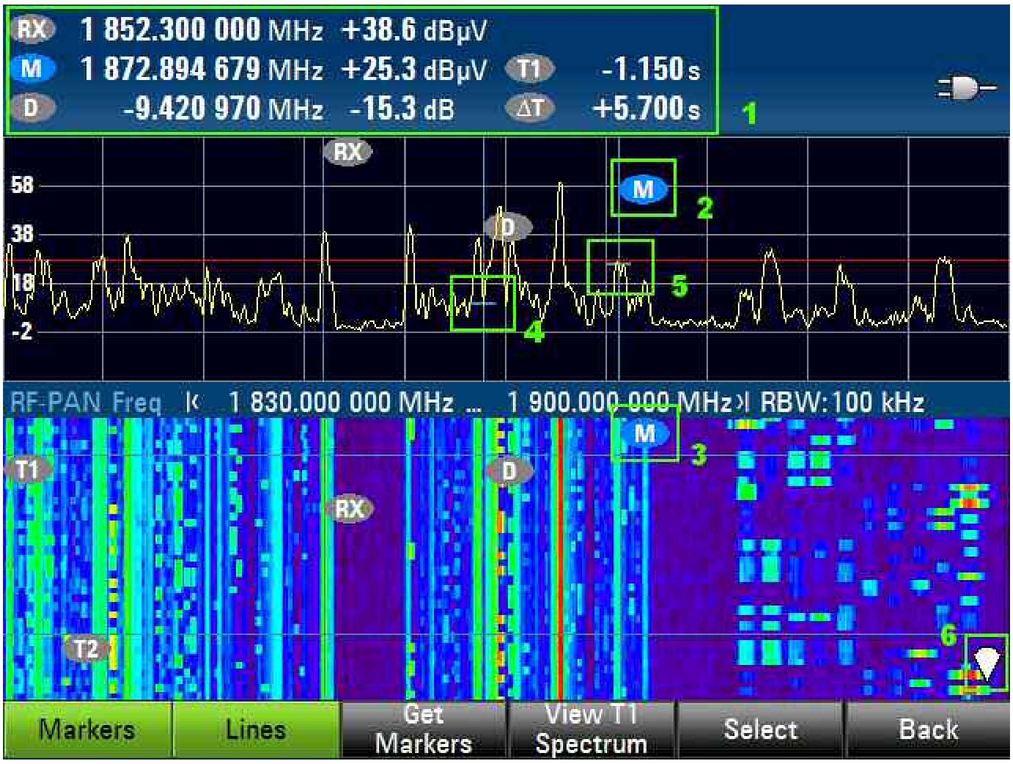


Fig. 7-11: Marker screen

The different elements in the marker screen are listed in the following table.

No.	Explanation
1	Numerical values at the marker positions. D indicates the difference between the marker positions (D-M). ΔT indicates the difference between the time markers (T2-T1). The time T1 is negative because it is in the past. L1 and L2 (level markers in spectrum, not in graphic) indicate the levels at the current marker positions (and not the difference).
2,3	Currently selected marker, highlighted in blue
4,5	Crosses for the marker positions
6	Scroll arrow; the waterfall has components below the screen that are not displayed.

The following functions are available in the marker screen:

F1(Marker) switches the vertical frequency markers D and M on and off.

F2(Lines) with waterfall switches the horizontal time markers T1 and T2 on and off.

F2(Lines) with spectrum switches the horizontal level markers L1 and L2 on and off.

F3(Get Markers) moves the markers back into the visible range if they are located outside of this range. A marker line which is located outside of the visible range is indicated using a rectangular marker icon (M,D,T1,T2,L1,L2) with a tip at the corresponding edge of the screen.

F4(View T1 Spectrum) (waterfall only) decides whether the current spectrum is displayed in the top spectrum window (View T1 off) or the spectrum which is found in the waterfall under the time marker T1 (View T1 on). In a pure waterfall view, the spectrum is shown as long as View T1 is enabled.

This function can be used for more precise analysis of a current or (especially) a paused waterfall by moving the T1 marker.

F5(Select) cycles through and selects one of the markers M, D, RX, T1/L1, T2/L2 or the scroll arrows (field 6 in Fig. 7-11 (p. 77)). The selected marker/scroll arrow is highlighted in blue (field 2 and 3 in Fig. 7-11 (p. 77)).

F6(Exit) closes the marker screen and returns to the previous screen. The activated markers remain visible even in the normal view until they are deactivated in the marker screen.

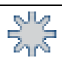
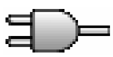
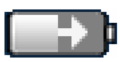
The selected marker can be moved as follows:

- Using the front rotary knob
- Using the cursor keys (left/right for frequency markers, up/down for time and level markers)
- Based on numeric input. The time markers do not accept time values; instead, they require line numbers (pixel lines).

Scroll arrows at the top and/or bottom edge of the screen appear if parts of the waterfall are not visible above or below the screen area. When the scroll arrows are selected, the waterfall can be moved up or down using the front rotary knob or the cursor keys.

Indicator icons

Various indicator icons appear at the top right of the display. They are listed below along with their meaning and references to the section where they are explained.

Icon	Explanation	Reference
	Overload at RF input, hardware	Fig. 7-6 (p. 63)
	Audio mute, receive section	Audio **output** 103)
	Level over squelch level, receive section	squelch (p. 55)
	AC power, hardware	Connecting to the power supply (p. 33)
	Battery power, 75% battery capacity remaining, hardware	Connecting to the power supply (p. 33)
	AC power, battery charging, hardware	Connecting to the power supply (p. 33)

	RX frequency outside current antenna band, field strength measurement option	Fig. 7-33 (p.104)
	Trigger waiting on start signal, external triggered measurement option	Fig. 7-37 (p. 109)
	Action triggered, external triggered measurement option	Fig. 7-37 (p. 109)
	Waterfall paused, display	Operation (p. 75)
	Recording underway, internal recording option	Fig. 7-24(p. 95)
	Audio playback running, internal recording option	Fig. 7-29 (p. 99)
	Audio playback stopped, internal recording option	Fig. 7-29 (p. 99)
	Audio playback paused, internal recording option	Fig. 7-29 (p. 99)

Associated SCPI commands:

Switch display mode DISPlay:WINDow<display> 180
Switch dual screen on / off DISPlay:WINDow<display> 180
Pause waterfall DISPlay:WATerfall:HOLD[:STATe]<Boolean> 178

Markers
CALCulate:PSCan:MARKer:MAXimum[:PEAK] 161
CALCulate:IFPan:MARKer:MAXimum[:PEAK] 159

Hop from peak to peak

CALCulate:IFPan:MARKer:MAXimum:LEFT 159
CALCulate:IFPan:MARKer:MAXimum:RIGHt 159
CALCulate:PSCan:MARKer:MAXimum:LEFT 161
CALCulate:PSCan:MARKer:MAXimum:RIGHt 162

Frequency zoom [SENSe]:FREQuency:SPAN<numeric_value>|UP|DOWN|MINimum|MAXimum ... 250

Memory system

Data management of the frequency points for MSCAN and FSCAN is described here.

MSCAN uses measurement points to make measurements, while FSCAN uses suppress points to skip frequency ranges that are not relevant.

These points are saved in the memory list or the suppress list (abbreviated as "Memory" or "Suppress" in many of the R&S PR100's menu items).

The memory list has 1024 memory locations while the suppress list has 100 memory locations. Besides processing in the R&S PR100, these lists can also be exchanged between the R&S PR100 and a PC via a USB or LAN connection using the PRView software supplied with the receiver. On the PC, these lists can be edited using PRView or exported / imported in the form of CSV files.

Navigation is possible in these two lists as follows:

- Using the front rotary knob
- Using the up/down cursor keys
- Based on numeric entry of the line numbers

The **memory list** is accessed using
MEM-F4(Edit Memory)
and can be edited as shown in Fig. 7-12 (p. 80).

Fig. 7-12: Memory list

F1 (Active/Suppress) selects the points that are actually to be used (filled square).
F2(Delete) deletes individual frequency points.
F3(Recall) – F6(Exit) accepts the frequency point as the current receiver setting (but only if the receiver is in MSCAN mode).
F4(View) shows the parameters for a single frequency point as shown in Fig. 7-13 (p. 81). The parameters can also be edited in this screen.

F5(Sort) can be used to sort the list entries by memory number, frequency and description (either in ascending or descending order); see Fig. 7-14 (p. 81). MSCAN processes the list that has been sorted in this manner from top to bottom, i.e. in the order of the line numbers.
Note: Do not confuse the memory numbers and line numbers!

F6(Exit) closes the memory list.

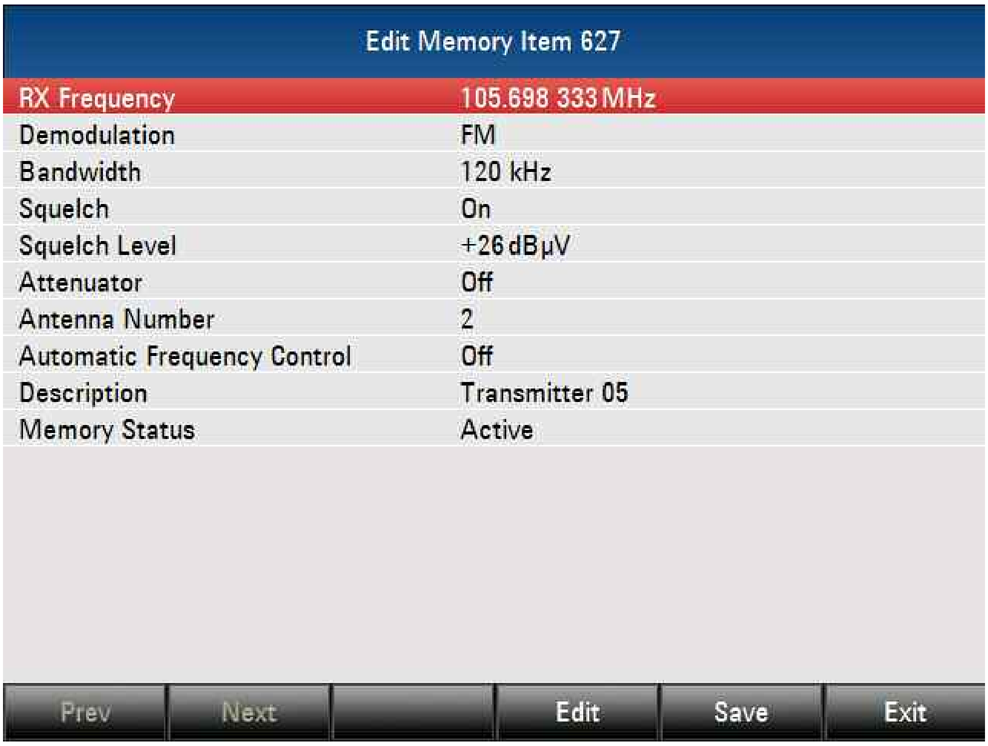


Fig. 7-13: Parameters for a frequency point

Fig. 7-14: Memory sort menu

The suppress list is accessed using
MEM-F5(Edit Suppress);
see Fig. 7-15 (p. 82).

Since it has almost the same editing capabilities as the memory list, only the features that differ are described.

Fig. 7-15: Suppress list

F3(Delete All) deletes all of the suppress entries. Note that F4(Sort) and F5(View) are swapped positions compared to the memory list.
F4(Sort) has been simplified and the list can only be sorted by frequency. During sorting, overlapping or embedded frequency ranges are also combined into a single frequency range.

Associated SCPI commands:

Content of the memory list MEMory:CONTents?<mem_loc> 192
Create memory entry MEMory:CONTents<mem_loc>,<mem_paras>|<packed_struct> 191

Content of the suppress list TRACe|DATA:VALue?<trace_name>,<index> 332
Create suppress entry TRACe|DATA:VALue<trace_name>,<index>,<numeric_value>........ 331

File system

This section discusses storage and file management with the SD card (with the exception of internal recording); see also section 7.1.9 (p. 94).

Pressing the FILE key causes file system functions to be assigned to function keys F1 to F6;
see Fig. 7-16 (p. 83).

If there is no SD card in the instrument, all of the file system functions except for F3-(User Presets) will be grayed out (deactivated). After insertion of an SD card, the functions are reactivated within approx. 8 s.

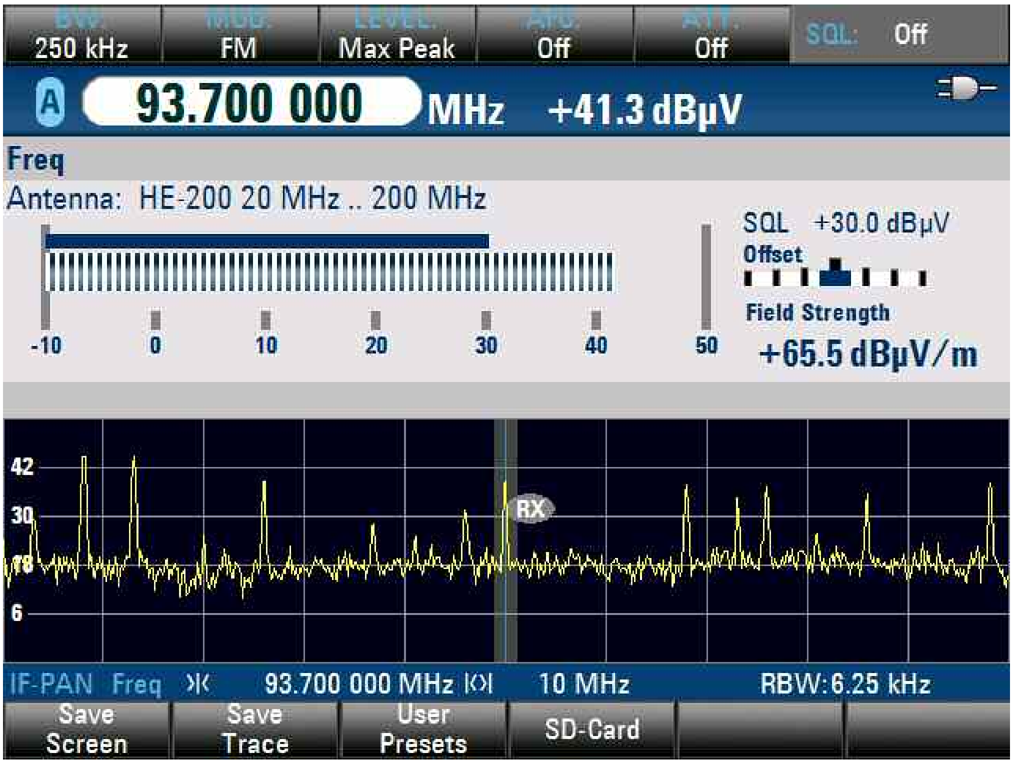


Fig. 7-16: FILE key assignments

F1 (Save Screen) saves the current screen in PNG format. To make it easier to print, the spectrum appears in black & white, but the waterfall retains its color. Prior to the save operation, the user can modify the automatically generated file name.

F2 (Save Trace) saves the current spectrum as a CSV file. One level value per pixel (approx. 640 pixels) is saved (instead of each frequency measured value). As before, the user can modify the automatically generated file name prior to the save operation.

F3 (User Presets) saves all of the current receiver settings in a data set so these settings can be recalled later.
User presets are described in Fig. 7-17 (p. 84).

F4 (SD Card) allows access to the file system on the SD card.
For details on this type of access, please see Fig. 7-18 (p. 85).

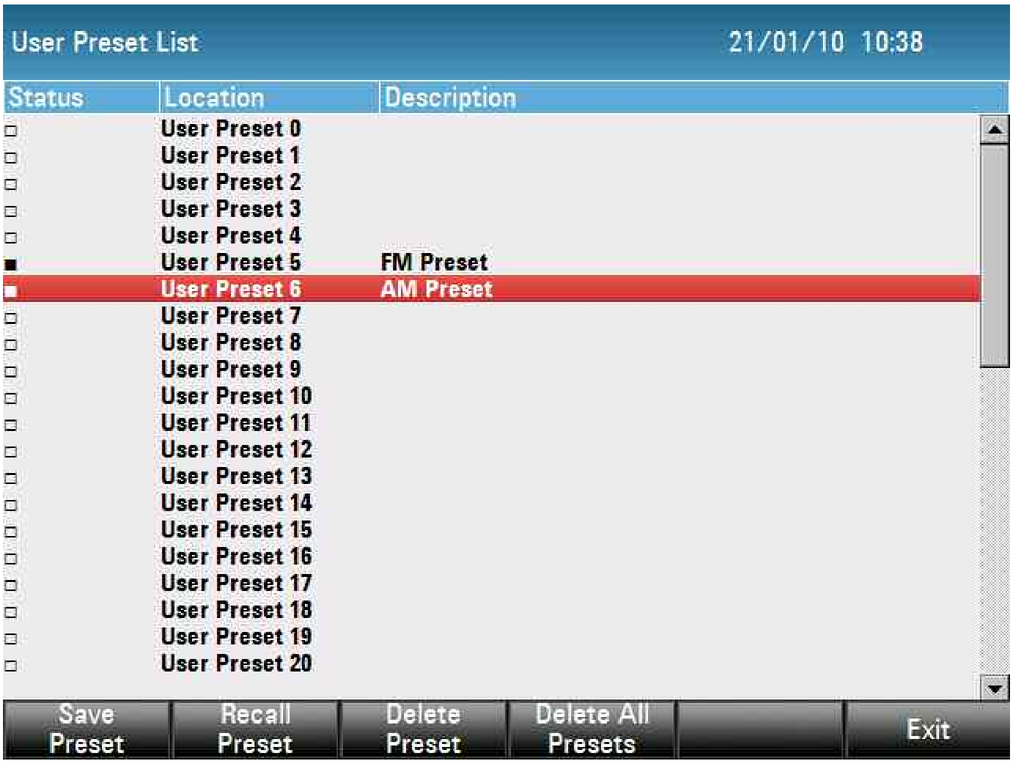


Fig. 7-17: User presets in the file system

The **user presets** in Fig. 7-17 (p. 84) store all of the current receiver settings in a data set so these settings can be recalled later.

50 different settings can be saved; used memory locations are marked with a black square.

The data is saved in the receiver's flash file system instead of on the SD card. Accordingly, the saved settings will be deleted if the flash file system is formatted (LOCK-F6 at startup).

User presets cannot be exported or imported.

Under certain circumstances, e.g. when a scan is running, any attempt to reload the settings is rejected and an error message is output.

Fig. 7-18: SD card in the file system

Access to **files and directories on the SD card** will now be discussed based on Fig. 7-18 (p. 85).

Directories are indicated using the icons seen at tags 1 and 2. The folder icon with the left arrow at tag 1 indicates the higher-level directory, while the folder icon without a left arrow at tag 2 indicates a subdirectory. The name of the directory that is currently displayed is indicated next to the higher-level directory. All of the other entries represent files.
The remaining memory that is free is shown at tag 3.

Navigation within the current directory, which involves moving the red bar, is possible using the front rotary knob or the up/down cursor keys.
Moving to a different directory (higher- or lower-level) involves two steps:

- Place the red bar on the target directory
- Press the Enter key or the center button on the front rotary knob

F1(Mark) switches the selection mode on and off. To prepare for an action, a file or a directory must be selected. One or more files/directories can be selected as follows:

- Activate F1(Mark) (green)
- Place the red bar on the file or directory
- Press the Enter key or the center button on the front rotary knob. The file/directory is now selected and the line appears in green.
- Select additional files/directories if so desired.
- If necessary, it is possible to deselect individual files/directories using the Enter key or the center button on the front rotary knob.

Note: The selection will be lost if F1(Mark) is deactivated.

F2(Select Action) enables the following **file actions**:

– Rename
– Delete
– Cut, Copy and Paste

These procedures are described individually below. It is assumed here that one or more files/directories have already been selected with green lines.

If there is no active selection, any actions performed with F2 will have no effect (exception: paste).

● Rename

F2(Select Action)-"Rename" –ENTER opens a window in which the new name can be entered. Complete this action using ENTER or F1(Rename). If multiple files were selected, only the topmost one will be renamed.

● Delete

F2(Select Action)-"Delete" –ENTER deletes the selected files/directories with no further warning. Directories are erased along with all of their contents.

● Cut

F2(Select Action)-"Cut" –ENTER marks the selected file (internally) to be cut. The file is not deleted at its old location until it is copied to the new location using the paste function.

● Copy

F2(Select Action)-"Copy" –ENTER marks the selected file (internally) to be copied.

● Paste

F2(Select Action)-"Paste" –ENTER copies the previously cut or copied file/directory to the current directory. It is permitted to change directories between the cut/copy and paste operations.
After the paste operation, the source file is no longer marked for copying; pasting a file twice requires performing the copy/paste operation twice.

F3(Sort) can be used to sort by:

– Name
– Date and time of day
– File type
– File size

The first sort operation by a specific criterion is in the ascending direction; the second sort operation by the same criterion is in the descending direction, etc.

F4(Tools) is used to create a new subdirectory ("Create Folder") and to format the SD card ("Format SD Card").

Notes:
1. For performance-related reasons, it is recommended to format new SD cards using this menu item.
2. The format procedure deletes all of the data on the SD card.

Associated SCPI commands:

Options

In the R&S PR100 and R&S EM100, additional features can be enabled using option codes. The following table provides a summary of the available options.

Option	Abbreviation	Order no. R&S PR100	Order no. R&S EM100	Comment
Panorama Scan	PS	4071.9306.02	4071.9306.03	
Internal Recording	IR	4071.9358.02	4071.9358.03	
Remote Control	RC	4071.9406.02	---	Preinstalled in the R&S EM100
Frequency Extension	FE	---	4070.4669.03	Extends R&S EM100 from 3.5 GHz to 7.5 GHz
External Triggered Measurement	ETM	4071.9458.02	4071.9458.03	
Field Strength Measurement	FS	4071.9506.02	4071.9506.03	
Frequency Processing SHF	FP	4071.9558.02	---	FS required in the R&S PR100; FS and FE required in the R&S EM100
Global Positioning System	GPS	4071.9958.02	4071.9958.03	In preparation

7.1.7 Option Code Activation

New option codes can be entered as follows:
CONF-F4(General)-"<Option name>" - ENTER

Terminate the entry of the option code with ENTER.

If the correct code is entered, the option will be activated and can be used.

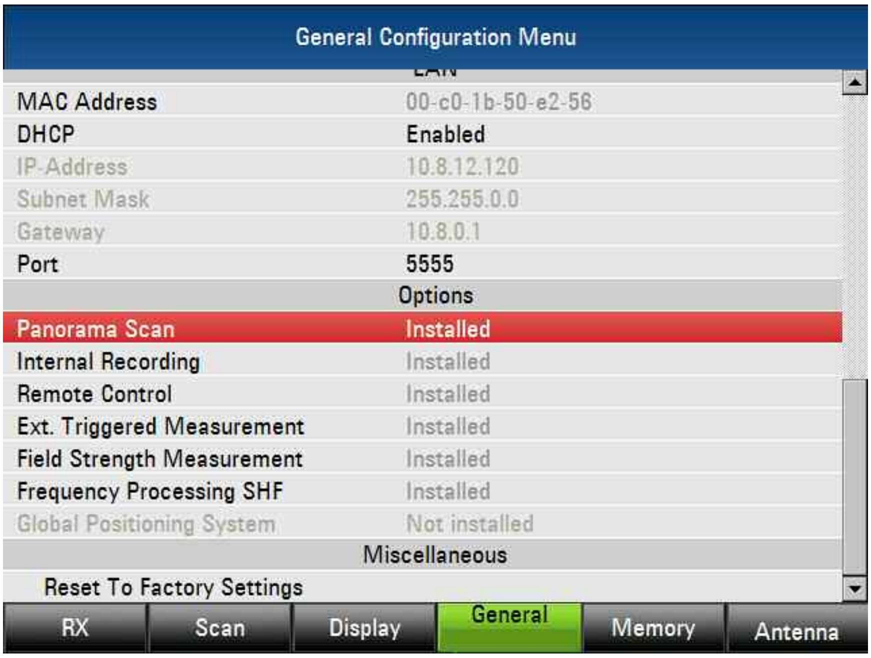


Fig. 7-19: Option code activation

Associated SCPI commands:

Installed options *OPT? 157
Enter option code SYSTem:SECurity:OPTion<code> 306

7.1.8 Panorama Scan Option

The panorama scan option makes it possible to select the PSCAN mode.

Characteristics

PSCAN mode scans a selectable frequency range using a frequency grid that can be selected in a stepwise manner. For this purpose, (IF) frequency windows of max. 10 MHz width are linked in succession, and thus the complete, predefined scan range is traversed . Each window is broken down into spectral points using an FFT. PSCAN provides very fast spectral scans over wide frequency ranges, but it does not provide any level data or audio.

The receiver adapts the IF bandwidth and the number of required IF blocks to the selected frequency limits for the scan and the "panorama scan resolution bandwidth". This resolution bandwidth is not identical to the demodulation width, but rather the spacing between two frequency points in the panorama scan, i.e. it is comparable to the "resolution bandwidth" (RBW) obtained when using the zoom function (see section "Display and evaluation" (p. 71)).

The following PSCAN resolution bandwidths are available:

PSCAN resolution bandwidths (kHz)					
0.125	0.25	0.5	0.625	1.25	2.5
3.125	6.25	12.5	25	50	100

Configuration

PSCAN is activated as follows:

Press SCAN-F1(Mode) repeatedly until PSCAN mode appears.

F3 (Run+) or F2 (Run-) initiates the scan in the up or down direction.

The following **PSCAN-specific settings** can be made. It is assumed here that the receiver is already in PSCAN mode.

The scan start frequency, scan stop frequency and PSCAN frequency resolution can be set as follows:

- SCAN-F5(Param) -
  "Scan Start Frequency" / "Scan Stop Frequency" / "RF Panorama Scan Resolution BW"
- Or using the configuration menu:
  CONF- F2(Scan) -
  "Scan Start Frequency" / "Scan Stop Frequency" / "RF Panorama Scan Resolution BW"

The parameters that influence the content of the spectrum can be set as follows in PSCAN:

IF bandwidth
indirectly via PSCAN frequency resolution; see above

Measurement time

- As described previously under "measurement *time*" (p. 54).
- In PSCAN mode, also using SCAN-F5(Param)-"Measure Time"

IF display mode
- Via the configuration, CONF-F3(Display)-"RF-PAN Display Mode"
- Via DISP-F2(Range)- "RF-PAN Display Mode"

Note: IF panorama = IF spectrum from FFM, FSCAN, MSCAN
RF panorama = PSCAN spectrum

Measurement mode
- CONF- F1(RX) – "Measuring Trace Mode"

Operation

PSCAN has three **special display and evaluation capabilities**:
- Difference mode
- Access to the receive section
- "Dual spectrum" display for PSCAN and FFM

In **difference mode**, the difference between the current spectrum and a previously recorded reference spectrum is displayed.

To generate a difference spectrum of this sort, a normal PSCAN spectrum is first recorded for use as the reference spectrum; see Fig. 7-20 (p. 90).

Next, difference mode is activated using DISP-F6(More)-F3(Diff Mode); see Fig. 7-21 (p. 91). This causes level differences with respect to the previously recorded reference spectrum to be displayed.

These level differences are determined by forming the difference between the dBµV values. In other words, what is displayed is the relationship of the two levels in dB.

It is possible to toggle between difference mode and normal mode while a PSCAN is underway or paused. In case of a paused PSCAN, it is possible to modify the measurement time or the IF display mode, for example, prior to the difference measurement in order to refer the current spectra to a reference spectrum that has been averaged over the longer term.

In difference mode, the difference values are displayed in the spectrum and also in the RX and waterfall display; see section "

Display and evaluation" (p. 71).

Fig. 7-20: Reference spectrum in difference mode

Fig. 7-21: Difference spectrum in difference mode

In PSCAN mode, it is possible to **access the receive section**. The RX marker can be adjusted using the front and top rotary knob or by means of numeric frequency input; see Fig. 7-22 (p. 92), field 2. During a running PSCAN, level measurements can be made on the set RX frequency. Moreover, it is possible to modify all of the FFM settings during a running PSCAN. The level value is updated as soon as the IF block in which the RX marker is located has been scanned.
For a paused PSCAN, audio can also be output. Moreover, the current FFM settings can be copied to the memory or suppress list as follows:

- SCAN-F6(More)-F3(Direct Save)
- Or SCAN-F6(More)-F2(Suppress)

In order to obtain comparable values in the spectrum and in the numerical level display, make sure that the receive bandwidth in FFM and the resolution bandwidth (RBW) in PSCAN are set the same. The same applies to the FFM detector and the PSCAN IF display mode since the level refers to the power in a (bin) bandwidth. It is also recommended to switch on the AFC to ensure that the signal of interest is actually entirely within the demodulation bandwidth.

Fig. 7-22 (p. 92) explains some of the fields in the "RX + Spectrum" display in PSCAN.

Field	Explanation
1	FFM parameters, receive section
2	Adjustable RX marker
3	PSCAN parameters
4	PSCAN status (running/paused)
5	RX level, measured in FFM receive section
6	Bandwidth of FFM receive section

Note: Fig. 7-22 (p. 92) shows three different bandwidths:

– Bin bandwidth (resolution bandwidth) for the PSCAN in field 3
– Bin bandwidth (resolution bandwidth) for the FFM IF spectrum in field 1
– Detector bandwidth for the FFM receive section in field 6

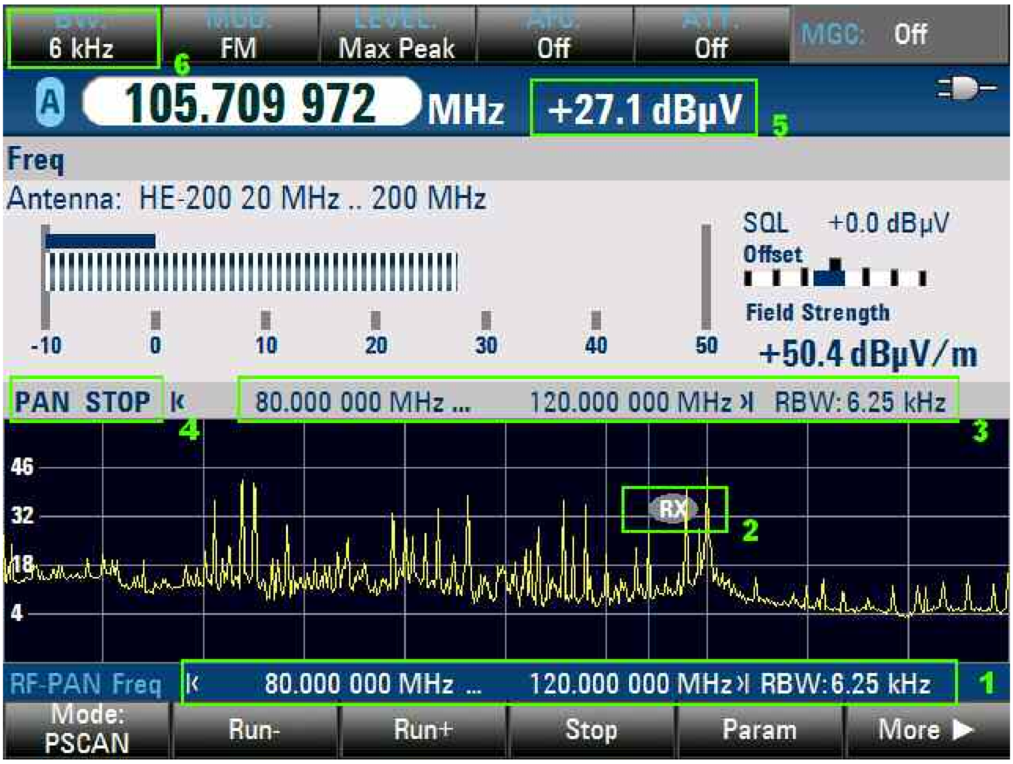


Fig. 7-22: RX level measurement in PSCAN

The spectra for the PSCAN and the IF around the RX marker can be jointly monitored in a **"dual spectrum" display**; see Fig. 7-23 (p. 93). This display is activated as follows:

- DISP-F1(Display Mode)-"Dual Spectrum"

The lower half of the screen shows the PSCAN spectrum and the upper half shows the FFM spectrum as long as PSCAN is paused.

The following table explains some of the fields in the "Dual Spectrum" display in PSCAN.

Field	Explanation
1	PSCAN parameters
2	FFM parameters, receive section Adjustable RX marker
3	RX level, measured in FFM receive section
4	Bandwidth of FFM receive section

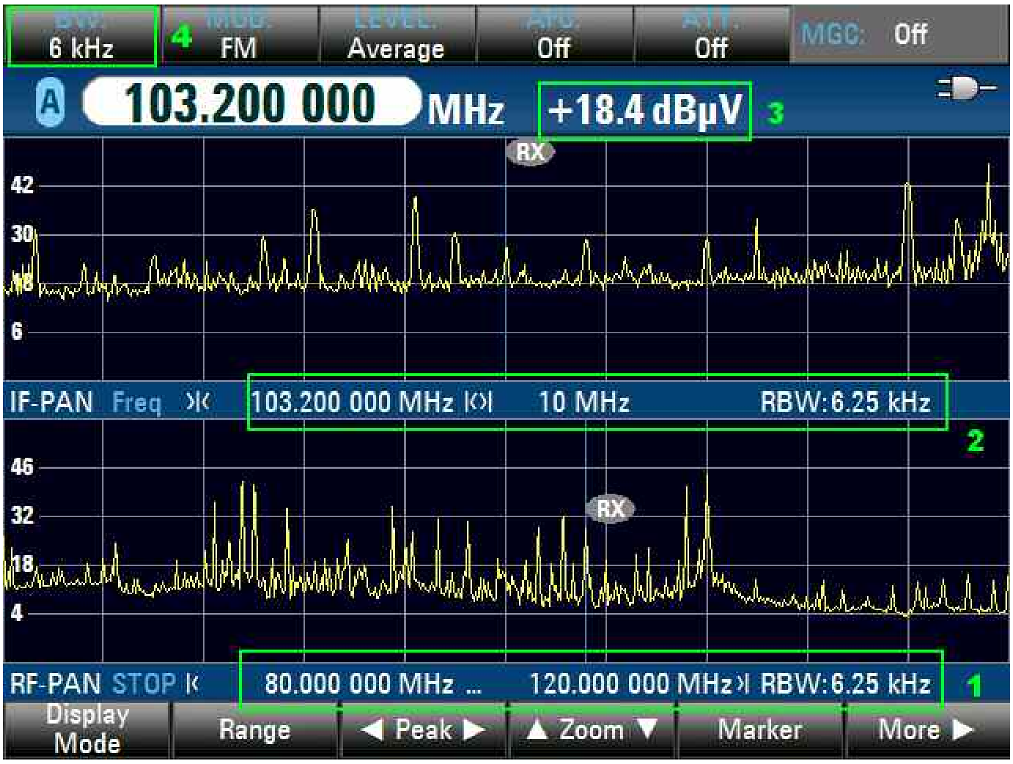


Fig. 7-23: Dual spectrum display in PSCAN

Associated SCPI commands:

Activate PSCAN mode [SENSe]:FREQuency:MODE CW|FIXed|SWEep|MSCan|PSCan................. 245
Start scan INITiate[:IMMediate].. 186
Stop scan ABORt 157

Scan start frequency [SENSe]:FREQuency:PSCan:STARt<numeric_value>|MINimum|MAXimum. 248
Scan stop frequenc [SENSe]:FREQuency:PSCan:STOP<numeric_value>|MINimum|MAXimum.. 249
Scan stepsize [SENSe]:PSCan:STEP<numeric_value>|UP|DOWN|MINimum|MAXimum.... 271
Scan direction [SENSe]:PSCan:DIRectionUP|DOWN 270

PSCAN display mode CALCulate:PSCan:AVERage:TYPEMINimum|MAXimum|SCALar|OFF...... 160
Dual spectrum display DISPlay:WINDow<display> 180

7.1.9 Internal Recording Option

The internal recording (IR) option makes it possible to record data streams either in the receiver's internal RAM or on the SD card.

The following data can be recorded:

- Digital audio data
- Spectra (i.e. trace data) from FFM, FSCAN, MSCAN and PSCAN
- IQ data up to 500 kHz bandwidth

Characteristics

Internal recording can also play back recorded audio and trace data; IQ data are not available for playback.

Audio is recorded in WAV files. The recording format for trace and IQ data is the format for the (LAN) UDP streams; see section 14 (p. 369).

Audio data can be recorded continuously or using squelch control. The sampling rate and other audio parameters can be set by the user.

Trace and IQ data are recorded using the current receiver settings. These settings may be modified while recording is underway.

In conjunction with the external triggered measurement (ETM) option, the recording process can also be controlled by a trigger, e.g. by the squelch or external signals.

Recorded data can be written to the receiver's RAM or saved on the SD card.

For RAM recording, the memory size can be selected in steps between 8 MB and 64 MB and the recording mode ("memory mode") can be toggled between "cyclic" and "stop on full". In the "cyclic" memory mode, the available memory is used as a ring buffer so that current data for the most recent past is always available as a function of the memory size. "Stop on full" records until the selected memory is full and then stops recording.

The RAM content is lost when the receiver is switched off. The content can be saved on the SD card using REC-F4(Save RAM).

When recording on the SD card, the operating system supports a maximum file size of 4 GB. Recording ends when the user or the trigger (ETM option) stops recording or the SD card is full. Cyclic recording mode is not supported with the SD card.

Internal recording requires a high-speed SD card. A slower card can lead to internal buffer overflows and loss of data.

For performance-related reasons, certain actions requiring significant computing power are not allowed during recording and are disabled. The following mutual limitations apply:

- Multiple simultaneous recordings (e.g. trace + audio) are not possible.
- Playback and recording are not possible simultaneously.
- Waterfall display mode is disabled during recording.
- UDP streams are possible in parallel to recording, but with reduced throughput.
- The scan speed can be reduced during recording.
- IQ streaming is paused as long as IQ data are being recorded.
- Audio streaming is paused as long as audio is being recorded.
- Audio is recorded only if an audio signal is available. In other words: When a PSCAN is underway, audio is never recorded. In FSCAN and MSCAN modes, audio is recorded only during dwell times but not during the scan movement.

NOTE!

The high recording speeds necessitate the use of a high-quality, class 6 SD card with a write speed of at least
133x / 20 MB/s. A suitable card (4 GB, class 6) is available from Rohde & Schwarz under part number 4070.4475.00.

SD cards with a size up to 32 GB can be used in the R&S PR100.

A new SD card must be formatted in the R&S PR100 using
FILE-F4(SD-Card)-F4(Tools)-"Format SD Card"
in order to achieve the full recording speed.

Operation

Operation of internal recording will now be discussed based on Fig. 7-24 (p. 95). Pressing the REC key causes recording functions to be assigned to function keys F1 to F6.

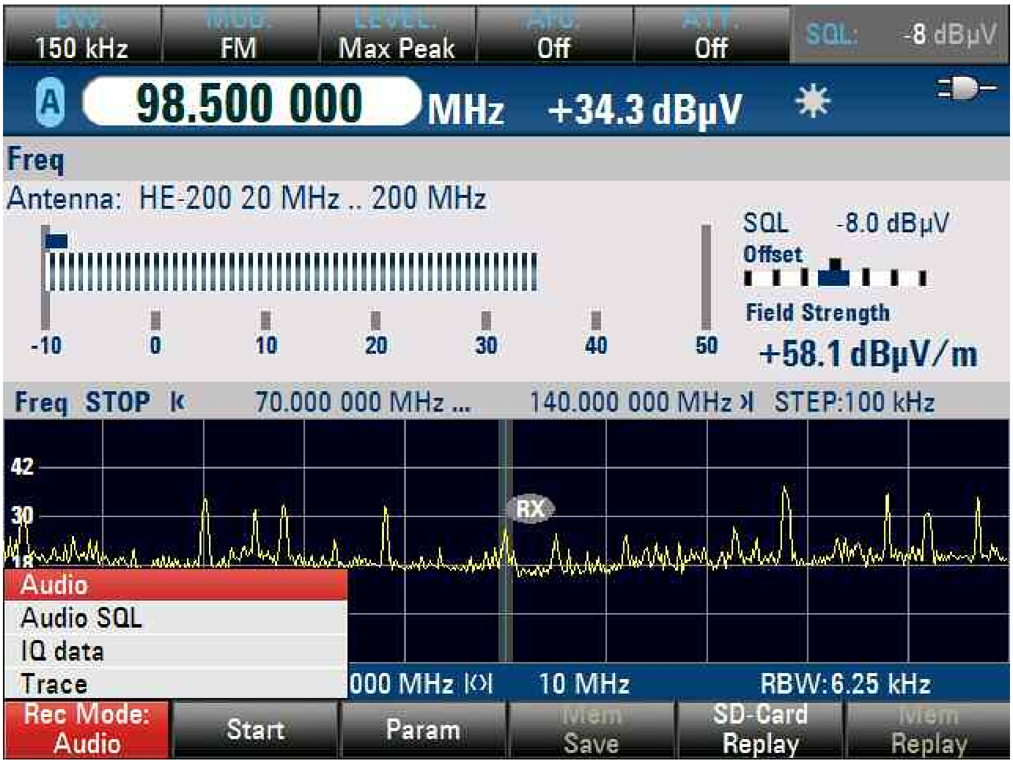


Fig. 7-24: Internal recording

F1(Rec Mode) determines what to record:

Text	Explanation
Audio	Continuous audio recording
Audio SQL	Audio recording only when level >= squelch
IQ data	IQ data
Trace	Spectral data with the current setting. This setting can be modified dynamically by the user or also by FSCAN or MSCAN.

F2(Start) starts and ends recording. When it is desired to record very short time intervals, the start message (which is normally displayed for 8 seconds) can be clicked off by touching any other key (e.g. CANCEL).

F3(Param) configures the recording medium and the audio recording.
The following individual parameters can be selected:

Parameter	Possible selections	Explanation
Recording Storage	RAM / SD card	Target memory for recording
Record Memory Size	8, 16, 32, 64 MB	RAM size for recording
Memory Mode		Relevant only for RAM
	Cyclic	Continuous recording; RAM is used as ring buffer
	Stop on full	Single recording that ends as soon as the selected RAM memory size is full
Digital Audio Mode	Audio data formats fromTable 13-8 (p. 359)	Sample rate, bits, mono/stereo

These settings can also be modified in the configuration as follows:
CONF-F5(Memory)-"Recording"

F4(Mem Save) saves a recording in RAM to the SD card; see Fig. 7-25 (p. 96). This menu item is activated only upon termination of a RAM recording with Stop.

If no SD card is inserted, the corresponding F2, F4 and F5 keys will remain grayed out (i.e. inactive).

Fig. 7-25: Saving RAM to the SD card

F5(SD-Card Replay) and

F6(Mem Replay)
are used to play back the RAM content or a recorded file on the SD card.
Playback is possible for trace data (*.rtr) and audio data (*.wav) but not for IQ data (*.riq).

During playback from the SD card, a file selection menu is also enabled as seen in Fig. 7-26 (p. 97).

Fig. 7-26: File selection for playback

Playback of trace data will now be discussed based on Fig. 7-27 (p. 97) and Fig. 7-28 (p. 98).

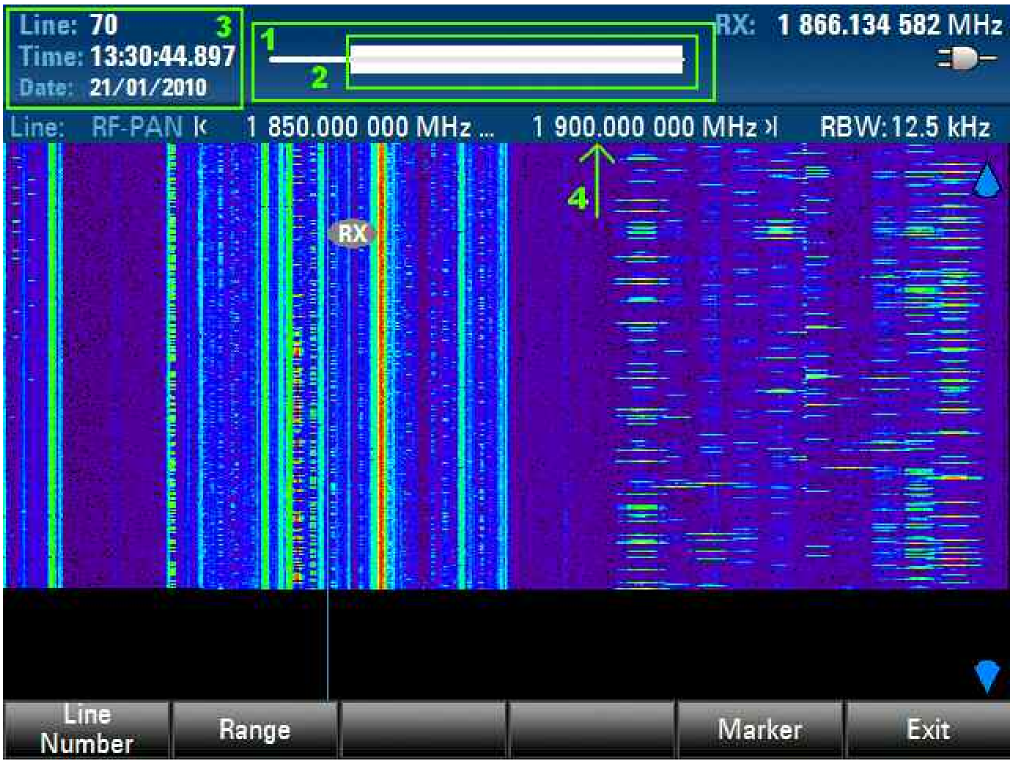


Fig. 7-27: Trace playback screen

After selecting a trace file or RAM content with a trace, the playback screen shown above appears with the waterfall representing the recorded data. The newest data is found on the top edge (tag 4)

and the older data continues downwards.
The screen shows only an excerpt of the recorded data. Tag 1 represents all of the recorded data and tag 2 represents the size and position of the displayed excerpt.
The line number and time at tag 3 refer to the top edge of the displayed excerpt.

Navigation is possible in this screen using the up/down cursor keys and with F1(Line) by entering a line number. The line numbers correspond to the recorded spectra (max. 20 per second).

F2(Range) can be used to scale the level of the waterfall and select the waterfall color scheme.

F5(Marker) opens the marker screen; see Fig. 7-28 (p. 98).
F6(Exit) returns to the previous screen.

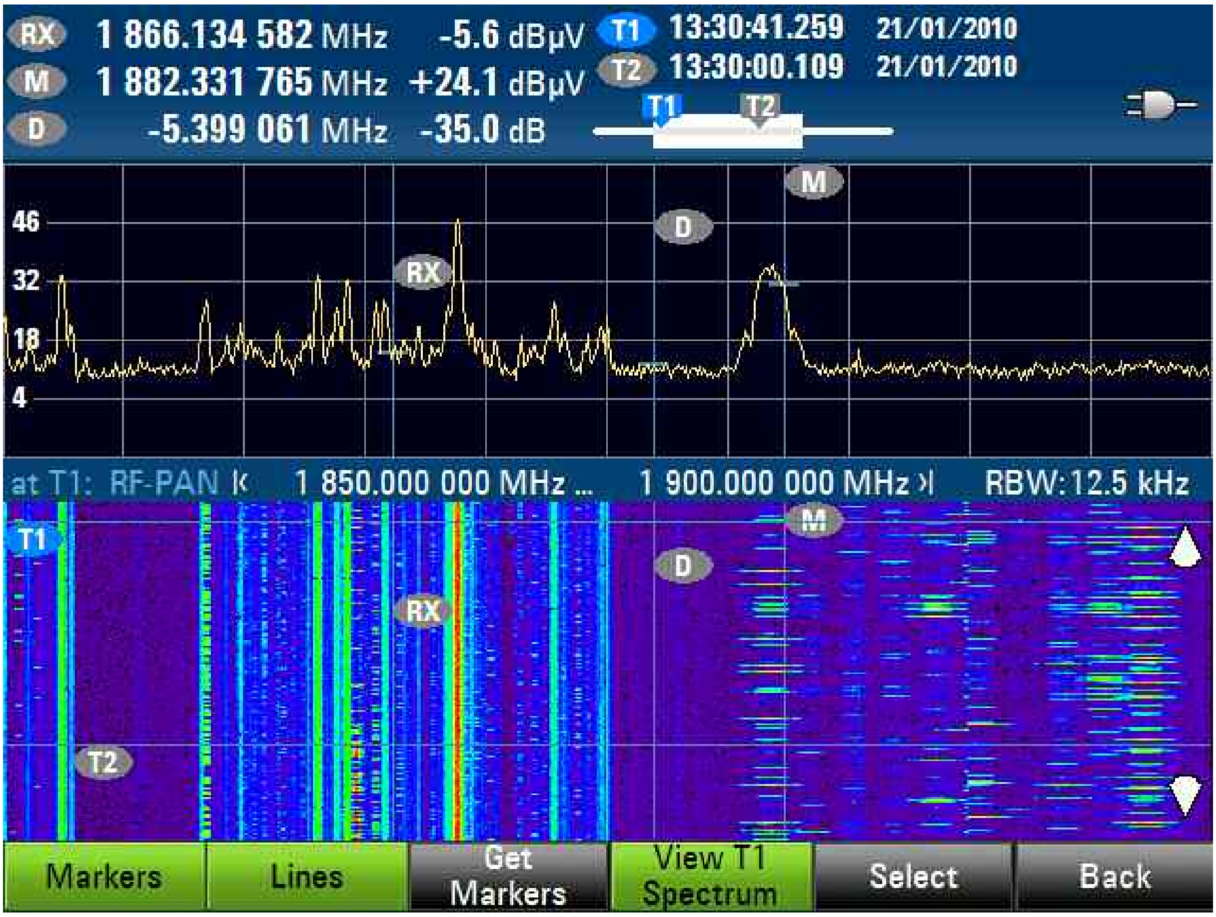


Fig. 7-28: Markers in the trace playback screen

The markers in trace playback operate like the waterfall markers (see Fig. 7-11 (p. 77)) but with the following distinctions:

- The position of the time markers is displayed in the top white bar
- The waterfall cannot be scrolled with the front rotary knob when the scroll arrow is selected; only the up/down cursor keys and Enter+line number can be used.

Playback of audio data will now be discussed based on Fig. 7-29 (p. 99).

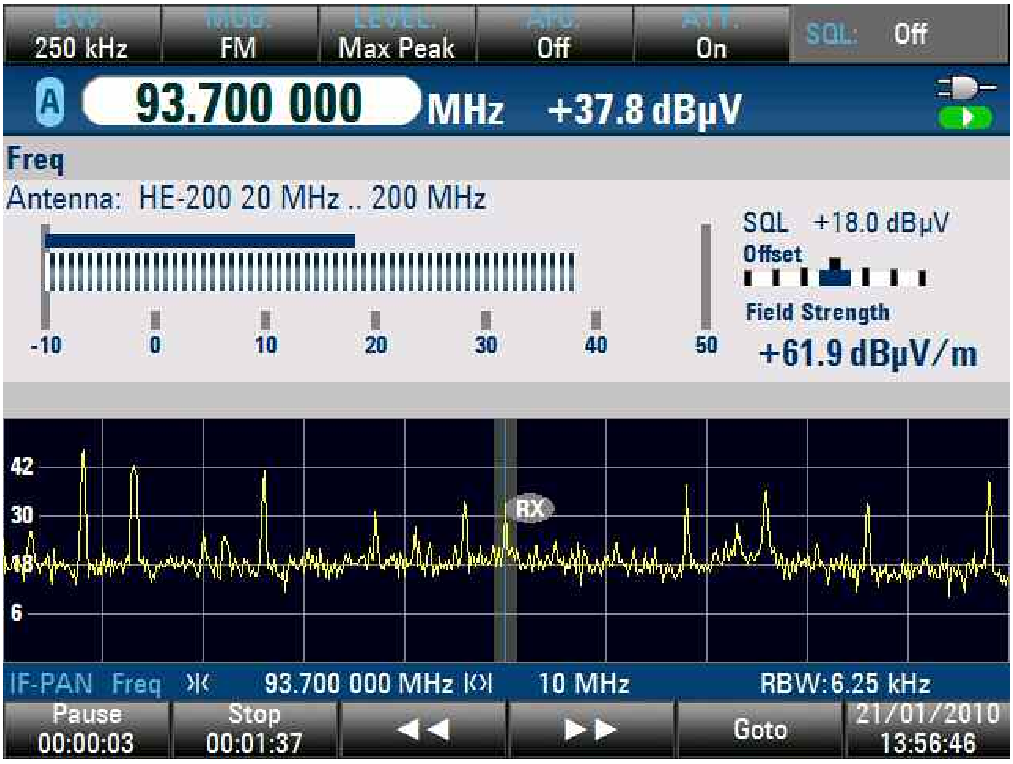


Fig. 7-29: Internal recording, audio playback

Audio playback has the following modes:

– Playing 
– Paused 
– Stopped 

The corresponding icons appear at the top right in the display window.

F1(Play/Pause) is used to start playback and F2(Stop) to stop playback.
Playback can be paused and resumed using F1 (Play/Pause).

During playback of an audio recording, normal work with the receiver can proceed. However, the limitations described under "mutual limitations apply" (p. 94) do apply.
When playback is paused or stopped, the audio signal that is currently received is output; the audio recording is output during playback of a recording.

If the Stop key is not visible while playback is running or paused, it can be redisplayed by pressing the REC key.

For the current audio file, three times are displayed:

– Total length of the current audio file at F2(Stop)
– Relative playback position within the total length at F1(Play/Pause)
– Absolute time of the current playback position at F6

Navigation is possible within audio files as follows:

Skips:

Skip magnitude	Backwards	Forwards
1 s	F3(<<)	F4(>>)
5% of total duration	Cursor key < (left)	Cursor key > (right)
20% of total duration	Cursor key v (down)	Cursor key ^ (up)

Positioning:
F5(Goto) with indication of the relative playback position

Such navigation is possible in all of the playback modes (playing, paused and stopped).

Associated SCPI commands:

Format SD card	MMEMory:INIT[<label>]	207
Data type for recording	TRACe|DATA:RECord:SOURceIQ|AUDio|AOS|TRACes	316
Storage medium	TRACe|DATA:RECord:STORageMEMory|FILE	317
RAM size	TRACe|DATA:RECord:MEMory:SIZE<size>|MINimum|MAXimum	318
Memory mode	TRACe|DATA:RECord:MEMory:MODECYCLic|ONCE	320
Start recording	TRACe|DATA:RECord:STARt	322
Stop recording	TRACe|DATA:RECord:STOP	324
Recording, data loss?	TRACe|DATA:RECord:OVERruns?	325
Save RAM on SD card	TRACe|DATA:RECord:MEMory:SAVE<filename>	321
Start playback	TRACe|DATA:REPLay:STARt[<filename>]	326
Pause playback	TRACe|DATA:REPLay:STOP	327
Resume playback	TRACe|DATA:REPLay:RESume	329
Stop playback	TRACe|DATA:REPLay:STOP	327
Playback, seek in file	TRACe|DATA:REPLay:SEEK<position>|MINimum|MAXimum	325

7.1.10 Field Strength Measurement Option

The field strength measurement (FS) option makes it possible to take antenna factors into account. A field strength measurement makes it possible to display levels as well as field strength values (in dBμV/m), query these values via SCPI and stream them via UDP. Spectra are not converted into field strengths.

Antenna parameters

Antennas are managed using an antenna list with 100 locations as shown in Fig. 7-30 (p. 101). The antenna list is accessed as follows:
CONF-F6(Antenna)

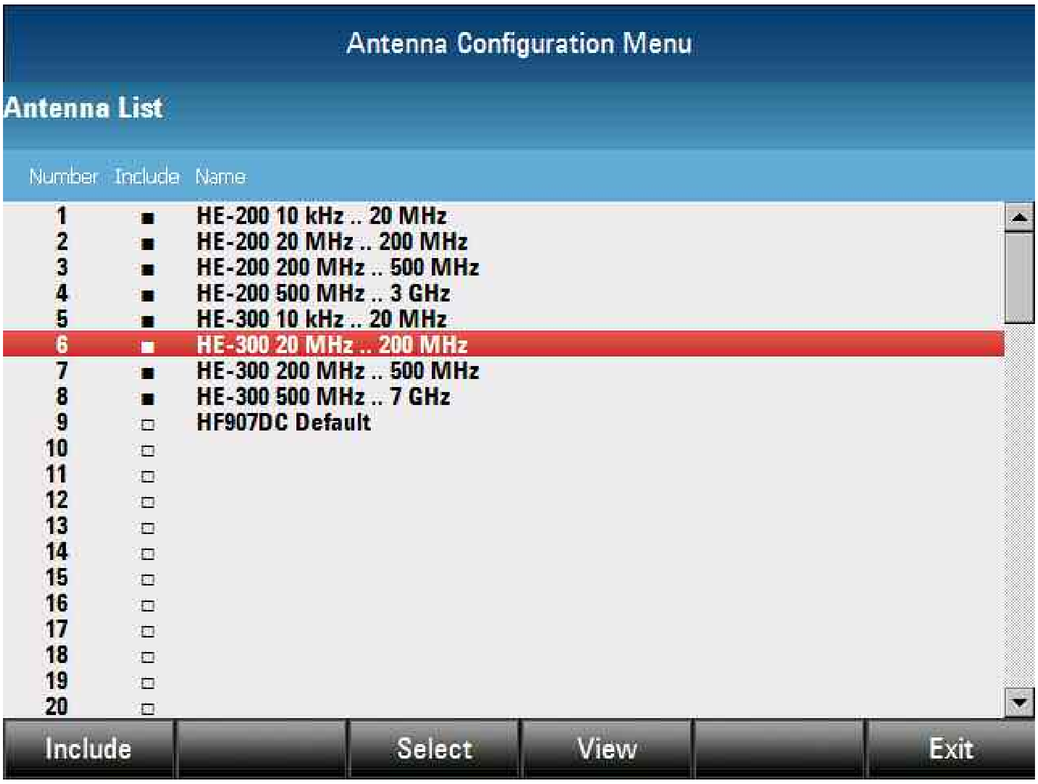


Fig. 7-30: Antenna list

Navigation is possible in the antenna list using the front rotary knob and the up/down cursor keys.

F3(Select) makes the selected antenna the current antenna.

F4(View) displays the parameters for the selected antenna; see Fig. 7-31 (p. 102).

F6(Exit) returns to the previous screen.

Antennas can be deleted as follows:
CONF-F6(Antenna)-F4(View)-F5(Delete).
This command deletes all of the antenna parameters and the antenna is no longer available.

Antenna parameters can be modified as follows:
CONF-F6(Antenna)-F4(View)-F4(Edit);
see Fig. 7-31 (p. 102)

Insertion of antenna parameters into an empty antenna position simultaneously creates a new antenna.

The antenna parameters will now be discussed based on Fig. 7-31 (p. 102).

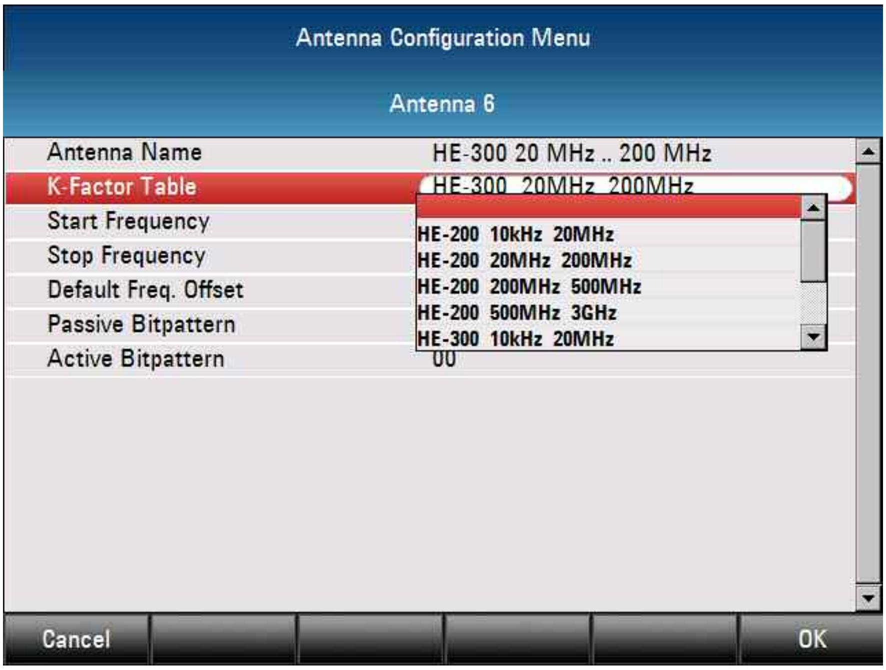


Fig. 7-31: Editing the antenna parameters

The antenna parameters are as follows:

Name	Explanation
Antenna Name	Name of the antenna; this is shown in the RX display
K-Factor Table	Table of antenna factors representing the antenna's frequency response; see "K-factor table" (p. 103). Fig. 7-31 shows a selection of K-factor tables.
Start Frequency	Lower limit of the antenna frequency range
Stop Frequency	Upper limit of the antenna frequency range
Default Freq. Offset	Reserved (unused)
Passive Bit Pattern	Level of antenna control lines ANT1 and ANT0 if the antenna was switched to "passive" (preamplifier off) in the R&S PR100. See "Antenna control " (p. 103).
Active Bit Pattern	Like passive bit pattern, but "active", i.e. preamplifier on

MSCAN antenna list

There is one peculiarity to note with MSCAN. Any antenna in the list can be assigned to each MSCAN frequency point. However, in the antenna list only 8 antennas can be simultaneously marked as "included" since they are kept in a fast background memory. Accordingly, MSCAN skips all of the frequency points whose antennas are not included in order to avoid long loading times. Selection of the currently valid antenna for FFM, FSCAN and PSCAN is not affected and it does not have to be included.

Antenna selection

The currently valid antenna can be selected in the following ways:

- Via the antenna list with CONF-F6(Antenna)-F3(Select)
- Via the configuration with CONF-F1(RX)-Antenna
- For an MSCAN point, using
  MEM-F4(Edit Memory)-F4(View)-F4(Edit)-"Antenna Number"

Antenna control

To allow physical control of connected antennas or switch platforms, the PR100 has the outputs I/O 0 = ANT 0 and I/O 1 = ANT 1 on the AUX1 output (top); see Fig. 6-3 (p. 43).

The bit patterns in Fig. 7-31 (p. 102) control these two lines if nothing else is specified in the receiver configuration.
It is possible to determine whether the bit pattern for the antenna or a bit pattern specified by the user is present on AUX1 as follows:
CONF-F1(RX)-"Antenna Lines"
"AUTO" uses the bit pattern for the antenna; the other bit patterns appear directly at the output.

Toggling of the preamplifier (on/off) can be performed as follows:
CONF-F1(RX)-"Antenna Mode".
This toggling operation places the passive or active bit pattern for the current antenna parameters on the AUX1 output (but only if "Antenna Lines" was set to "AUTO").

The settings for "Antenna Lines" and "Antenna Mode" apply globally even during an MSCAN which can have an individual antenna for each frequency point.

K-factor table

K-factor tables model the frequency response of an antenna and are included in an antenna description by referencing their name.
One line of the K-factor table contains the frequency in Hz and one entry each for the gain with and without the preamplifier switched on (antenna mode passive/active).

A K-factor table can contain a maximum of 1000 points; the gain per point can be selected between -99.9 and +99.9.

These tables cannot be interactively edited in the R&S PR100. Instead, they must be exchanged between the R&S PR100 and a PC via a USB or LAN connection using the supplied PRView software. On the PC, these tables can be edited using PRView or exported / imported in the form of CSV files.

In particular, it is possible in this manner to input the measured K-factor tables that are supplied with an antenna into the PR100.

Note: If a new K-factor table is assigned to an antenna, it is not activated until the receiver is restarted.

Field strength display

The field strength can be read off in the RX display (tag 1 in Fig. 7-32 (p.104)) as long as the receive frequency is located within the antenna frequency range.

If the receive frequency is outside of the antenna frequency range, a warning icon will be displayed and no field strength value will appear (tags 2 and 3 in Fig. 7-33 (p.104)).

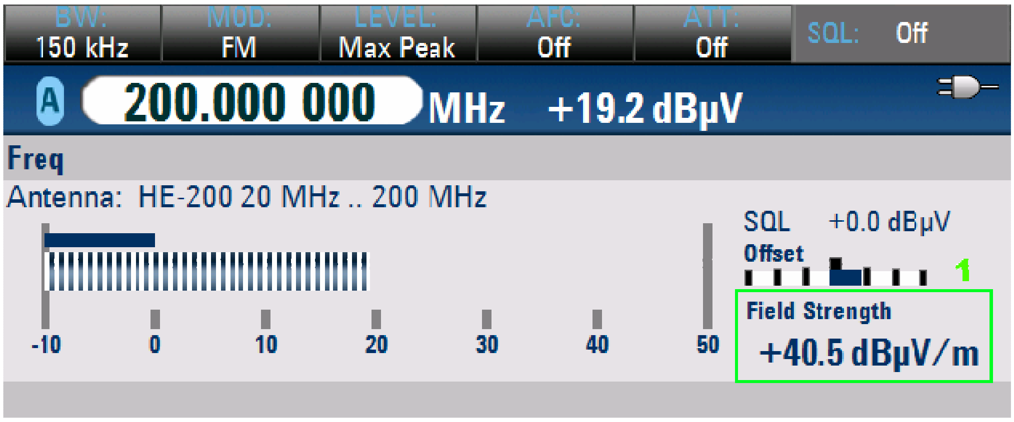


Fig. 7-32: Receive frequency within antenna range

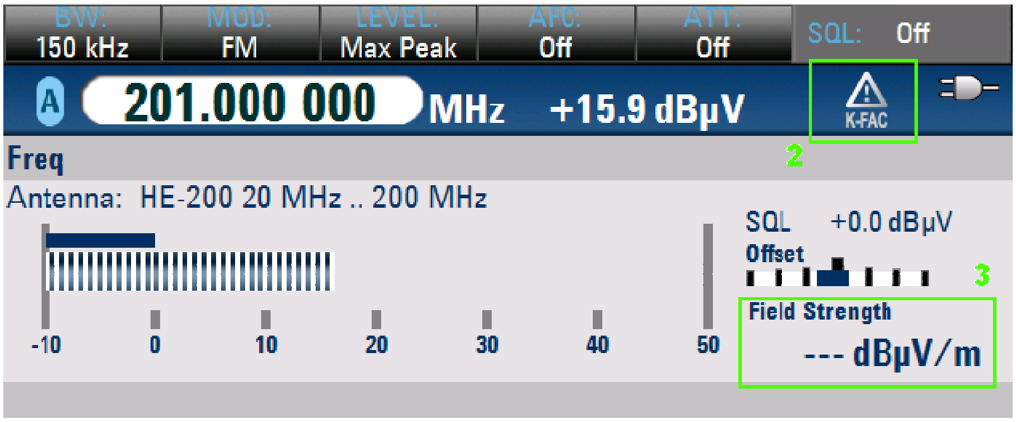


Fig. 7-33: Receive frequency outside of antenna range

Associated SCPI commands:

Output antenna list ROUTe:PATH:CATalog? 226
Define antenna ROUTe:PATH[:DEFine]<name>,<channel> 228

Set parameters for an antenna

ROUTe:PATH:KFACtor<channel>,<table> 232
ROUTe:PATH:FREQuency:RANGe<channel>,<start_frequency>,<stop_frequency> 231
ROUTe:PATH:BITPattern:ACTive<channel>,<numeric_value> 224
ROUTe:PATH:BITPattern:PASSive<channel>,<numeric_value> 225
Select current antenna ROUTe:SELect<channel> 235
Antenna control [SENSe]:CORRection:ANTennaACTive|PASSive 236
Available KF tables ROUTe:PATH:KFACtor:CATalog? 233
Switch field strength display on/off DISPlay:FSTRength<Boolean> 166

Note: In the ROUTE commands, OPEN/CLOSE refers to opening and closing (virtual) relays.

7.1.11 Remote Control Option

The remote control (RC) option is used to connect the PR100 to a LAN.

It is needed for the following applications:

- Communication with the PR100Control remote control software
- SCPI communication
- UDP streaming via LAN
- Firmware update via LAN

Configuration

It is possible to switch between a fixed IP address and usage of a DHCP server as follows:
CONF-F4(General)-"DHCP"

The IP address, subnet mask and gateway can also be configured as follows:
CONF-F4(General)-"<Parameter name>"

Using CONF-F4(General)-"Port", it is possible to set the port on which the receiver accepts SCPI commands.

The hostname for the receiver is derived from the serial number as follows:
For R&S PR100 rs-pr100-<serial number>-002
For R&S EM100 rs-em100-<serial number>-002
Example: rs-pr100-102007-002

The PR100 is shipped with the following factory default settings:

DHCP	OFF
IP address	172.17.75.1
Subnet mask	255.255.255.0
Port	5555
Gateway	0.0.0.0

In case of a reset to the factory default settings, the current LAN settings are retained!

If DHCP access is changed from enabled to disabled, the PR100 will switch to the IP address that is statically configured.

Operation

Setup and testing of a LAN connection between a PC and the PR100 is discussed here. This LAN connection can be used to input all of the SCPI commands and observe the responses. UDP streams cannot be monitored in this manner.

- Connect the LAN cable to the PC and the PR100 (direct connection), or connect the PR100 to the office network (network connection). The PR100 will automatically detect crossed and uncrossed LAN cables.
- In case of a direct connection, set the IP addresses and subnet masks for the PR100 and PC so that a connection can be established.
- In case of a network connection, set the PR100 to DHCP and configure the DHCP server as required, or (without DHCP) set the IP addresses and subnet masks like for a direct connection.
- Open a DOS window and ping the PR100 as follows:
  `ping –a 12.34.56.78`
  The parameter –a returns the hostname of the R&S PR100.

- If the connection is working, open a hyperterminal on the PC as follows:
  Start-Programs-Accessories-Communication-Hyperterminal

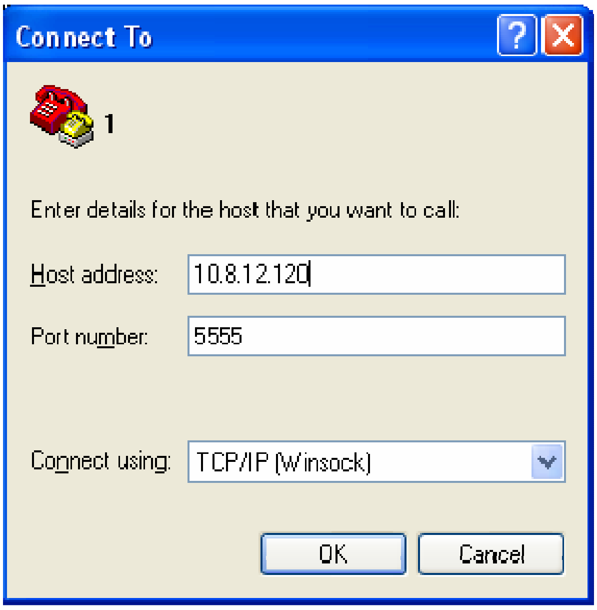


Fig. 7-34: Hyperterminal connection setup

- In Hyperterminal, enable transmission of line ends and local echo as follows:
  File – Properties – Settings – ASCII Configuration

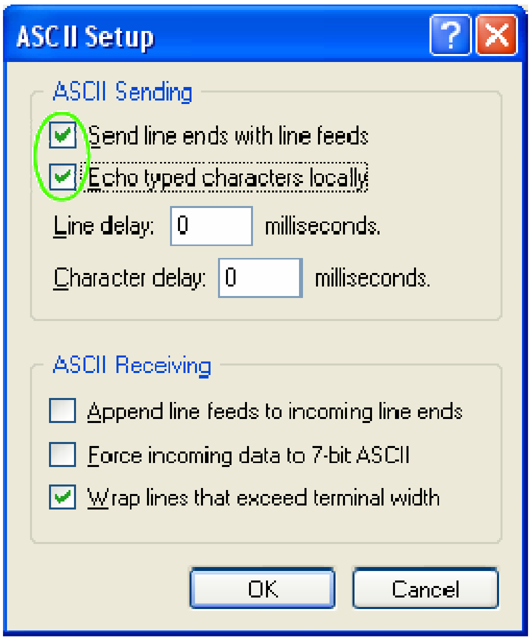


Fig. 7-35: Hyperterminal configuration

- In Hyperterminal, enter the SCPI command
  `*IDN?     (+Return)`
  and the receiver should respond with
  "Rohde&Schwarz", instrument type, serial number, firmware version.

Note: You might need to enter *IDN? several times before the receiver responds.

Fig. 7-36: Hyperterminal SCPI command

- Instead of Hyperterminal, you can also use a DOS window and open a telnet connection to the receiver as follows:
  `telnet -t vt100 12.34.56.78 5555`

Associated SCPI commands:

DHCP on / off SYSTem:COMMunicate:SOCKet:DHCP[:STATe]<Boolean> 296
Gateway SYSTem:COMMunicate:LAN:GATeway<ip-address>................................. 293
Subnet mask SYSTem:COMMunicate:LAN:SUBMask<subnetmask> 294
IP address SYSTem:COMMunicate:SOCKet:ADDRess<ip-address> 295
Port SYSTem:COMMunicate:SOCKet:PORT<numeric_value> 297
Query MAC address SYSTem:COMMunicate:LAN:ETHernet?.. 292

7.1.12 External Triggered Measurement Option

The external triggered measurement (ETM) option can be used for start/stop control of different actions involving triggers such as a button press, squelch or external electrical signals. The following must be distinguished:

– Single actions such as storage of an image
– Continuous actions such as recording of audio data

Continuous actions can be started and stopped, while
single actions can only be started (since they stop on their own accord).

The following actions can be controlled using external triggered measurement:

Action	Single "s" or continuous "C"	Explanation
No action	C	Needed when nothing is to be triggered temporarily
Save screen	s	Save current screen as PNG image; see F1 in Fig. 7-16 (p.83)
Save spectrum	s	Save current spectrum as CSV file; see F2 in Fig. 7-16 (p.83)
Scan Run+	C	Start scan

Start recording	C	Begin recording using internal recording; see "Internal Recording Option" (p. 94). Requires the IR option.

The following trigger sources (trigger signals) can trigger or terminate an action:

Trigger source	Start "ON", Stop "OFF"	Explanation
(none)	OFF	Actions that are started can also run indefinitely or until they are interrupted by the user.
Auto	OFF	The trigger status reverts to "not triggered" immediately after the action is triggered.
Button press	ON + OFF	Button press in center of front rotary knob.
Electrical signal, rising edge	ON + OFF	An electrical signal can be supplied to AUX2 (located on side), "Trigger_in" connector. Its transitions serve as triggers. See also "AUX1/AUX2 input and output" (p. 43).
Electrical signal, falling edge	ON + OFF	See above.
Squelch, rising	ON + OFF	Level transition from "below squelch" to "above squelch".
Squelch, falling	ON + OFF	Level transition from "above squelch" to "below squelch".
Time T1	ON	Predetermined start time, with date, resolution: 1 second.
Time T2	OFF	Predetermined stop time, with date, resolution: 1 second.
Duration T3	OFF	Time duration since start trigger, resolution: 1 second, duration: 1 s to 999 s.
SCPI trigger	ON + OFF	Triggering by an SCPI command: TRIGger[:SEQuence]:IMMediate (p. 353) Requires the RC option.

Configuration

The trigger action is selected as follows:
CONF-F1(RX)-"Trigger Action"

The trigger source for the start or stop can be selected as follows:

- CONF-F1(RX)-"Trigger Start Source" or
- CONF-F1(RX)-"Trigger Stop Source"

The associated times T1, T2 and T3 are configured as follows:

- CONF-F1(RX)-"Trigger Time T1 Start"
- CONF-F1(RX)-"Trigger Time T2 Stop"
- CONF-F1(RX)-"Trigger ON Duration T3"

The lines for T1, T2, T3 are activated, respectively, only if a time was selected as the trigger source.

Triggering can be activated and deactivated globally (trigger enabled) as follows:
CONF-F1(RX)-"Trigger Function"
Triggering is also deactivated automatically if trigger parameters are modified or if a trigger keyboard lock is interrupted with LOCK-F6(Unlock) by the user.

The trigger start (but not the stop) can be set to sound a beep as follows:
CONF-F1(RX)-"Trigger Beep"

The keyboard can be locked to prevent faulty operation (between trigger start and trigger stop) as follows:
CONF-F1(RX)-"Trigger Lock"
In this manner, the front keyboard is locked (analogous to LOCK-F2(Lock Front)). However, the center button of the front rotary knob remains activated if it was selected as a stop trigger source. SCPI command control is not affected by the locking.

Operation

The trigger in the PR100 can assume three different states:

– Deactivated
– Waiting
– Triggered

This **trigger state** is not persistent; the PR100 always starts with a deactivated trigger.

The "Waiting" and "Triggered" states are indicated using the icons in Fig. 7-37 (p. 109). With the ETM option installed, the deactivated state is recognizable only from the absence of these icons.

Fig. 7-37: Indication of the trigger state

The "Start" and "Stop" trigger signals cause a transition between the "Waiting" and "Triggered" states; see Fig. 7-38 (p. 109).

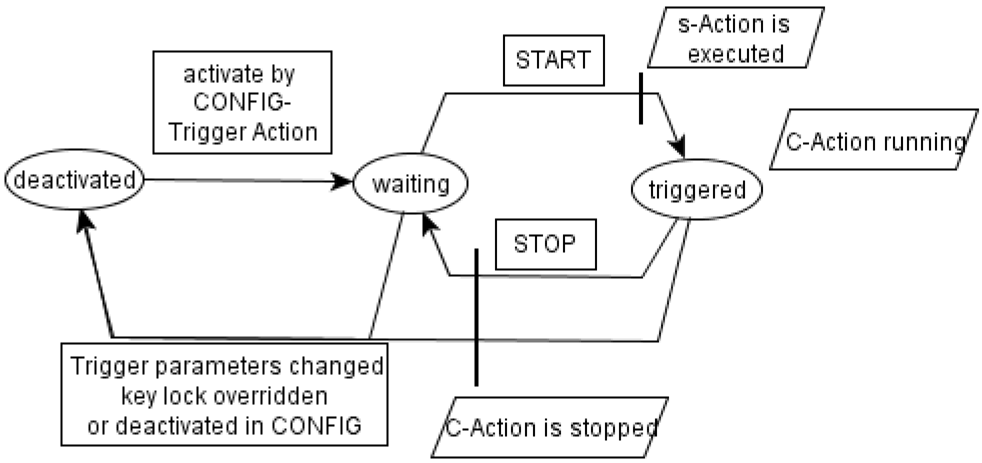


Fig. 7-38: Trigger states

In the triggered state, the R&S PR100 can still be operated if the trigger keyboard lock was not enabled. In particular, the action that was triggered can also be terminated manually. However, in this case the trigger state remains on "Triggered".

Continuous actions run as long as the trigger is in the "Triggered" state and the user has not terminated the action.
Single actions are triggered at the transition from "Waiting" to "Triggered", as is the trigger beep if it is so configured.

Stop signals are ignored in the waiting state and start signals are ignored in the triggered state. In other words, multiple start signals do not trigger an action repeatedly as long as no stop signal was received in the meantime.

For single actions, two different behaviors can thus be configured:

– If the trigger source for stop is set to "Auto" using
  CONF-F1(RX)-"Trigger Stop Source" - "Auto",
  at the end of the single action the trigger is reset to "Waiting". In other words, each start signal will trigger the action if it does not occur during the execution time of the single action.
– If the trigger source for stop is set to some value other than "Auto",
  the single event is triggered by the first start signal and then is not retriggered until after each stop signal/start signal sequence.

If continuous actions are terminated by the user, here too the trigger state must first be set to "Waiting" before the action can be retriggered by a start signal.

The **keyboard lock** influences only the front keyboard. It does not affect SCPI command control. The center button of the front rotary knob remains unlocked if it was configured as a trigger source. The presence of a keyboard lock can be recognized based on a function key assignment as seen in

Fig. 7-39 (p. 110).

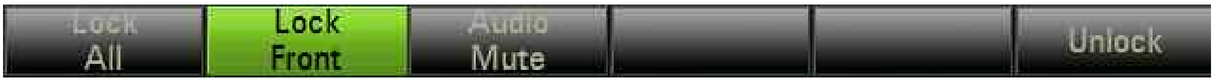


Fig. 7-39: Trigger keyboard lock

The keyboard lock is enabled only during the "Triggered" trigger state. Upon the transition from "Triggered" to "Waiting", i.e. after a stop signal, the keyboard lock is disabled unless the user previously locked the receiver.

The user can make use of LOCK-F6(Unlock) to remove the keyboard lock. In this process, the current action is terminated and the trigger is deactivated even if the receiver was previously locked by the user prior to the trigger.

If the **squelch** is selected as the start/stop criterion for recording, note that each trigger will result in a new recording. This is in contrast to "Audio on Squelch" with internal recording, which continues the same recording. In other words, during RAM recording only the last squelch period is available in RAM at any time. During recording to the SD card, one file is written per squelch period.

Associated SCPI commands:

Enable trigger TRIGger[:SEQuence]:ENABle<Boolean> 342
Trigger action TRIGger[:SEQuence]:ACTionNONE|SCReen|TRACe|GPS|SCAN|RECord 351
Trigger source

TRIGger[:SEQuence]:STARt:SOURceROTary|AUX|SQUelch|TIME|SCPI 345
TRIGger[:SEQuence]:STARt:SLOPePOSitive|NEGative 347
TRIGger[:SEQuence] :STOP: NONE|AUTO|ROTary|AUX|SQUelch|TIME|TDURation|SCPI 346
TRIGger[:SEQuence]:STOP:SLOPePOSitive|NEGative 348

Trigger times

7.1.13 Frequency Processing Option

The frequency processing (FP) option makes it possible to monitor frequencies up to 18 GHz in conjunction with the R&S®HF907DC antenna.

The field strength measurement (FS) option is required as a basis for the frequency processing (FP) option. In the R&S EM100 receiver, the frequency extension (FE) option is also required.

When the R&S®HF907DC antenna is connected, a frequency range from 7.5 GHz to 18 GHz can be scanned continuously using FSCAN, MSCAN and PSCAN, if installed.

Characteristics

Frequencies up to 18 GHz can be entered and read out without conversion and are also output in UDP streams and recordings as "true RF frequencies".

The R&S®HF907DC antenna has two frequency bands as shown in Table 2 (p. 111). The switchover point is at 12.5 GHz. The PR100 automatically switches between these bands if necessary. The band switch on the R&S®HF907DC must be set to "Remote" for this to occur.

Table 2: Bands in the* R&S®HF907DC *antenna

Frequencies in GHz	Lower band	Upper band
Minimum input frequency	7.5	12.5
Converted to output frequency	6.5	7.5
Maximum input frequency	12.5	18
Converted to output frequency	1.5	2.0
Frequency offset (inverted position)	-14	-20
Band designation	Band 1	Band 2

The band switching time is approx. 1 second.

The 12.5 GHz frequency point belongs to the lower band. Scans that start at this frequency should begin at 12.5 GHz + 1 Hz in order to avoid switching during the scan.
The R&S®HF907DC antenna can also be operated exclusively in the lower band or in the upper band (band switch on "Band1" or "Band2"). In this case, the user is responsible for ensuring that no frequencies from the other band are selected since the PR100 assumes that the bands are always properly switched.

If a frequency outside of the selected band is used, entirely incorrect values for the frequency and level will be displayed.

Configuration

In order to activate frequency processing, one or more antennas must be entered in the (see Fig. 7-30 (p. 101)) that have a name starting with "HF907DC". They refer to a k-factor table for the R&S®HF907DC (either to the table that is preinstalled in the PR100 or the measured table that is supplied with the R&S®HF907DC).

For the frequency processing option, the table for the R&S®HF907DC must be selected which includes both frequencies (Table " HF907DC-123456_7.5GHz_18GHz" for serial number 123456)
Note: If the flash memory is deleted, the default antenna list and the default antenna factors will be reinstalled.

The active and passive bit patterns in Fig. 7-31 (p. 102) are ignored;
'01' is commanded for band 1 and '00' for band 2.
ANT1 thus remains on 0 and can be used in principle in MSCAN in order to control additional antennas for the frequency range < 7.5 GHz.

In the configuration (CONF-F1(RX)), the following parameters are overridden:

- Antenna Lines -> AUTO
- Antenna Mode -> Active

Operation

Frequency processing is activated as soon as an antenna is selected that has a name starting with "HF907DC".
In this state, the only valid input frequencies are those in the range from 7.5 GHz to 18 GHz.

When editing the MSCAN parameters (see Fig. 7-13 (p. 81)), however, frequencies below 7.5 GHz can also be entered for other antennas.

Likewise in the MSCAN scan, it is possible to switch between the R&S®HF907DC and other antennas. Note, however, that the R&S PR100 is delayed by the required band switching time in the R&S®HF907DC.

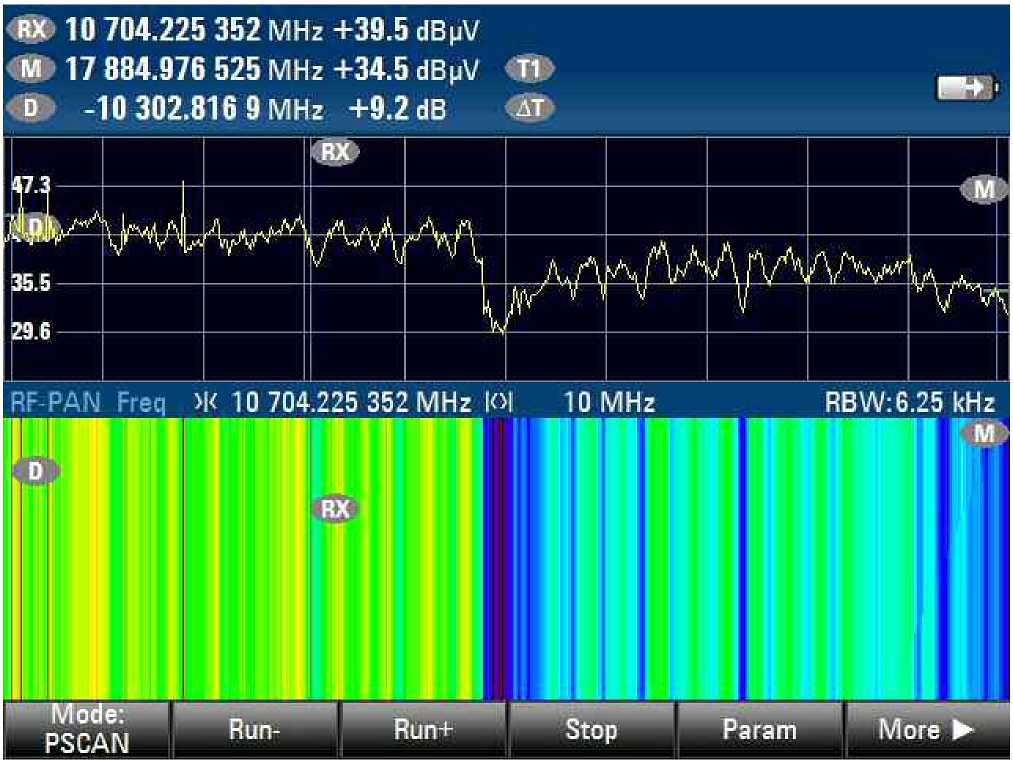


Fig. 7-40: Panorama scan from 7.5 GHz to 18 GHz

Associated SCPI commands:

No additional commands

8 Troubleshooting

Symptom: **R&S PR100 won't boot**
or symptom: **User presets cannot be loaded**

Possible cause: Flash file system faulty

Action: Format flash file system with Lock_F6;
see "Switching the monitoring receiver on and off" (p. 36)

Side effects of action: Memory and suppress lists are deleted, user presets are deleted, antenna list and K-factor tables are deleted and replaced by factory default settings.

Symptom: **Display is black**

Possible cause: Display backlighting set to 0%

Action: Enter the following key sequence:
CONF – F4, then 7 times the down cursor key
ENTER, 1,0,0, ENTER.
The display backlighting should now be reset to 100%.
Note: The display is slightly readable with a powerful lamp held close to it.

Side effects of action: None

Symptom: **IP address changes unexpectedly**

Possible cause: DHCP was activated / deactivated. When DHCP is activated, the receiver obtains a new IP address from the DHCP server. When DHCP is deactivated, the old static address is reenabled.

Action: Set the desired DHCP status;
see " Remote Control Option" (p. 105)

Side effects of action: None

Symptom: **High load in entire network**.

Possible cause: UDP stream in the R&S PR100 was activated but the UDP sink (PC) cannot (or can no longer) be reached. As a result, the UDP packets are broadcast via switches and routers in the entire network, resulting in a high load.

Action: Disable the UDP stream or reenable the UDP sink

Side effects of action: None

Symptom: **Start key for internal recording is grayed out**

Possible cause: 1) SD card not inserted or not detected
2) SD card full

Action: 1) Insert the SD card (or take it out and reinsert it)
2) Insert an SD card with free capacity;
see "Internal Recording Option" (p. 94)

Side effects of action: None

Symptom: **Poor recording quality, missing data sets**

Possible cause: SD card too slow
Incorrect type, fragmented or not formatted in R&S PR100

Action: Make sure that a class 6 SD card that handles 20 MB/s is used;
format the card in the R&S PR100;
see "Internal Recording Option" (p. 94)

Side effects of action: Formatting erases the data on the card

Symptom: **Recall key in memory menu is grayed out**

Possible cause: Receiver is not in MSCAN mode

Action: Activate MSCAN mode, e.g. using the FREQ/MEM key;
see "Memory system" (p. 79)

Side effects of action: None

Symptom: **Memory list won't open**

Possible cause: Receiver is in PSCAN mode; the MEM key is deactivated in this mode

Action: Select FFM, FSCAN or MSCAN mode using SCAN-F1(Mode);
see "Memory system" (p. 79)

Side effects of action: A PSCAN that is underway might be interrupted or the receiver might switch from dual-screen display to RX+Spectrum display.

9 SCPI Interface

Document Outline

The SCPI standard describes an interface with which instruments can be controlled. The idea behind SCPI is that it should not matter what kind of instrument measures e.g. a voltage level, be it a multimeter or a radio scanner measuring the voltage at the antenna output; the command should always be the same. Although theoretically possible, in practice this goal in unachievable. However, the goal of every instrument designer is to stay as close to SCPI as possible.
The goal of every instrument designer is to stay as close to SCPI as possible. In addition, the PR100 tries to be backward compatible with its predecessor, the EB200 Miniport Receiver, when possible. In fact, this compatibility requirement outweighs the SCPI compliance requirement. Therefore, the SCPI interface for the PR100 is defined with the following rules:

1. If an EB200 SCPI command relates to functionality that is not supported by the PR100, the command is not supported either.
2. If a function can be done via an existing EB200 SCPI command, that command is supported.
3. If a function cannot be done via an existing EB200 SCPI command, but a suitable SCPI compliant command is available, the SCPI compliant command is supported.
4. Otherwise, a new SCPI-like command is added, specific for the PR100.

A command is rarely useful if no data can be retrieved to monitor its effect. In SCPI, this is done via queries. Queries can be used to retrieve the settings of an instrument. However, measurements can consist of large sets of data. Outputting that over the SCPI interface could delay the reaction time to commands, which is why the PR100 also offers the data in another format that can be sent via the UDP/IP protocol .

9.1.1 List of figures

9.1.2 List of tables

9.1.3 List of commands

9.1.4 Conventions Used in the Documentation

The following conventions are used throughout the R&S PR100 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 parentheses.
“KEYS”	Key names are written in capital letters and enclosed by parentheses.
Input	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.

Convention	Description
"Links"	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by parentheses.

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.

10 SCPI Commands

SCPI Introduction

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming devices, irrespective of the type of device 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 that defines the same functions for different devices. Command systems were generated that 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. Figure 10-1 (S. 127) illustrates this tree structure using a section of command system SYSTEM. The other examples regarding syntax and structure of the commands are derived from the command system SENSE, which operates the sensor functions of the devices.

SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic 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 10.1.4).

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" (= any number of space characters, ASCII code 32 decimal). The headers may consist of several keywords. Queries are formed by directly appending a question mark to the header.

Table 10-1: List of abbreviations

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
NA	Not Applicable
SCPI	Standard Commands for Programmable Instruments
ESE	Event Status Enable
ESR	Event Status Register
IP	Internet Protocol
IST	Individual STatus
LSB	Least Significant Byte
MAV	Message AVailable
MR	Monitoring Receiver
MSB	Most Significant Byte
NTR	Negative TRansition
PRE	Parallel Poll Register Enable
PTR	Positive TRansition
SRE	Service Request Enable
SRQ	Service ReQuest
STB	STatus Byte
UDP	User Datagram Protocol

10.1.1 Common Command Structure

Common commands consist of a header preceded by an asterisk "*" and one or several parameters, if any.

Examples:

`*RST` RESET, resets the device

`*ESE 253` EVENT STATUS ENABLE, sets the bits of the event status enable register to 253

`*ESR?` EVENT STATUS QUERY, queries the contents of the event status register.

10.1.2 Device-Specific Command Structure

Hierarchy

Device-specific commands are of hierarchical structure (see Figure 10-1 (S. 127)). Commands of the highest level (root level) consist of only one keyword. This keyword denotes a complete command system.

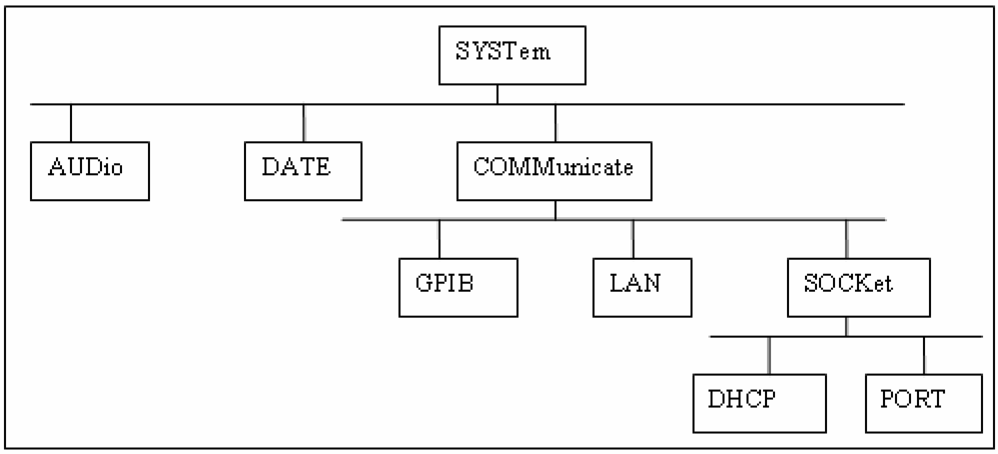


Figure 10-1: Tree-Structure example of command system " SYSTem "

Example:

`SYSTem` This keyword denotes the command system SYSTem.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual keywords being separated by a colon ":".

Example:

`SENSe:FREQuency:STARt 118 MHz`

This command lies in the third level of the SENSe system. It sets the starting frequency of a scan to 118 MHz.

Keywords that occur at several levels within one command system can have different effects.

Example:

`MMEMory:CATalog?` List all files in the current directory.

`DISPlay:WINDow:CATalog?` List all available display modes.

Optional keywords

Some command systems permit certain keywords to be optionally inserted into a command or omitted. These keywords are marked by square brackets in the description. Some commands are considerably shortened by these optional keywords, although the full command length is also recognized by the device.

Example:

Command description: `FORMat[:DATA] ASCii`

Full command: `FORMat ASCii`

Shortened command: `FORM ASC`

Note: An optional keyword must not be omitted if its effect is specified in detail by a numeric suffix.

Long and short form

The keywords can be of a long form or a short form. Either the short form or the long form can be entered, other abbreviations are not permissible.

Example:

Long form: `STATus:QUEStionable:ENABle 1`

Short form: `STAT:QUES:ENAB 1`

Note: The short form is marked by upper-case letters, the long form corresponds to the complete word. Upper-case and lower-case notation only serve the human reader, the device itself does not make any difference between upper- 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. For a description of the types of parameter, refer to "Parameters" in Section 10.1.5.

Example:

`DISPlay:BRIGhtness? MAXimum` Response: 1.00

This query requests the maximal value for the display backlight.

Numeric Suffix

If a device features several functions or characteristics of the same kind, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1.

10.1.3 Structure of a Command Line

Several commands in a line are separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon.

Example:

`DISPlay:BRIGhtness MAXimum;:SYSTem:AUDio:VOLume MAXimum`

This command line contains two commands. The first command is part of the DISPlay system and is used to specify the level of the display backlight. The second command is part of the SYSTem system and sets the audio volume to maximum.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels (see also Figure 10-1 (S. 127)). The colon following the semicolon must be omitted in this case.

Example:

`DISPlay:BRIGhtness MAXimum;:DISPlay:DATE:FORMat ddmmyyyy`

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the DISPlay command system, ie they have one level in common.

When abbreviating the command line, the second command begins with the level below DISPlay. The colon after the semicolon is omitted. The abbreviated form of the command line reads as follows:

`DISPlay:BRIGhtness MAXimum;DATE:FORMat ddmmyyyy`

However, a new command line always begins with the complete path.

Example:

`DISPlay:BRIGhtness MAXimum`

`DISPlay:BRIGhtness 0.5`

10.1.4 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.

1. Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.

Example: `SENSe:FREQuency:STARt? MIN`

Response: 9000

2. Numerical values are output without a unit. Physical quantities are referred to the basic units.

Example: `SENSe:FREQuency:STOP?`

Response: 100000000 for 100 MHz

3. Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).

Example: `OUTPut:IF:STATe?`

Response: 1

4. Text (character data) is returned in a short form (see also "Parameters" on page 130).

Example: `FORMat:BORDer?`

Response: SWAP

10.1.5 Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings, block data and expressions. The type of parameter required for each command and the permissible range of values are specified in the command description (see Section 12 (p.157)).

Numerical values

Numerical values can be entered in several forms, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the device are rounded. The mantissa may comprise up to 41 characters, the exponent must lie inside the value range -37 to 37. 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 units are as follows:

- For frequencies GHz, MHz or MAHz, kHz and Hz, default unit is Hz
- For times s, ms, us, ns; default unit is s
- For levels dBµV; default unit is dBµV
- For percentage PCT, default unit PCT

If the unit is missing, the default unit is used. Note that mHz (milli Hz) as a unit is not used to avoid confusion with MHz (mega Hz) since SCPI is case insensitive.

Example:

`SENSe:FREQuency:STARt 123 MHz` = `SENSe:FREQuency:STARt 123E6`

Special numerical

The texts `MIN, MAX, UP, DOWN, INF, NINF`, and `NAN` are interpreted as special numerical values. In the case of a query, the numerical value is provided.

Example:

Command: `SENSe:FREQuency:STARt MINimum`

Query: `SENSe: FREQuency:STARt?`

Response: 9000

Table 10-2: Special numerical values

MIN/MAX	MINimum and MAXimum denote the minimum and maximum value
UP/DOWN	UP, DOWN increases or decreases the numerical value by one step. The step width can be specified for most parameters with a separate command. Some parameters can only be changed in fixed steps (e.g. SENSe:BWIDth UP).
INF	INFinity stands for + ∞. For queries the numerical value 9,9E37 is output.
NINF	Negative INFinity (NINF) stands for - ∞. For queries the numerical value -9,9E37 is output. In a measured-value query, this value is output if the measurement cannot be carried out (e.g. due to a wrong device setting).
NAN	Not A Number (NAN) stands for results of calculations that are not number. Possible causes are the division by zero, the subtraction of infinity from infinity and simply missing values. SCPI outputs the value 9,91E37 where NAN is meant. NAN is only sent as a device response, it cannot be entered in a command.

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. 0 or 1 is provided in a query.

Example:

Setting command: `SYST:COMM:SOCK:DHCP:STAT ON`

Query: `SYST:COMM:SOCK:DHCP:STAT?`

Response: 1

Text

Text parameters (character data) observe the syntactic rules for keywords, i.e. they can be entered using the 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:	`FORMat:BORDer SWAPped`
Query:	`FORMat:BORDer?`
Response	SWAP

Strings

Strings must always be entered in quotation marks (' or ").

Example:

```
PROGram:PRESet:DEFine "User Preset 1"
PROGram:PRESet:DEFine 'User Preset 2'
```

Block Data

Block data (Definite Length Block) 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; a single character for each byte. Data elements comprising more than one byte are transmitted with the byte being the first that was specified by SCPI command "FORMat:BORDer".

During the transmission of the data bytes all flow-control (e.g End-of-Line) that is sent as an ASCII character is ignored until all bytes are transmitted. Note that e.g. a VXI-11 connection also has flow-control that is not sent as ASCII characters.

Expressions

Expression must always be in parentheses.

Syntax Elements

Table 10-3 offers an overview of the syntax elements.

Table 10-3: Syntax elements

Element	Comment
:	The colon separates the key words of a command. In a command line the colon after the separating semicolon marks the uppermost command level.
;	The semicolon separates two commands of a command line. 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.
#	ASCII character # introduces block data.
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e g blank) separates header and parameter.
( )	Parentheses enclose an expression (channel lists).

Status Reporting

The status reporting system stores all the information on the present operating state of a device and on errors that have occurred. This information is stored in the status registers and in the error queue.

For each remote client of a device (up to 5 cients are possible) there is a separate status reporting system that offers access to all registers of the error queue. The registers form 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 information from the other registers and evaluates whether an SRQ or IST message has to be generated: The IST flag ("Individual STatus") and the “parallel poll enable” register (PRE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire device status in a single bit. The PRE fulfils a function for the IST flag as the SRE does for the service request.

For SCPI over TCP/IP, an SRQ is a text-response “&SRQ<CR><LF>”, where <CR> is a carriage-return, and <LF> is a line-feed. A C-type string would read as: “&SRQ\r\n”.

The message queue contains the messages the device sends back to the controller. It is not part of the status reporting system but determines the value of the “message available” (MAV) bit in STB and is thus shown in Section 10.1.8.2.

10.1.6 Structure of an SCPI Status Register

Each SCPI register consists of 5 sections each having a width of 16 bits (see Figure 10-2 (p. 134)). Bit 15 (the most significant bit) is set to zero for all sections. Thus the contents of the register sections can be processed by the controller as positive integers. The function of each section is explained below.

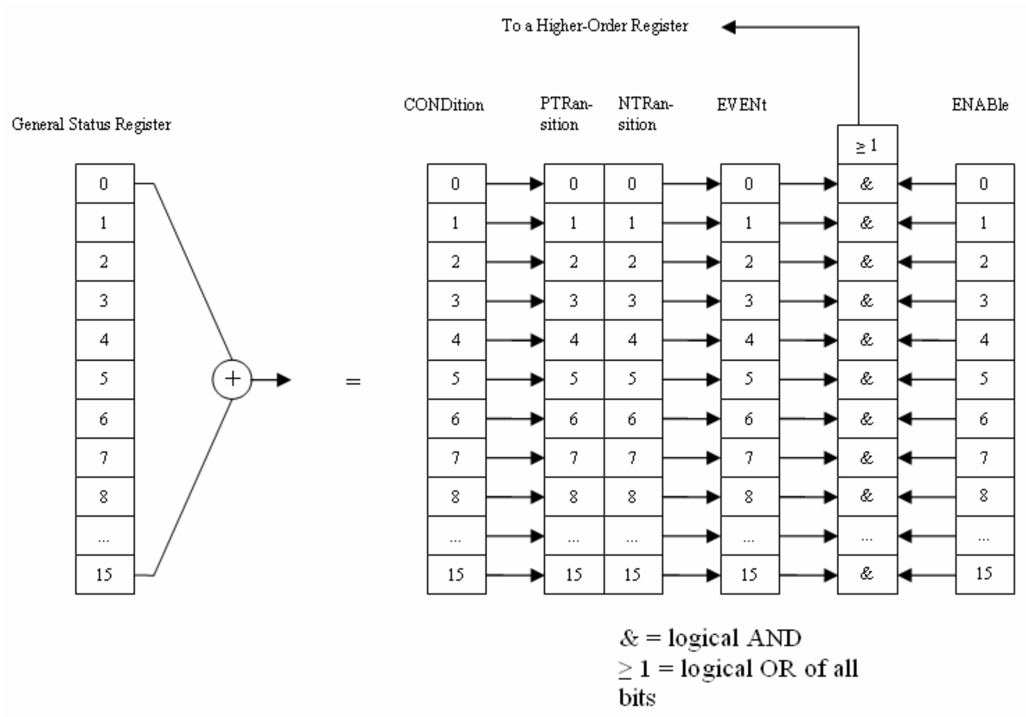


Figure 10-2: Status Register Model

CONDition section

The CONDition section of a register reflects directly the state of the hardware. This register section can only be read. Its contents are not changed during reading. As an alternative, a bit in a CONDition register can also contain the summary information of a further status register connected in front. In this case, the bit is cleared only when reading out the root-cause of the bit: another bit in another status register connected in front.

PTRansition section

The Positive-TRansition section acts as an edge detector. When a bit of the CONDition section 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 section can be written into and read from in any way. Its contents are not changed during reading.

NTRansition section

The Negative-TRansition section also acts as an edge detector. When a bit of the CONDition section 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 section can be written into and read from in any way. Its contents are not changed during reading.

With these two edge register sections the user can define which state transition of the condition section (none, 0 to 1, 1 to 0 or both) is stored in the EVENt section.

EVENt section

The EVENt section indicates whether an event has occurred since the last reading, it is the "memory" of the CONDition section. It only indicates events passed on by the edge filters. The EVENt section is permanently updated by the device. This part can only be read. During reading, its contents are set to zero. This section is often regarded as the entire register.

ENABle section

The ENABle section determines whether the associated EVENt bit contributes to the summary bit (see below). Each bit of the EVENt section is ANDed with the associated ENABle bit (symbol '&'). The results of all logical operations of this section are passed on to the summary bit via an OR operation (symbol '1').

ENABle bit = 0: the associated EVENt bit does not contribute to the summary bit
ENABle bit = 1: if the associated EVENT bit is "1", the summary bit is set to "1" as well.

This section can be written into and read by the user in any way. Its contents is not changed during reading.

Summary bit

As indicated above, the summary bit is obtained from the EVENt and ENABle section for each register. The result is then entered into a bit of the CONDition section of the higher-order register. The device automatically generates the summary bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request through all the hierarchy levels.

Note: The service request enable register SRE defined in IEEE 488.2 can be taken as ENABle section of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABle section of the ESR.

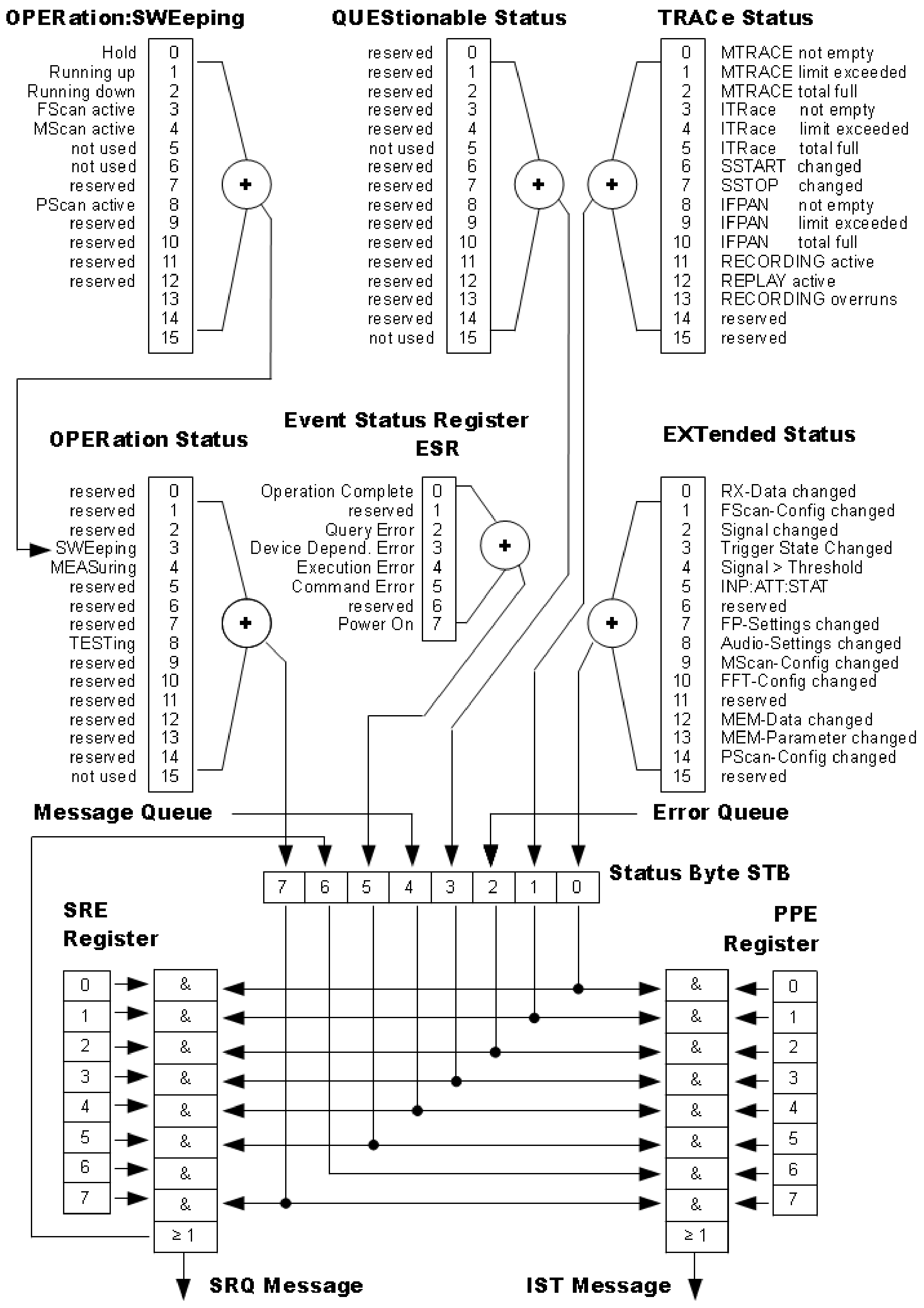

OPERation:SWEeping
Hold
Running up
Running down
FScan active
MScan active
not used
not used
reserved
PScan active
reserved
reserved
reserved
reserved
QUEStionable Status
reserved
not used
TRACe Status
MTRACE not empty
MTRACE limit exceeded
MTRACE total full
ITRace not empty
ITRace limit exceeded
ITRace total full
SSTART changed
SSTOP changed
IFPAN not empty
IFPAN limit exceeded
IFPAN total full
RECORDING active
REPLAY active
RECORDING overruns
reserved
reserved
OPERation Status
reserved
reserved
reserved
SWEeping
MEASuring
reserved
reserved
reserved
TESTing
reserved
reserved
reserved
reserved
reserved
reserved
not used
Event Status Register
ESR
Operation Complete
reserved
Query Error
Device Depend. Error
Execution Error
Command Error
reserved
Power On
EXTended Status
RX-Data changed
FScan-Config changed
Signal changed
Trigger State Changed
Signal > Threshold
INP:ATT:STAT
reserved
FP-Settings changed
Audio-Settings changed
MScan-Config changed
FFT-Config changed
reserved
MEM-Data changed
MEM-Parameter changed
PScan-Config changed
reserved
Message Queue
Error Queue
Status Byte STB
SRE
Register
PPE
Register
SRQ Message
IST Message

Figure 10-3: Status Registers

10.1.7 Description of the Status Registers

10.1.7.1 Status Byte (STB) and Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides an overview of the device status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition section of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the summary bit of the other bits of the status byte.
The STATUS BYTE is read out using the command "*STB?".
The STB implies the SRE. As to its function, it corresponds to the ENABle section of the SCPI register. A bit in the SRE is assigned to each bit of the STB. 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. The SRE can be set using command "*SRE" and read using "*SRE?".

Table 10-4: Bit allocation of status byte

Bit No.	Meaning
0	**EXTended status register summary bit** The bit is set if an EVENt bit is set in the EXTended-status register and if the corresponding ENABle bit is set to 1. The states of the hardware functions and change bits are combined in the EXTended-status register.
1	**TRACe status register summary bit** The bit is set if an EVENt bit is set in the TRACe-status register and if the corresponding ENABle bit is set to 1. The states of the TRACes MTRACE, ITRACE, SSTART and SSTOP are represented in the TRACe-status register.
2	**Error Queue not empty** The bit is set when the error queue contains an entry. If this bit is enabled by the SRE, an entry into the empty 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.
3	**QUEStionable status register summary bit** The bit is set if an EVENt bit is set in the QUEStionable-status register and the corresponding ENABle bit is set to 1. A set bit indicates a questionable device status which can be specified in greater detail by polling the QUEStionable-status register.
4	**MAV bit (message available)** This bit is set when the message queue is not empty.
5	**ESB bit** Summary bit of the EVENt status register. It is set if one of the bits in the EVENt status register is set and is also enabled in the EVENt status enable register. Setting of this bit implies a serious error which can be specified in greater detail by polling the EVENt status register.
6	**MSS bit (master status summary bit)** The bit is set if the device triggers a service request. This is the case if one of the other bits of this register is set together with its mask bit in the service request enable register SRE.
7	**OPERation status register summary bit** The bit is set if an EVENt bit is set in the OPERation-status register and the corresponding ENABle bit is set to 1. A set bit indicates that the device is just performing an action. The type of action can be determined by polling the OPERation-status register.

10.1.7.2 IST Flag and Parallel Poll Enable (PPE) Register

Analogous to the SRQ message, the IST flag combines the entire status information in a single bit. It can be queried by using command "*IST?".

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are ANDed with the corresponding bits of the PPE. In contrast to SRE bit 6 is also used here. The IST flag results from the ORing of all results. The PPE can be set using the "*PRE" commands and read using the "*PRE?" command.

10.1.7.3 Event Status Register (ESR) and Event Status Enable (ESE) Register

The ESR is already defined in IEEE 488.2. It can be compared with the EVENt section of an SCPI register. The EVENt status register can be read out using the "*ESR?" command.

The ESE is the associated ENABle section. It can be set using the "*ESE" command and read using the "*ESE?" command.

Table 10-5: Bit allocation of event status register

Bit No.	Meaning
0	**Operation Complete** On receipt of the command *OPC, this bit is set exactly when all previous commands have been executed.
2	**Query Error** This bit is set if a query 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 denoting the error in greater detail is entered into the error queue (see section “Error Messages” (p. 145)).
4	**Execution Error** This bit is set if a received command is syntactically correct but cannot be performed for different reasons. An error message with a number between -200 and -299 denoting the error in greater detail is entered into the error queue (see section “Error Messages” (p. 145)).
5	**Command Error** This bit is set if an undefined and syntactically incorrect command is received. An error message with a number between -100 and -199 denoting the error in greater detail is entered into the error queue (see section “Error Messages” (p. 145)).
7	**Power On (supply voltage on)** This bit is set when the device is switched on.

10.1.7.4 STATus:OPERation Register

In the CONDition section, this register contains information about the type of actions currently being executed by the device. In the EVENt section, it also contains information about the type of actions having been executed since the last reading. It can be read using the commands

"STATus:OPERation:CONDition?" or
"STATus:OPERation[:EVENt]?".

Table 10-6: Bit allocation of STATus:OPERation register

Bit No.	Meaning
3	**SWEeping** This bit is set when the sum bit of STATus:OPERation:SWEeping bits is set
4	**MEASuring** This bit is set for the duration of a measurement
8	**TESTing** This bit is set when a self-test is running

10.1.7.5 STATus:OPERation:SWEeping Register

This register contains more detailed information on the operating state of the device. The device is either set to normal receive mode (Fixed Frequency Mode FFM) or to one of several scan modes (FSCAN, MSCAN, PSCAN).

The status is determined by using the command SENSe:FREQuency:MODE. The CW|FIXed status is set by clearing bits 3 to 7 from the STATus:OPERation:SWEeping register.

Table 10-7: Bit allocation of STATus:OPERation:SWEeping register

Bit No.	Meaning
0	**Hold** This bit is set if an FSCAN or MSCAN was interrupted due to the fulfillment of a hold criterion.
1	**Running up** This bit is set if sweeping is to be carried out in the direction of increasing frequency values or memory location numbers.
2	**Running down** This bit is set if sweeping is to be carried out in the direction of decreasing frequency values or memory location numbers.
3	**FSCAN active** This bit is set if FREQ:MODE is set to SWEep
4	**MSCAN active** This bit is set if FREQ:MODE is set to MSCan
5	Not used, always 0 (was used for DSCAN mode in EB200)
6	Not used, always 0 (was used for FASTlevcw mode in EB200)
7	Not used, always 0 (was used for LIST mode in EB200)
8	**PSCAN active** This bit is set if FREQ:MODE is set to PSCan

10.1.7.6 STATus:TRACe Register

This register contains information on ambiguous states of the traces MTRACE, ITRACE, IFPAN, SSTART and SSTOP. It can be queried with the commands STATus:TRACe:CONDition? or STATus:TRACe[:EVENt]?.

Table 10-8: Bit allocation of STATus:TRACe register

Bit No.	Meaning
0	**MTRACE not empty** This bit is set if the MTRACE contains at least one measured value.
1	**MTRACE limit exceeded** This bit is set if the number of measured values contained in the MTRACE exceeds the threshold given by the command TRACe:LIMit[:UPPer] MTRACE.
2	**MTRACE total full** This bit is set if the MTRACE is loaded with the maximum number of measured values.
3	**ITRACE not empty** This bit is set if the ITRACE contains at least one information value.
4	**ITRACE limit exceeded** This bit is set if the number of measured values contained in the ITRACE exceeds the threshold given by the command TRACe:LIMit[:UPPer] ITRACE.
5	**ITRACE total full** This bit is set if the ITRACE is loaded with the maximum number of information values.
6	**SSTART changed** This bit is set if one or several start frequencies of the current suppress table have changed.
7	**SSTOP changed** This bit is set if one or several stop frequencies of the current suppress table have changed.
8	**IFPAN not empty** This bit is set if at least one measured value is stored under IFPAN.
9	**IFPAN Limit exceeded** This bit is set if the number of measured values stored under IFPAN exceeds the threshold set by TRACe:LIMit[:UPPer] IFPAN.
10	**IFPAN total full** This bit is set if the maximal number of measured values is stored under IFPAN.
11	**RECORDING active**
12	**reserved for AUDIO**
13	**reserved for AUDIO**

10.1.7.7 STATus:EXTension Register

This register contains in the CONDition part information on different receiver states which cannot be assigned to the other registers. Information about the actions the unit had carried out since the last read out is stored in the EVENt part. The corresponding registers can be queried with the commands STATus:EXTension:CONDition? or STATus:EXTension[:EVENt]? .

Table 10-9: Bit allocation of STATus:Extension register

Bit No.	Meaning
0	**RX data changed** This bit is set if the receiver data-set is changed by manual control or by another remote client. See also Table 10-10.
1	**FSCAN configuration changed** This bit is set if the FSCAN data-set is changed by manual control or by another remote client. See also Table 10-10.
2	**Signal changed** This bit is set if the received signal changes in level or offset. The device need not implement a hysteresis, since this bit is only used for test purposes. See also Table 10-10.
3	**Trigger State changed** This bit is set if the trigger state is changed.
4	**SIGNal > THReshold** This bit is set if the signal level is above the squelch threshold (precondition: squelch is switched on).
5	**INPut:ATTenuation:STATe** This bit is set if the input attenuator is switched on.
7	**FP settings changed** This bit is set if the front-panel data-set is changed by manual control or by another remote client. See also Table 10-10.
8	**Audio settings changed** This bit is set if a parameter was changed by manual control or by another remote client in the data set "miscellaneous". See also Table 10-10.
9	**MSCAN configuration changed** This bit is set if the MSCAN data-set is changed by manual control or by another remote client. See also Table 10-10.
10	not used, always 0 (was used for DSCAN in EB200)
12	**MEMory data changed** This bit is set if memory data was changed by manual control or by another remote client. See also Table 10-10.
13	**MEMory parameter changed** This bit is set if the memory-query bit was changed. See also Table 10-10.
14	**PSCAN configuration changed** This bit is set if the PSCAN data-set is changed by manual control or by another remote client. See also Table 10-10.

With bits 0 to 2 and 7 to 9 and 12 to 14, the host can be informed via an SRQ about parameter changes. Cyclical polling of the settings by the host is thus stopped during manual operation or if the signal parameters are to be indicated. In the CONDition section of the register, the change bits are set after manual control or signal change and are reset by special query commands. Changes done by front panel or by another remote client affect the change bits equally.

Table 10-10: Change bit-allocation in STATus:EXTension register

Bit No.	Set by change of:	Reset by query:
0	Frequency, demodulation, bandwidth, threshold value, MGC value, control mode, antenna number, attenuation, type of detector, squelch enable, squelch control, sensor function, AFC, TONE mode, tone reference threshold, AUX bit(s), AUX output mode, IF-panorama display width, IF-panorama display mode, measuring time	`FREQ?, DEM?, BAND?, GCON:MODE?, INP:ATT:STAT?, DET?, OUTP:SQU?, OUTP:SQU:CONT?, FUNC?, FREQ:AFC?, OUTP:TONE?, OUTP:TONE:THR?, OUTP:BYTAux?, OUTP:AUX?, CALC:IFPAN:AVERTYPE?, CALC:IFPAN:AVER:TIME?, MEAS:TIME?`
1	FSCAN: Start frequency, stop frequency, stepwidth, number of SWE:HOLD:TIME?, runs, synchronizing time, listening time, scan mode	`FREQ:STAR?, FREQ:STOP?, SWE:STEP?, SWE:COUN?, SWE:DWEL?, SWE:DIR?, SWE:CONT?`
2	Signal level, offset	`SENS:DATA?`
3	Trigger state	`TRIG:STAT?`
7	Display variants, display mode, display disable, antenna names, display illumination cut-out time, display brightness	`DISP:CMAP?, DISP:BRIG?,`
8	Volume, loudspeaker, balance, external reference, tone monitoring	`SYST:AUD:VOL?, SYST:AUD:BAL?, ROSC:SOUR?, OUTP:TONE:CONT?`
9	MSCAN: Number of runs, synchronizing time, listening time, scan mode	`MSC:COUN?, MSC:DWEL?, MSC:HOLD:TIME?, MSC:DIR?; MSC:CONT?`
10	not used, always 0 (was used for DSCAN in EB200)	-
12	Frequency, demodulation, bandwidth, threshold value, antenna number, attenuation, squelch enable, AFC	`MEM:CONT? 0 ... 1023` `MEM:CONT:MPAR? 0 ... 1023`
13	Query bit: (set, reset).	`MEM:CONT? 0 ... 1023` `MEM:CONT:MPAR? 0 ... 1023`
14	PSCAN: Start frequency, stop frequency	`FREQ:STAR?, FREQ:STOP?`

10.1.7.8 STATus:QUEStionable Register

This register contains information on ambiguous device states. They can occur, for example if the device is operated outside its specification range. It can be queried using the commands STATus:QUEStionable:CONDition? or STATus:QUEStionable[:EVENt]?.

Not all bits of this register are free for any use. Table 10-11: Bit allocation of STATus: QUEStionable register shows what bits have requirements.

Table 10-11: Bit allocation of STATus: QUEStionable register

Bit No.	Meaning
2	**Reserved for BATTery low** This bit is set if the supply (or battery) voltage becomes too low (Not used in current release).

Bit No.	Meaning
4	**Reserved for TEMPerature** This bit is set if the internal temperature is too high (Not used in current release).
9	**Reserved for LEVel** This bit is set when the IF section is overdriven by an excessively high input signal. The result of a level measurement is then suspect.

10.1.8 Use of the Status Reporting System

In order to be able to effectively use the status reporting system, the information contained there has to be transmitted to the host where it is further processed. There are several methods which are described in the following sub-sections.

10.1.8.1 Service Request, making use of the hierarchy structure

Under certain circumstances, the device can send a "service request" (SRQ) to the host. As Section 10.1.6 shows, an SRQ is always initiated if one or several of the bits 0, 1, 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. By setting the ENABle sections of the status registers correspondingly, it can be achieved that any bits in any status register initiate an SRQ. In order to use the service request, some bits should be set to "1" in enable registers SRE and ESE. Only those bits need to be set that represent the situations for which a service request must be received.

Examples (also see Section 10.1.6*):*

Use command "*OPC" to generate an SRQ

- Set bit 0 in the ESE (Operation Complete)
- Set bit 5 in the SRE

After completion of the settings, the device generates an SRQ.
For SCPI over TCP/IP, this is a text-response "&SRQ<CR><LF>", where <CR> is a carriage-return, and <LF> is a line-feed.
A C-type string would read as: "&SRQ\r\n".

Indication of a signal during a sweep by means of an SRQ at the host

- Set bit 7 in the SRE (summary bit of the STATus:OPERation register)
- Set bit 3 (SWEeping) in the STATus:OPERation:ENABle.
- Set bit 3 in the STATus:OPERation:NTRansition so that the change of SWEeping-bit 3 from 0 to 1 is also recorded in the EVENt section.
- Set bit 0 in STATus:OPERation:SWEeping:ENABle
- Set bit 0 in STATus:OPERation:SWEeping:PTRansition so that the change of hold-bit 0 from 0 to 1 is also recorded in the EVENt section.

The device generates an SRQ after a signal has been found.

Once an SRQ has been received, the contents of the status-byte register can be polled. For SCPI over TCP/IP, polling is done by sending the string "&POL". The R&S **PR100** device then answers with the string "&<value><CR><LF>", where <value> is the decimal value of the contents of the STB.

The SRQ is the only possibility for the device to become active on its own. Each host program should set the device so that a service request is initiated in case of malfunction. The program should react appropriately to the service request.

10.1.8.2 Query by means of Commands

Each part of every status register can be read by means of queries. Only one number is returned which represents the bit pattern of the register queried. The format of the number can be set by the FORMat:SREGister command.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

10.1.8.3 Error-Queue Query

Each error state in the device results in an entry in the error queue. The entries of the error queue are detailed plain-text error messages which can be queried by the command SYSTem:ERRor?. Each call of SYSTem:ERRor? provides one entry from the error queue. If no error messages are stored there anymore, the device 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 during the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the device are recorded there as well.

10.1.9 Resetting Values of the Status Reporting System

Table 10-12 comprises the different commands and events causing the status reporting system to be reset. None of the commands, except for *RST, influences the functional device settings. In particular, DCL does not change the device settings.

Table 10-12: Resetting status registers

(1: the next command-line clears the output buffer, DCL: Device Clear, SDC Selected Device Clear)

Effect	Power On	DCL, SDC	*RST	STATus:PRESet	*CLS
Clear STB, ESR	yes	-	-	-	yes
Clear SRE, ESE	yes	-	-	-	-
Clear PPE	yes	-	-	-	-
Clear EVENt sections of the registers	yes	-	-	-	yes
Clear ENABle section of all OPERation and QUEStionable registers, Fill ENABle sections of all other registers with "1".	yes	-	-	yes	-
Fill PTRansition sections with "1" , Clear NTRansition sections	yes	-	-	yes	-
Clear error queue	yes	-	-	-	yes
Clear output buffer	yes	yes	1	1	1
Clear command processing and input buffer	yes	yes	-	-	yes

Error Messages

The following list contains all error messages for errors occurring in the instrument. The meaning of negative error codes is defined in SCPI (Standard Commands for Programmable Instruments), positive error codes mark errors specific for the instrument.

In the left column the table contains the error text which is entered in the error/event queue. In the right column there is an explanation regarding the respective error.

For some errors, a so-called device-dependent info is added to the error message. It gives further information about the error source (eg. -222, "Data out of range", frequency too high).

Table 10-13: "No Error" message

Error code from queue query	Error explanation
0,"No error"	This message is output if the error queue does not contain entries.

Table 10-14: Command Errors

- Faulty command; sets bit 5 in the ESR register

Error code from queue query	Error explanation
-100,"Command error"	The command is faulty or invalid.
-101,"Invalid character"	The command contains an invalid sign. Example: A command contains an ampersand, "SENSe &".
-102,"Syntax error"	The command is invalid. Example: The command contains block data the instrument does not accept.
-103,"Invalid separator"	The command contains an impermissible sign instead of a separator. Example: A semicolon is missing after the command.
-104,"Data type error"	The command contains an invalid value indication. Example: ON is indicated instead of a numeric value for frequency setting.
-105,"GET not allowed"	A Group Execute Trigger (GET) is within a command line.
-108,"Parameter not allowed"	The command contains too many parameters. Example: Command SENSe:FREQuency permits only one frequency indication.
-109,"Missing parameter"	The command contains too few parameters. Example: Command SENSe:FREQuency requires a frequency indication.
-111,"Header separator error"	The command contains an impermissible separator. Example: The header is not followed by a "White Space", "*ESE255"
-112,"Program mnemonic too long"	The command contains more than 12 characters.
-113,"Undefined header"	The command is not defined for the instrument. Example *XYZ is undefined for every instrument.
-114,"Header suffix out of range"	The command contains an impermissible numeric suffix. Example: SENSe9 does not exist in the instrument.
-121,"Invalid character in number"	A number contains an impermissible character.
-123,"Exponent too large"	The absolute value of the exponent is larger than 32000.
-124,"Too many digits"	The number contains too many digits.

-128,"Numeric data not allowed"	The command contains a number which is not allowed at this position. Example: Command FORMat:BORDer requires the indication of a text parameter.
-131,"Invalid suffix"	The suffix is invalid for this instrument. Example: nHz is not defined.
-134,"Suffix too long"	The suffix contains more than 12 digits.
-138,"Suffix not allowed"	A suffix is not allowed for this command or at this position of the command.
-141,"Invalid character data"	The text parameter either contains an invalid sign or it is invalid for this command. Example: spelling mistakes during parameter indication; FORMat:BORder WASP
-144,"Character data too long"	The text parameter contains more than 12 characters.
-148,"Character data not allowed"	The text parameter is not allowed for this command or at this position of the command.
-151,"Invalid string data"	The command contains a faulty character string. Example: An End-of-Line (not a character but a flow-control) was received before the final quote character.
-158,"String data not allowed"	The command contains a valid character string at a position which is not allowed. Example: A text parameter is set in quotation marks, FORMat:BORder "SWAP"
-161,"Invalid block data"	The command contains faulty block data. Example: An End-of-Line signal was received before the expected number of data had been received.
-168,"Block data not allowed"	The command contains valid block data at an impermissible position.
-171,"Invalid expression"	The command contains an impermissible mathematical expression. Example: The expression contains an uneven number of parentheses.
-178,"Expression data not allowed"	The command contains an expression at an impermissible position.

Table 10-15: Execution Errors

- Error in executing the command; sets bit 4 in the ESR register

Error code from queue query	Error explanation
-200,"Execution error"	Error during execution of the command.
-203,"Command protected"	Command not accepted because the Remote Control option is not installed.
-211, "Trigger Ignored"	A trigger is ignored when e.g. it occurs before the measuring time has elapsed. This can happen when the trigger time is smaller than the measuring time.
-221,"Settings conflict"	There is a settings conflict between two parameters.
-222,"Data out of range"	The parameter value is outside the permissible range of the instrument.
-223,"Too much data"	The command requires more storage for data than is available. E.g. A list of frequencies may only contain 5 elements, and the command tries to add a sixth.
-224, "Illegal parameter value"	Used when an exact value, from a list of possible values was expected.
-240,"Hardware error"	Hardware error is not further specified.
-241,"Hardware missing"	The command cannot be executed due to missing hardware. Example: An option is not installed.
-250,"Mass storage error"	Error in writing to or reading from mass storage device (i.e. SD Card).
-257,"File name error"	File name is not correct.
-291,"Out of memory"	Requested size of recording memory not available.

-292,"Referenced name does not exist"	An unknown name was sent as a parameter. Example: An unknown file name is to be deleted, MMEM:RDIR "Flubber".
-293,"Referenced name already exists"	The name is defined twice. Example: An file already exists.

Table 10-16: Device Specific Errors

- sets bit 3 in the ESR register

Error code from queue query	**Error explanation**
-300,"Device-specific error"	Some data in memory not valid.
-350,"Queue overflow"	This error code is entered into the queue instead of the actual error code if the queue is full. It indicates that an error has occurred but not been accepted. The queue can accept 5 entries.

Table 10-17: Query Errors

- sets bit 2 in the ESR register

Error code from queue query	**Error explanation**
-400,"Query error"	General error which is not further specified.
-410,"Query INTERRUPTED"	The query has been interrupted. Example: After a query, the instrument receives new data before the response has been sent completely.
-420,"Query UNTERMINATED"	The query is incomplete. Example: The instrument is addressed as a talker and receives incomplete data.
-430,"Query DEADLOCKED"	The query cannot be processed. Example: The input and output buffers are full, the instrument cannot continue the operation.

Table 10-18: Device-dependent Errors

- sets bit 3 in the ESR register

Error code from queue query	**Error explanation**
1,"Device dependent error"	The error is not further specified.
3, "Ethernet error"	Error in ethernet connection has been recognized.
10,"Component failure"	A component indicates an error.
20, "No free resources for action"	Indicates e.g. that a software buffer is full.
200,"Temperature too high"	The internal temperature of the unit is too high.
300,"Power fail"	One of the supply (or battery) voltage is too low.

Commands Description

10.1.10 Notation

In the following sections, all commands implemented in the device are described in detail. The notation corresponds to the SCPI standard.

Indentations

The different levels of the SCPI command hierarchy are represented in the description by means of indentations to the right. The lower the level is, the further is the indentation to the right. Please observe that the complete notation of the command always includes the higher levels as well.

Example: `SENSe:FREQuency:STARt` is indicated in the description as follows:

SENSe	first level
. :FREQuency	second level
. . :STARt	third level

Upper-/Lower Case

Upper/lower-case letters serve to mark the long or short form of the key words of a command in the description (see next sections). The device itself does not distinguish between upper- and lower-case letters.

Special Characters

| Vertical Stroke

A selection of keywords with an identical effect exists for some commands. These keywords are given in the same line and are separated by a vertical stroke. Only one of these keywords has to be indicated in the header of the command. The effect of the command is independent of the keywords being indicated.

Example:

SENSe
. :BANDwidth|:BWIDth

The two following commands of identical meaning can be formed. They set the bandwidth of the device to 150 kHz:

`SENSe:BANDwidth 150E3 = SENSe:BWIDth 150E3`

A vertical stroke in indicating the parameters marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is entered.

Example: Selection of parameter for command

`SENSe:GCONTrol:MODE FIXed|MGC AUTO|AGC`

If the parameter `FIXed` is selected, the gain is determined by the MGC voltage. In case of `AUTO` the gain depends on the signal. The two parameters MGC and AGC are synonymous for `FIXed` and `AUTO`.

[ ] Square Brackets

Keywords in square brackets can be omitted in the command. The device also accepts the full command. Parameters in square brackets can also be optionally inserted into the command or can be omitted.

{ } Curly Braces

Parameters in braces can be inserted in the command once or several times, or be omitted altogether.

10.1.11 Unprotected commands

Most of the SCPI commands described in this chapter are protected, meaning that they can only be used if the Remote Control option has been installed (see SYSTem:SECurity:OPTion and *OPT? commands).

Without this option a protected command will be refused with error -203 “Command protected”.

The following commands are unprotected (so they are always accepted):

Table 10-19: Unprotected Commands

*WAI	SYSTem:ERRor:CODE:ALL?
*IDN?	SYSTem:ERRor:CODE[:NEXT]?
*OPT?	SYSTem:ERRor:COUNt?
*WAI?	SYSTem:ERRor[:NEXT]?
MEMory:CONFig	SYSTem:FIRMware:UPDate
DIAGnostic[:SERVice]:ADAPter[:STATe]	SYSTem:RESet:COLD
DIAGnostic[:SERVice]:ADAPter[:STATe]?	SYSTem:RESet[:WARM]
MEMory:CONFig?	SYSTem:SECurity:OPTion
MEMory:CONFig:CATalog?	SYSTem:TIME?
MMEMory subsystem: all commands	TRACe|DATA:SUPPress:CONFig
SYSTem:DATE?	TRACe|DATA:SUPPress:CONFig?
SYSTem:ERRor:ALL?	TRACe|DATA:SUPPress:CONFig:CATalog?

10.1.12 Errors

In the description of the commands only those error codes are mentioned for which some more specific explanation was thought to be useful. For all other errors refer to section "Error Messages" (p. 145), which gives a general overview of SCPI error handling and of the meaning of returned error codes.

10.1.13 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. Many common commands concern the "status reporting system" in section “SCPI Commands“ (p. 126).

Table 10-20: Common Commands

Command	Parameter	Query (also|no|only query)
*CLS		no query
*ESE	0 ... 255	also query
*ESR?		only query
*IDN?		only query
*IST?		only query
*OPC		also query
*OPT?		only query
*PRE	0 ... 255	also query
*RST		no query
*SRE	0 ... 255	also query
*STB?		only query
*TRG		no query
*TST?		only query
*WAI		also query

***CLS**

CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENt sections 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 0 ... 255**

EVENT STATUS ENABLE sets the event status enable register to the value indicated. Query *ESE? returns the contents of the event status enable register in decimal form.

***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.

***IDN?**

IDENTIFICATION QUERY queries unit about identification. The output of the unit must be:
"ROHDE&SCHWARZ, <model nr>, <serial nr>, <sw version>”

<model nr> the model number of the device (e.g. **PR100**)
<serial nr> the serial number of the unit, format 123456
<sw version> the firmware version number, e.g. 1.20

***IST?**

INDIVIDUAL STATUS QUERY states the contents of the IST flags
in decimal form (0 | 1).

***OPC**

OPERATION COMPLETE sets the bit in the event-status register to 0 if all previous commands were carried out. This bit can be used for triggering a service request.

***OPC?**

OPERATION COMPLETE QUERY writes the message '1' into the output buffer as soon as all previous commands were carried out.

***OPT?**

OPTION IDENTIFICATION QUERY queries about the options in the unit. It outputs a comma separated list of 7 fields, where each field corresponds to a specific option. If the option is installed the field contains an abbreviation identifying the option, else the field contains a zero value. The following options are supported:

Table 10-21: Option Identification

Field nr.	Abbreviation	Option
1	PS	Panorama Scan
2	IR	Internal Recording
3	RC	Remote Control
4	ET	External Triggered Measurement
5	FS	Fieldstrength Measurement
6	FP	Frequency Processing SHF
8	FE	Frequency Extension (on EM100 only)
others		Reserved for future usage

Example:

```
*OPT? -> PS,IR,RC,0,FS,0,0 (on PR100)
       -> PS,IR,RC,0,FS,0,0,FE (on EM100)
```

***PRE 0 ... 255**

PARALLEL-POLL REGISTER ENABLE sets parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.

***RST**

RESET sets the device to a defined default status. The default setting is indicated in the description of the commands.

***SRE 0 ... 255**

SERVICE REQUEST ENABLE sets the service request enable register to the value indicated. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is triggered. Query *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

***STB?**

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

***TRG**

TRIGGER triggers the same actions as the INITiate:CONM[:IMMediate] command.

***TST?**

SELFTEST QUERY triggers the module state test and yields a figure which is to be interpreted as the bit field:

Result = 0
All modules are ok.

Result ? 0
There is a fault in one or several modules. The information about the possible error can be queried by means of the SYSTem:ERRor? Command.

***WAI**

WAIT-to-CONTINUE only permits the servicing of the subsequent commands after all preceding commands have been executed and all signals have settled.

11 Instrument Behaviour

The behaviour of the R&S **PR100** is defined by the following aspects:

- Error Situations
  There are several types of error situations that apply to a number of, otherwise unrelated, commands.

- Ranging and Rounding
  This applies to all commands that set a value. Ideally, the user supplies a value that is within the instrument's range and corresponds with its resolution. When this ideal situation is not met, ranging and rounding must be applied to get a value the instrument can handle.

- Value Representation
  This applies to all commands that return a value. This value must be presented to the user with an adequate accuracy.

- Default Values
  Each parameter that can be set or queried via SCPI has a default value after applying the *RST command.

- Instrument States
  The behaviour of a command may vary between instrument states.

Error Situations

The common behaviour of the instrument in error situations is as listed below (unless other behaviour has been explicitly specified for a specific command or query):

- Do a command or query in an instrument state in which the command/query is not supported

The error -221 "Settings conflict" is returned

- Set a parameter to such a state that it conflicts with other parameters

The error -221 "Settings conflict" is returned. The device does not adapt other parameters in order to try to resolve a settings conflict. The new parameter setting is rejected and the device setup remains unchanged.

- Query a measurement result that is not available

SCPI outputs NAN instead of a value acc. to SCPI standard Section 7.2.1. Note that NAN is output as 9.91E37, as is also described in [SCPI].

Differences with EB200/EM050 Devices:

- A similar error situation may produce a different error code and message on the R&S **PR100** and on the EB200/EM050.

Ranging and Rounding

Each parameter of the device that takes a value has a maximum and a minimum. In addition, each parameter has a resolution. The approach for setting a value for a parameter is as follows:

- if the supplied value is beyond its maximum or below its minimum, return error -222 "Data out of range" without changing the parameter. The device does not adapt other parameters in order to try to resolve a data out of range situation. The new parameter setting is rejected and the device setup remains unchanged.
- round the supplied value to the device's resolution. For specific parameters (e.g. bandwidth), R&S **PR100** can choose to round up or down instead of rounding towards the closest value.
- if the supplied value results in an error situation, return an error appropriate for that situation without changing the parameter.
- accept the rounded value.

Differences to EB200/EM050 devices:

- The EB200 operates as described above, but does rounding before the range checking. That means that a value is accepted if it is out of range, but within the resolution of the minimum or maximum,.

Value Representation

When a value (from either a measurement or from a setting) is presented to the user by means of a response to an SCPI query, it is presented with the accuracy that is used by the instrument. Exceptions to this rule will be documented.

Default Values

The device has only one set of default values: That means that both the user interface and the remote interface (SCPI) use the same default values for parameters. This is identical to the EB200/EM050 devices.

The EB200 and the R&S **PR100** do not use the same set of default parameters and their values are not the same either.

Instrument States

11.1.1 Introduction

In order to get a good overview of how the R&S **PR100** reacts to SCPI commands, one should study the various instrument states the device can have. If an SCPI command is disallowed or allowed depends on the state the instrument is in. When a command is allowed, two situations can be distinguished:

- the command triggers a state transition and executes from there
- the command executes in the current state

This section describes the instrument states and shows the commands that trigger state transitions. A full description of these commands is part of the subsequent sections. Each command is assigned to one or more states in which it can execute.

11.1.2 Receiver States

The various states of the R&S **PR100** are depicted below:

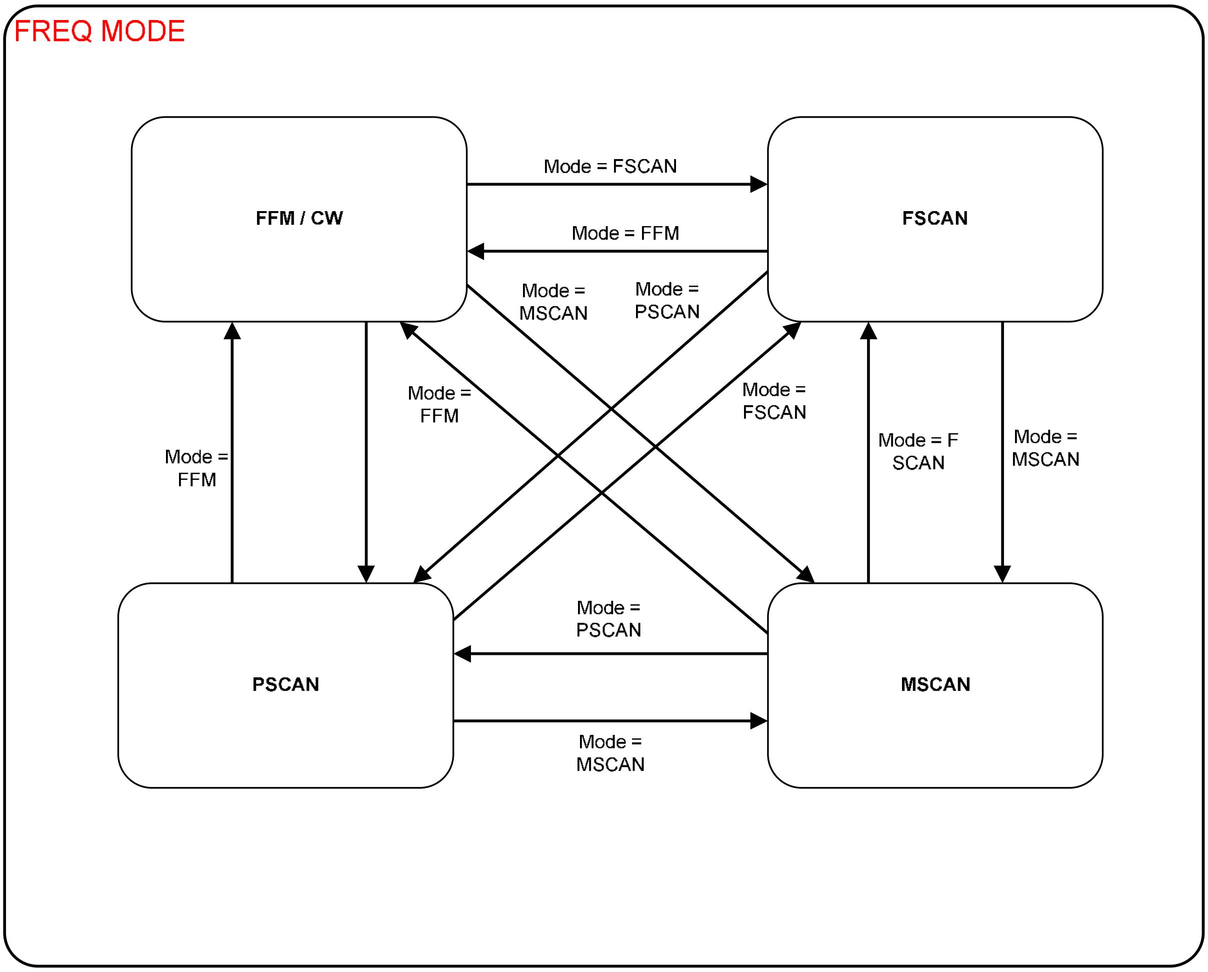


Figure 11-1: Receiver States

11.1.2.1 Fixed Frequency Mode (FFM/CW)

FFM is short for Fixed Frequency Mode. The modes correspond exactly to those of the SCPI command

Fixed Frequency Mode uses a single running state.

11.1.2.2 Frequency Scan Mode FSCAN

SENS:FREQ:MODE. In both Fscan and Mscan mode, the devices has several substates that are shown in Figure 11-2 (p. 156) below:

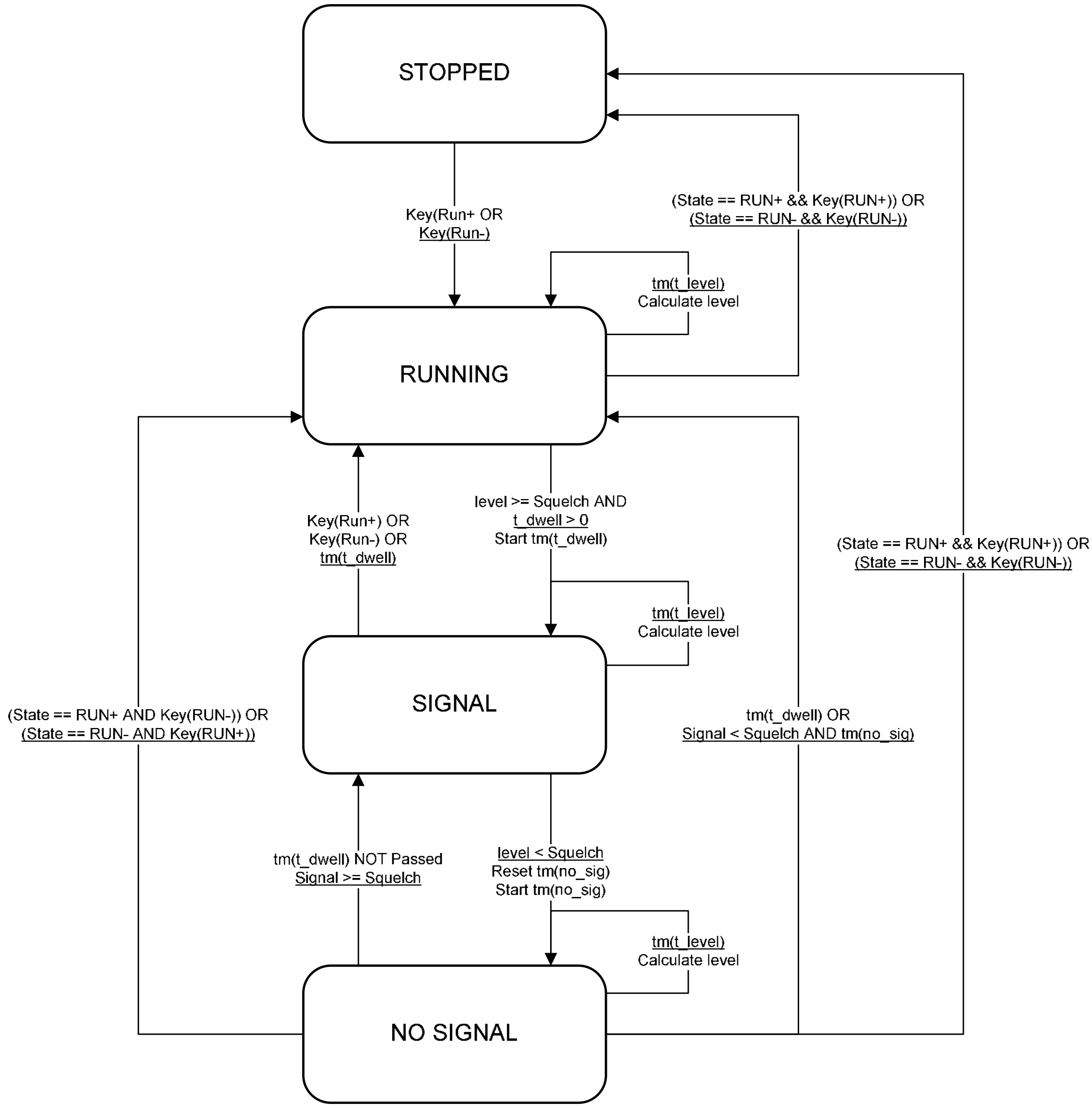


Figure 11-2: States of Frequency Scan Mode and Memory Scan Mode

11.1.2.3 Memory Scan Mode MSCAN

Memory Scan Mode shows exactly the same behaviour as the Frequency Scan Mode in the way of internal states as presented in Figure 11-2 (p. 156).

11.1.2.4 Panorama Scan Mode PSCAN

In Panorama Scan Mode only states Stopped and Running are applicable.

12 Commands Reference

This section describes the SCPI commands that are specific to the R&S **PR100**. They are additional to the SCPI Common Commands in Table 10-20.

Common Commands

*OPT?

OPTION IDENTIFICATION QUERY queries about the options in the unit and outputs a list of installed options. The options are separated by a comma, the format of the returned optionlist is of fixed length within a given fimware version. Installed options are indicated by the abbreviations below, options which are not installed are marked by zero.

Panorama Scan	PS
Internal Recording	IR
Remote Control	RC
External Triggered Measurement	ET
Fieldstrength Measurement	FS
Frequency Processing	FP

Parameters

none

Example

`*OPT?` returned PS,IR,RC,ET,FS,FP,0

This instrument has the following options installed:

- Panorama Scan
- Internal Recording
- Remote Control
- External Triggered Measurement
- Fieldstrength Measurement
- Frequency Processing
- Reserved

ABORt subsystem

ABORt

Stop command for scans. This command stops an active scan and is the counterpart of INIT:IMM.

Parameters

none

Example

`ABORt`

CALCulate subsystem

CALCulate
. :IFPan
. . :AVERage
. . . :TYPE MINimum|MAXimum|SCALar|OFF

Setting of the averaging procedure for the IF-panorama data.

Parameters

MINimum	Keep minimum value of obtained measurements
MAXimum	Keep maximum value of obtained measurements
SCALar	Average measurements according to a device specific algorithm
OFF	Do not process obtained measurements

Example

`CALCulate:IFPan:AVERage:TYPE MINimum`

CALCulate
. :IFPan
. . :AVERage
. . . :TYPE?

Query of the averaging procedure for the IF-panorama data.

Result

MIN, MAX, SCAL, OFF

Example

`CALCulate:IFPan:AVERage:TYPE? -> MIN`

CALCulate
. :IFPan
. . :CLEar

Restart of the averaging function for the IF-panorama data. The value obtained from IF-panorama measurements thus far is deleted, and a new value is obtained.

Parameters

None

Example

```
CALCulate:IFPan:CLEar
```

CALCulate
. :IFPan
. . :MARKer:MAXimum[:PEAK]

Centering of the IF-panorama spectrum to the absolute-level maximum. This changes the receiver frequency SENS:FREQ:CW.

Parameters

None

Example

```
CALCulate:IFPan:MARKer:MAXimum
```

CALCulate
. :IFPan
. . :MARKer:MAXimum:LEFT

The center of the IF-panorama spectrum is moved toward the nearest maximum on the left. This changes the receiver frequency SENS:FREQ:CW.

Parameters

None

Example

```
CALCulate:IFPan:MARKer:LEFT
```

CALCulate
. :IFPan
. . :MARKer:MAXimum:RIGHt

The center of the IF-panorama spectrum is moved toward the nearest maximum on the right. This changes the receiver frequency SENS:FREQ:CW.

Parameters

None

Example

`CALCulate:IFPan:MARKer:RIGHt`

CALCulate
. :PSCan
. . :AVERage
. . . :TYPE MINimum|MAXimum|SCALar| OFF

Setting of the averaging procedure for the panorama-scan data. Each FFT sample is processed separately, e.g. for the MAXimum type a maximum value is kept for each bin in a panorama scan.

Parameters

MINimum	Keep minimum value of obtained measurements
MAXimum	Keep maximum value of obtained measurements
SCALar	Average measurements over the measurement time
OFF	Do not process obtained measurements

Example

`CALCulate:PSCan:AVERage:TYPE MINimum`

CALCulate
. :PSCan
. . :AVERage
. . . :TYPE?

Query of the averaging procedure for the panorama-scan data.

Result

MIN, MAX, SCAL, OFF

Example

```
CALCulate:PSCan:AVERage:TYPE? -> MIN
```

CALCulate
. :PSCan
. . :CLEar

Restart of the averaging function for the panorama-scan data. The values for each bin in the FFTs measured thus far are deleted, and new values are obtained.

Parameters

None

Example

```
CALCulate:PSCan:CLEar
```

CALCulate
. :PSCan
. . :MARKer:MAXimum[:PEAK]

Moves the reveiver frequency to the FFT-bin with the absolute-level maximum in the RF panorama. This changes the receiver frequency SENS:FREQ:CW

Parameters

None

Example

```
CALCulate:PSCan:MARKer:MAXimum
```

CALCulate
. :PSCan
. . :MARKer:MAXimum:LEFT

Moves the reveiver frequency to the maximum that lies to the left of the current frequency in the RF-panorama scan. This changes the receiver frequency SENS:FREQ:CW. If squelch is on, only the maxima that are above the squelch level are taken into account.

Parameters

None

Example

```
CALCulate:PSCan:MARKer:LEFT
```

CALCulate
. :PSCan
. . :MARKer:MAXimum:RIGHt

Moves the reveiver frequency to the maximum that lies to the right of the current frequency in the RF-panorama scan. This changes the receiver frequency SENS:FREQ:CW. If squelch is on, only the maxima that are above the squelch level are taken into account.

Parameters

None

Example

```
CALCulate:PSCan:MARKer:RIGHt
```

DIAGnostic subsystem

DIAGnostic
. [:SERVice]
. . :ADAPter
. . . [:STATe]?

Query whether the instrument is currently being powered by a mains adapter.

Result

0	Instrument is powered by internal battery.
1	Instrument is powered by mains adapter.

Example

```
DIAGnostic:ADAPter? -> 1
```

DIAGnostic
. [:SERVice]
. . :INFO
. . . :SVERsion?

Query of the software version.

Parameters

None

Result

Software version

Example

```
DIAGnostic:INFO:SVERsion? -> V[12.34]
```

“V” indicates this is a release version, “B” is for beta versions
12 is the major version number
24 is the minor version num

DISPlay subsystem

DISPlay
. :BRIGhtness <numeric_value>|MINimum|MAXimum

Controls the brightness of the display backlighting.

Parameters

<numeric_value>	Brightness of backlighting from 0.00 to 1.00
MINimum	Backlighting off
MAXimum	Full backlighting

Remark

The brightness can be set between 0.00 and 1.00 with 2 decimals resolution.

Example

```
DISPlay:BRIGhtness 0.45
```

DISPlay
. :BRIGhtness? [MINimum|MAXimum]

Query of brightness of display backlighting.

Parameter

None	Query of current brightness
MINimum	Query of lowest brightness
MAXimum	Query of highest brightness

Result

Brightness of backlighting from 0.00 to 1.00

0.00 = backlighting off
1.00 = full backlighting

Example

```
DISPlay:BRIGhtness? -> 0.45
```

DISPlay
. :CMAP:DEFault

Selection of display-colors for indoor use.

Parameters

None

Example

```
DISPlay:CMAP:DEFault
```

DISPlay
. :CMAP INDoor|OUTDoor|BW

Selection of display color-scheme.

Parameters

INDoor	Color scheme for indoor use
OUTDoor	Color scheme for outdoor use
BW	Black and White color scheme

Example

```
DISPlay:CMAP OUTDoor
```

DISPlay
. :CMAP?

Query of the currently selected color-scheme.

Parameters

None

Result

IND, OUTD, BW

Example

```
DISPlay:CMAP? -> OUTD
```

DISPlay
. :DATE
. . :FORMat DDMMyyyy|MMDDyyyy

Sets the date format used for display

Parameters

DDMMyyyy	E.g. 31/12/2005
MMDDyyyy	E.g. 12/31/2005

Example

```
DISPlay:DATE:FORMat MMDDyyyy
```

DISPlay
. :DATE
. . :FORMat?

Query the date format used for display

Parameter

None

Result

DDMM, MMDD

Example

```
DISPlay:DATE:FORMat? -> MMDD
```

DISPlay
. :FSTRength <Boolean>

Enable or disable the display of field strength information. Note that the information can only be shown if a valid K-factor has been set.

Parameters

ON	Enable fieldstrength display
OFF	Disable fieldstrength display

Example

```
DISPlay:FSTRength OFF
```

DISPlay
. :FSTRength?

Query whether field-strength is displayed or not

Parameters

None

Result

0	OFF
1	ON

Example

```
DISPlay:FSTRength? -> 0
```

DISPlay
. :IFPan
. . :LEVel
. . . :AUTO

This command is used to initiate an autorange event which calculates and setup the best level-range and level-reference value for IFPAN.

Parameters

None

Remark

The level-range and level-reference is modified in such a way that the signal is positioned between 20% and 80% of the total range.

Example

```
DISPlay:IFPan:LEVel:AUTO
```

DISPlay
. :IFPan
. . :LEVel
. . . :RANGe <numeric_value>|MINimum|MAXimum

Sets the range of signal levels that is displayed in a panorama view. Different levels within this range can be distinguished in the view. The top-end of the range is equal to “DISP:IFP:LEV:REF”.

Parameters

<numeric_value>	Signal level range in dBµV
MINimum	Minimum range
MAXimum	Maximum range

Example

```
DISPlay:IFPan:LEVel:RANGe 30
```

DISPlay
. :IFPan
. . :LEVel
. . . :RANGe? [MINimum|MAXimum]

Query the range of signal levels that is displayed in an IFPan view

Parameter

None	Query of current range
MINimum	Query of minimum range
MAXimum	Query of maximum range

Result

Signal-level range in dBµV

Example

```
DISPlay:IFPan:LEVel:RANGe? -> 30
```

DISPlay
. :IFPan
. . :LEVel
. . . :REFerence <numeric_value>|MINimum|MAXimum

Sets the maximum signal-level that can be displayed in an IFPan view.

Parameters

<numeric_value>	Reference level in dBµV
MINimum	Lowest reference level
MAXimum	Highest reference level

Example

```
DISPlay:IFPan:LEVel:REFerence 40
```

DISPlay
. :IFPan
. . :LEVel
. . . :REFerence? [MINimum|MAXimum]

Query of maximum signal-level that can be displayed in an IFPan view

Parameter

None	Query of current reference level
MINimum	Query of lowest reference level
MAXimum	Query of highest reference level

Result

Reference level in dBµV

Example

```
DISPlay:IFPan:LEVel:REFerence? -> 40
```

DISPlay
. :LEVel
. . :AUTO

This command is used to initiate an autorange event which calculates and setup the best level-range and level-reference value for the levelbar.

Parameter

None

Remark

The level range is set to 60 dB.

The level bar low limit is set in such a way that the level is positioned in the middle of the level bar.

Example

```
DISPlay:LEVel:AUTO
```

DISPlay
. :LEVel
. . :LIMit
. . . :MINimum <numeric_value>|MINimum|MAXimum

Sets the lower limit for the level-bar display. Signal-level with lower values cannot be distinguished (i.e. are displayed with the same size of level bar).

This setting only applies if the tone mode if off (OUTP:TONE:STAT OFF). If tone mode is on, the device determines the lower limit itself.

Parameters

<numeric_value>	Signal-level in dBµV
MINimum	Lowest signal-level
MAXimum	Highest signal-level

Example

```
DISPlay:LEVel:LIMit:MINimum 20
```

DISPlay
. :LEVel
. . :LIMit
. . . :MINimum? [MINimum|MAXimum]

Query of lower limit for the level-bar display

This setting only applies if the tone mode if off (OUTP:TONE:STAT OFF). If tone mode is on, the device determines the lower limit itself.

Parameter

None	Query of current signal-level in dBµV
MINimum	Query of lowest signal-level
MAXimum	Query of highest signal-level

Result

Signal-level in dBµV

Example

```
DISPlay:LEVel:LIMit:MINimum? -> 20
```

DISPlay
. :LEVel
. . :RANGe <numeric_value>|MINimum|MAXimum

Sets the range of signal levels that is displayed in a level-bar view. Different levels within this range can be distinguished in the panorama view. The top-end of the range is equal to “DISP:LEV:LIM:MIN”.

This setting only applies if the tone mode if off (OUTP:TONE:STAT OFF). If tone mode is on, the device determines the lower limit itself.

Parameters

<numeric_value>	Signal-level range in dBµV
MINimum	Minimum range
MAXimum	Maximum range

Remark

The range can be set in discrete steps. Intermediate values are therefore rounded to the nearest discrete value.

Example

```
DISPlay:LEVel:RANGe 30
```

DISPlay
. :LEVel
. . :RANGe? [MINimum|MAXimum]

Query range of signal levels that is displayed in a level-bar view

This setting only applies if the tone mode if off (OUTP:TONE:STAT OFF). If tone mode is on, the device determines the lower limit itself.

Parameter

None	Query of current range
MINimum	Query of minimum range
MAXimum	Query of maximum range

Result

Signal-level range in dBµV

Example

```
DISPlay:LEVel:RANGe? -> 30
```

DISPlay
. :PSCan
. . :LEVel
. . . :AUTO

This command is used to initiate an autorange event which calculates and setup the best level-range and level-reference value for a panorama view.

Parameters

None

Remark

The level-range and level-reference is modified in such a way that the signal is positioned between 20% and 80% of the total range.

Example

```
DISPlay:PSCAN:LEVel:AUTO
```

DISPlay
. :PSCan
. . :LEVel
. . . :RANGe <numeric_value>|MINimum|MAXimum

Sets the range of signal levels that is displayed in a panorama view. Different levels within this range can be distinguished in the view. The top-end of the range is equal to “DISP:PSCAN:LEV:REF”.

Parameters

<numeric_value>	Signal-level range in dBµV
MINimum	Minimum range
MAXimum	Maximum range

Example

```
DISPlay:PSCAN:LEVel:RANGe 30
```

DISPlay
. :PSCan
. . :LEVel
. . . :RANGe? [MINimum|MAXimum]

Query the range of signal levels that is displayed in a panorama view

Parameter

None	Query of current range
MINimum	Query of minimum range
MAXimum	Query of maximum range

Result

Signal-level range in dBµV

Example

```
DISPlay:PSCAN:LEVel:RANGe? -> 30
```

DISPlay
. :PSCan
. . :LEVel
. . . :REFerence <numeric_value>|MINimum|MAXimum

Sets the maximum signal-level that can be displayed in a panorama view.

Parameters

<numeric_value>	Reference level in dBμV
MINimum	Lowest reference level
MAXimum	Highest reference level

Example

```
DISPlay:PSCAN:LEVel:REFerence 40
```

DISPlay
. :PSCan
. . :LEVel
. . . :REFerence? [MINimum|MAXimum]

Query of maximum signal-level that can be displayed in a panorama view

Parameter

None	Query of current reference level
MINimum	Query of lowest reference level
MAXimum	Query of highest reference level

Result

Reference level in dBμV

Example

```
DISPlay:PSCAN:LEVel:REFerence? -> 40
```

DISPlay
. :WATerfall
. . :CMAP <color_map>

Sets the color map that is used for converting signal-levels to colors in the waterfall display. Possible color maps can be retrieved with “DISP:WAT:CMAP:CAT?”.

Parameters

<color_map> String with the name of the color map.

Note that the full string must be provided, no SCPI-like abbreviation applies here.

Example

```
DISPlay:CMAP "Black-White"
```

DISPlay
. :WATerfall
. . :CMAP?

Query the current color map for waterfall display

Parameter

None

Result

String with the name of the color map

Example

```
DISPlay:WATerfall:CMAP? -> "Black-White"
```

DISPlay
. :WATerfall
. . :CMAP
. . . :CATalog?

Produces a list of all available color maps as a comma separated list

Parameter

None

Result

Comma separated list of color maps

Example

```
DISPlay:WATerfall:CMAP:CATalog? -> "Default","Green-Yellow","Green-
Blue","Black-White","Red-Purple","Blue-Black"
```

DISPlay
. :WATerfall
. . :CMAP
. . . :RANGe <numeric_value>|MINimum|MAXimum

Determines the signal-level range over which distinguishing colors are assigned to different signal levels. The range starts at the threshold (DISP:WAT:CMAP:THR) as the lower end of the range.

Parameters

<numeric_value>	Range in dBµV
MINimum	Lowest setting for the range
MAXimum	Highest setting for the range

Example

```
DISPlay:WATerfall:CMAP:RANGe 30
```

DISPlay
. :WATerfall
. . :CMAP
. . . :RANGe? [MINimum|MAXimum]

Query of signal-level range for color coding in waterfall display

Parameter

None	Query of current range in dBµV
MINimum	Query of lowest range setting
MAXimum	Query of highest range setting

Result

Range in dBµV

Example

```
DISPlay:WATerfall:CMAP:RANGe? -> 30
```

DISPlay
. :WATerfall
. . :CMAP
. . . :THReshold <numeric_value>|MINimum|MAXimum

Signal levels below this threshold all get the same background color in the waterfall display. I.e. no distinguishing color is assigned to different signal levels below the threshold.

Parameters

<numeric_value>	Threshold in dBµV
MINimum	Lowest setting for the threshold
MAXimum	Highest setting for the threshold

Example

```
DISPlay:WATerfall:CMAP:THReshold 20
```

DISPlay
. :WATerfall
. . :CMAP
. . . :THReshold? [MINimum|MAXimum]

Query of signal threshold for color coding in waterfall display

Parameter

None	Current threshold in dBµV
MINimum	Query of lowest setting for the threshold
MAXimum	Query of highest setting for the threshold

Result

Threshold in dBµV

Example

```
DISPlay:WATerfall:CMAP:THReshold? -> 20
```

DISPlay
. :WATerfall
. . :HOLD
. . . [:STATe] <Boolean >

Freezes the waterfall. When the state is ON, the waterfall is frozen. In case the state is OFF, the waterfall runs again.

Parameters

OFF	Waterfall runs
ON	Waterfall is frozen

Example

```
DISPlay:WATerfall:HOLD ON
```

DISPlay
. :WATerfall
. . :HOLD
. . . [:STATe]?

Query of the waterfall state.

Parameter

None

Result

0	OFF
1	ON

Example

```
DISPlay:WATerfall:HOLD? -> 1
```

DISPlay
. :WATerfall
. . :SPEed <numeric_value>|MINimum|MAXimum

Controls the speed of the waterfall display.

Parameters

<numeric_value>	Number of lines per second
MINimum	Slowest speed
MAXimum	Fastest speed

Example

```
DISPlay:WATerfall:SPEed 10
```

DISPlay
. :WATerfall
. . :SPEed? [MINimum|MAXimum]

Query of speed of the waterfall display.

Parameter

None	Query of current speed
MINimum	Query of lowest speed
MAXimum	Query of highest speed

Result

Lines per second

Example

```
DISPlay:WATerfall:SPEed? -> 10
```

DISPlay
. :WINDow <display>

Controls what is displayed. In case a window is chosen that is incompatible with the current scan mode (see SENS:FREQ:MODE), an error is generated: -221, “Settings conflict”, and no change is made. In case the receiver is put into a mode that is incompatible with the currently selected display mode, the display mode defaults to “RX + Spectrum”.

Parameters

display	See “DISP:WIND:CAT?” for a list of possible displays

Example

```
DISPlay:WINDow "RX + Spectrum"
```

DISPlay
. :WINDow?

Query of current display

Parameter

None

Result

See “DISP:WIND:CAT?”

Example

```
DISPlay:WINDow? -> "RX + Spectrum"
```

DISPlay
. :WINDow
. . :CATalog?

Query of available displays.

Parameter

None

Result

“RX Only”	Receive information in whole screeen (not possible with PSCAN scan mode)
“RX + Spectrum”	Receive information in upper part and spectrum in lower part of screen
“Spectrum”	Spectrum in whole screen
“Spectrum + Waterfall”	Spectrum in upper part and waterfall in lower part of screen
“Waterfall”	Waterfall in whole screen
“Dual Spectrum”	Dual spectrum: IFPan spectrum in upper part and PSCAN spectrum in lower part (not possible with Memory and Frequency scan modes)

Example

```
DISPlay:WINDow:CATalog? -> … (See under Result)
```

DISPlay
. :WINDow
. . :FETch?

Creates a screen dump of the display in PNG format and outputs it as block data

Parameters

None

Example

`DISPlay:WINDow:FETch? -> Block data of PNG picture.`

DISPlay
. :WINDow
. . :STORe <file_name>

Creates a screen dump of the display in PNG format and stores it in a file on storage card with the name <file name>.

If <filename> does not have the extension ".png" or ".PNG", it is automatically extended with ".png".

If <filename> is relative (not starting with "\"), its location is taken relative from the current mass memory directory (see MMEMory:CDIRectory).

If <filename> is absolute (starting with "\") it must begin with "\Storage Card\", else it fails with error -257,"File name error".

The directory part of <filename> must already exist; if not the command with fail with error -292,"Referenced name does not exist".

If <filename> already exists it is overwritten.

Parameters

File_name	Name and path of file to store the screen dump in.

***RST state**

None, as command is an event.

Example

`DISPlay:WINDow:STORe "screen.png"` -> Creates "screen.png" in the current mass storage directory.

FORMat subsystem

Each individual client specifies it's own format meaning that different formats may be active at the same time among multiple clients.

FORMat
. :BORDer NORMal|SWAPped

Specifies whether numbers in binary data are sent with the least or most significant byte first. Binary data are data that are not in ASCii format, but in PACKed format as can be specified with the command FORMat:DATA.

Parameters

NORMal	MSB first, LSB last
SWAPped	LSB first, MSB last

Example

```
FORMat:BORDer SWAPped
```

FORMat
. :BORDer?

Query of output order for binary data.

Parameters

None

Result

NORM, SWAP

Result

FORMat:BORDer? -> SWAP

FORMat
. [:DATA] ASCii|PACKed [, length]

Specifies the output format of queries that output measurement data. The length parameter is currently only used for the ASCii setting. In this case, a length larger than zero determines the number of significant digits to be returned. When length is zero, the number of digits is determined by the device itself.

Parameters

ASCii	Output in ASCII format according to SCPI standard.
PACKed	Output in binary format
Length	Number of significant digits to be returned

Example

```
FORMat PACKed
```

FORMat
. [:DATA]?

Query of output format of the queries mentioned under the FORM:DATA command.

Parameters

None

Result

ASC, PACK

Example

`FORMat? -> PACK`

FORMat
. :MEMory ASCii|PACKed

Specifies the output format of the following queries:

`MEMory:CONTents?`

Parameters

ASCii	Output in ASCII format according to SCPI standard.
PACKed	Output in device specific binary format

Remark

See the description of `MEMory:CONTents?` for a specification of its device specific binary format.

Example

`FORMat:MEMory PACKed`

FORMat
. :MEMory?

Query of output format of the queries mentioned under the FORMat:MEMory command.

Parameters

None

Result

ASC, PACK

Example

```
FORMat:MEMory? -> PACK
```

FORMat
. :SREGister ASCii|BINary|HEXadecimal|OCTal

Specifies with which data format is used for the queries of all CONDition, EVENt, ENABle, PTRansition, NTRansition registers and all IEEE-488.2 status registers.

Parameters

ASCii	Output as decimal figure in ASCII code (e.g. 128)
BINary	Output as binary figure in ASCII code (e.g. #B10000000)
HEXadecimal	Output as hexadecimal figure in ASCII code (e.g. #H80)
OCTal	Output as octal figure in ASCII code (eg #Q200)

Remark

Note that a “Q” is used as prefix for octal numbers and not an “O” to avoid confusion with the digit 0 (zero).

Example

```
FORMat:SREGister HEXadecimal
```

FORMat
. :SREGister?

Query of output format of the queries mentioned under the FORM:SREG command.

Parameters

None

Result

ASC, BIN, HEX, OCT

Example

```
FORMat:SREGister? -> HEX
```

INITiate subsystem

INITiate
[:IMMediate]

The INITiate command is an event which starts an acquisition or measurement if the instrument mode is set to fixed frequency mode, CW, or the scanner if one of the scanner modes is active. An active scan is restarted if it was already started.

Parameters

None

Remark

All M-trace, I-trace and IFPan-trace buffers are cleared after executing an INITiate command. Only the first measurement value is stored in the trace-buffers when the measurement mode is set to continuous. Values will be added until the trace-buffer is full when the mode equals periodic.

Example

```
INITiate
```

INITiate
. :CONM
. . [:IMMediate]

The INITiate CONtinue Measurement is identical to the INITiate command described in the previous section except for the fact that trace buffers are not cleared and an active scan is not restarted. Using the CONTinue Measurement form appends new measurement values to the current values present in the trace buffers. Using this command causes the scanner to select the next frequency in frequency scan mode or the next memory channel when the memory scanner is active.

Parameters

None

Remark

The INITate CONtinue Measurement command has no effect when the measurement mode is set to periodic.

Example

`INITiate:CONM`

INPut subsystem

INPut
. :ATTenuation
. . :STATe <Boolean>

Switch on/off of input attenuator.

Parameters

ON	Attenuator on
OFF	Attenuator off

Example

`INPut:ATTenuation:STATe ON`

INPut
. :ATTenuation
. . :STATe?

Query of the input attenuator setting.

Parameters

None

Result

0	OFF
1	ON

Example

`INPut:ATTenuation:STATe? -> 1`

MEASure subsystem

MEASure
. :MODE CONTinuous|PERiodic

In the PERiodic measurement mode all detectors are discharged after the measurement time has elapsed and the next measurement is started. Only the individually measured values per measuring period are displayed.

In the CONTinuous measuring mode the measuring detector is read out every 200 ms, irrespective of the measuring time. These currently measured values are displayed.

Parameters

CONTinuous	Continuous measurement
PERiodic	Periodic measurement

Example

`MEASure:MODE PERiodic`

MEASure
. :MODE?

Query of the set measuring mode.

Parameters

None

Result

CONT, PER

Example

`MEASure:MODE? -> PER`

MEASure
. :TIME <numeric_value>|MINimum|MAXimum|DEFault

Setting of the measuring time for all measuring functions.

Remark

The measuring time has an effect on the level detectors. When the level mode is set to average, AVG, the measuring time determines the averaging time. When set to peak, PEAK, this time determines the fall time. Using fast as level method does not have any impact since it is only the current value which is measured.

The measuring time also has an impact on the averaging time of the IF-panorama data.

Parameters

<numeric_value>	Measuring time in seconds
MINimum	Shortest measuring time
MAXimum	Longest measuring time
DEFault	Use preset measuring times

Example

```
MEASure:TIME 50 ms
MEASure:TIME DEF
```

MEASure
. :TIME? [MINimum|MAXimum]

Query of the set measuring time

Parameters

None	Query of the current measuring time
MINimum	Query of the shortest measuring time
MAXimum	Query of the longest measuring time

Result

Measuring time in seconds; with the default measuring time being set, DEF will be output.

Example

```
MEASure:TIME? -> 0.050000
MEASure:TIME? -> DEF
```

MEMory subsystem

This subsystem contains all the functions necessary to operate the device's memory locations. A Memory location can be addressed in the following ways:

CURRENT	The currently selected memory location
0 ... 1023	Memory location 0 to memory location 1023
NEXT	The next free memory location, starting from and including the current location

RX	The current receiver settings

Not all of these addressing options are allowed for every memory command. Those that are allowed are specified. Note that the currently active memory location can be queried by the “MSCAN:CHAN?” command.

MEMory
. :CLEar <mem_loc>[,<count>|MAXimum]

Clearing the contents of a single memory location or a range of memory locations.

Parameters

<mem_loc>	CURRENT|0...1023
<count>	Number of memory locations to be cleared, starting from memory location <mem_loc>. As a default value, <count> = 1.
MAXimum	Clearing all memory locations following and including <mem_loc>

Example

```
MEMory:CLEar 123
```

MEMory
. :CONFig
. . :CATalog?

Outputs the name of the memory configuration. This name can only be modified by uploading another configuration via the MEMory:CONFig command.

Parameter

None

Result

Name of memory configuration file, in a format identical to that of MMEM:CAT? .

Example

```
MEMory:CONFig:CATalog? -> 3000, 120000000 SomeConfigurationName, .memlst,
1000, 14-12-2006,    19:05:03
```

MEMory
. :CONFig <block_data>

Upload and activate a configuration for memory locations.

Parameters

<block_data> Block data with memory configuration

Example

```
MEMory:CONFig <block-data specific for memory configuration>
```

MEMory
. : CONFig?

Outputs the configuration of the memory locations as block data.

Parameters

None

Result

<block_data> of file contents

Example

```
MEMory:CONFig? -> <block-data specific for memory configuration>
```

MEMory
. :CONTents <mem_loc>, <mem_paras>|<packed_struct>

Loading a memory location. The memory contents can be specified in two ways:

<mem_paras> A comma-separated list of parameters in a specific order.

<packed_struct> A device specific binary format, provided as a Block Data.

Parameters

<mem_loc> CURRENT|0...1023|NEXT|RX

<mem_paras> <F>, <THR>, <DEM>, <BW>, <ANT>, <ATT>, <ATTA>, <SQUC>, <AFC>, <ACT>

<packed_struct> Block Data with the following payload

The definition of the parameters is as follows:

Table 12-1: Parameters for MEMory:CONTents

Parameter	C Data Type	Description
<F>	unsigned long long	frequency in Hz (see SENS:FREQ:CW). Note that a “long” type is not large enough, since frequencies can be larger than 4 GHz.
<THR>	signed short	squelch threshold in dBμV (see OUTP:SQU:THR)
<DEM>	unsigned short	type of demodulation (see SENS:DEM)

Parameter	C Data Type	Description
<BW>	unsigned long	Bandwidth in Hz (see SENS:BWID).
<ANT>	unsigned char	antenna number packed_struct: 0...99
<ATT>	unsigned char	attenuator (see INP:ATT:STAT) packed_struct: 0 = OFF, 1 = ON
<ATTA>	unsigned char	Always 0 = OFF. This field was kept for compatibility with EB200.
<SQUC>	unsigned char	squelch function (see OUTP:SQU:STAT) packed_struct: 0 = OFF, 1 = ON
<AFC>	unsigned char	AFC function (see (SENS:FREQ:CW:AFC) packed_struct: 0 = OFF, 1 = ON
<ACT>	unsigned char	include the memory in a memory scan packed_struct: 0 = OFF, 1 = ON

The block data is a structure that is defined as follows:

Table 12-2: Block data structure for MEMory:CONTents

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
<F> (8 bytes)			
<THR>		<DEM>	
<BW>			
<ANT>	<ATT>	<ATTA>	<SQUC>
<AFC>	<AFC>	Not used	

Remark

The parameter <ACT> is ignored for the RX memory-location (current RX settings). However, it must be specified.

When loading with a <packed_struct>, the byte order within the 2- and 4-byte elements is determined by the command FORMat:BORDer.

Example

```
MEMory:CONTents 1,98.5 MHz,30,FM,300,10,OFF,OFF,ON,OFF,ON
```

MEMory
. :CONTents? <mem_loc>

Query of contents of memory location.

Parameters

<mem_loc>	CURRENT|0...1023|RX

Result

Depending on the setting by the command FORMat:MEMory, either ASCII or binary data are output. See MEM:CONT command for the format specifications.

Depending on the setting by the command FORMat:BORder, the data are either big- or little-endian.

Remark

The parameter <ACT> is not defined for the RX location. However, it is output, so it should be ignored.

When trying to read out an empty memory location, error -292 ("Referenced name does not exist") is generated.

Example

```
MEMory:CONTents? 1 -> 98500000,30,FM,300,10,0,0,1,0,1
```

MEMory
. :CONTents
. . :MPAR <mem_loc>,<Boolean>

Setting the memory location parameter <ACT> (MPAR = Memory PARameter).

Parameters

<mem_loc>	CURRENT|0...1023|NEXT
<Boolean>	Include/exclude the memory in a memory scan

Example

```
MEMory:CONTents:MPAR 1, OFF
```

MEMory
. :CONTents
. . :MPAR? <mem_loc>

Query of memory-location parameter <ACT>.

Parameters

<mem_loc>	CURRENT|0...1023

Result

0	OFF
1	ON

Example

```
MEMory:CONTents:MPAR? 1 -> 0
```

MEMory
. :COPY <src_loc>, <dest_loc>

Copy the contents of one memory (source) to another (destination).

Parameters

<src_loc>	CURRENT|0...1023|RX
<dest_loc>	CURRENT|0...1023|NEXT|RX

Example

`MEMory:COPY 123, 10`	Copy from location 123 to location 10
`MEMory:COPY RX, NEXT`	Store current receiver settings in next free (see MEM:CLE) location

MEMory
. :EXCHange <mem_loc1>, <mem_loc2>

Exchange of contents of two memory locations. The contents of location <mem_loc1> is swapped with that of location <mem_loc2>. In case one of the locations is RX, and RX would get an impossible value due to the exchange, the RX value remains unchanged, and the other location gets RX's value. The impossible value is thus lost.

Parameters

<mem_loc1>	CURRENT|0...1023|RX
<mem_loc2>	CURRENT|0...1023|RX

Example

```
MEMory:EXCHange 123, RX
```

MEMory
. :LABel <mem_loc>, <String>

Defines a descriptive text for a memory location

Parameters

<mem_loc> 0...1023

Example

`MEMory:LABel 500, “Radio FM”`

MEMory
. :LABel? <mem_loc>

Query of the descriptive label of a memory location

Parameter

<mem_loc> 0...1023

Result

String

Example

`MEMory:LABel? 500 -> “Radio FM”`

12.1.1 Memory list subsystem

The commands listed in this section are only intended for testing the associated function in the user interface. They are not to be used by the remote user.

Although each memory location (0...1023) can be addressed directly, it is sometimes convenient to run through all of them in a specific order (e.g. in order of increasing frequency). To accomodate both an unordered and an ordered accesss of the memory locations, the memory list is used.

The memory list has a number of items, one for each memory location. Each item links to a certain memory location. This way, the order in the memory locations can remain unchanged, while the list item allow to run through the memories in another order. See below an example for ordering on increasing frequency via the memory list:

xxx...

item 55 -> 25 (freq. 100000000)

item 56 -> 6 (freq. 125000000)

item 57 -> 2 (freq. 140000000)

item 58 -> 800 (freq. 160000000)

xxx...

The memory scan (SENS:FREQ:MODE MSC) uses the memory list to run through all memory locations. The commands below under the MEMory:LIST subsystem control the order of the memory list.

MEMory
. :LIST
. . :CONTents? <index>

Query to which memory location a list item has been linked

Parameter

<index>	Integer number in the range [0,1023]

Result

0...1023

Example

```
MEMory:LIST:CONTents? 25 -> 60
```

MEMory
. :LIST
. . :MEMory? <mem_loc>

Find the memory-list item that links to <mem_loc>

Parameter

<mem_loc>	0...1023

Result

Integer number in the range [0,1023]

NONE	No memory-list item link to <mem_loc>

Example

```
MEMory:LIST:MEMory? 60 -> 25
```

MEMory
. :LIST
. . :SORT <order>

Sorts the memory locations and puts the result in the memory list.

Parameters

<order>	One of the following:
MEM_UP	Increasing memory-location number
MEM_DOWN	Decreasing memory-location number
FREQ_UP	Increasing frequency
FREQ_DOWN	Descreasing frequency
DES_UP	Increasing alphabetical on description
DES_DOWN	Decreasing alphabetical on description

Example

```
MEMory:LIST:SORT DES_DOWN
```

12.1.2 Memory save subsystem

This subsystem contains all commands for automatically saving receiver settings to memory locations.

MEMory
. :SAVE
. . :AUTO
. . . :STARt <mem_loc>

Sets first memory location that is used to save receiver settings when automatic save is active. The last location is set with MEM:SAVE:AUTO:STOP. A start location that is larger than the stop location is rejected with error -221("Settings conflict").

This setting applies to scans with squelch on (see OUTP:SQU:STOR). When the received signal is stronger than the squelch level during a memory scan or a frequency scan, the receiver settings are saved into the first free auto-save memory-location (see MEM:SAVE:AUTO:STAR and MEM:SAVE:AUTO:STOP). This setting is ignored in case the squelch is off (see OUTP:SQU:STAT).

Parameters

<mem_loc>	0...1023

Example

```
MEMory:SAVE:AUTO:STARt 120
```

MEMory
. :SAVE
. . :AUTO
. . . :STARt?

Query of first memory location for auto save

Parameter

None

Result

0...1023

Example

```
MEMory:SAVE:AUTO:STARt? -> 120
```

MEMory
. :SAVE
. . :AUTO
. . . :STOP <mem_loc>

Sets the last memory location that is used to save receiver settings when automatic save on squelch is active (see OUTP:SQU:STOR). The first location is set with MEM:SAVE:AUTO:STAR. A stop location that is smaller than the start location is rejected with error -221("Settings conflict").

Parameters

<mem_loc>	0...1023

Example

```
MEMory:SAVE:AUTO:STOP 180
```

MEMory
. :SAVE
. . :AUTO
. . . :STOP?

Query of the last memory location used for auto save.

Parameter

None

Result

0...1023

Example

```
MEMory:SAVE:AUTO:STOP? -> 180
```

MEMory
. :SAVE
. . :DIRect
. . . :STARt <mem_loc>

Sets first memory location that is used to save receiver settings when the direct save button is pressed. The last location is set with MEM:SAVE:DIR:STOP. A start location that is larger than the stop location is rejected with error -221("Settings conflict"). When the direct save button is pressed, the receiver settings are saved into the first free direct-save memory-location.

Parameters

<mem_loc>	0...1023

Example

```
MEMory:SAVE:DIRect:STARt 60
```

MEMory
. :SAVE
. . :DIRect
. . . :STARt?

Query of first memory location for direct save

Parameter

None

Result

0...1023

Example

```
MEMory:SAVE:DIRect:STARt? -> 60
```

MEMory
. :SAVE
. . :DIRect
. . . :STOP <mem_loc>

Sets the last memory location that is used to save receiver settings when the direct save button is pressed. The first location is set with MEM:SAVE:DIR:STAR. A stop location that is smaller than the start location is rejected with error -221("Settings conflict").

Parameters

<mem_loc> 0...1023

Example

```
MEMory:SAVE:DIRect:STOP 120
```

MEMory
. :SAVE
. . :DIRect
. . . :STOP?

Query of last memory location used for direct save

Parameter

None

Result

0...1023

Example

```
MEMory:SAVE:DIRect:STOP? -> 120
```

MMEMory subsystem

This subsystem contains all commands that act on the mass storage of the receiver, e.g. SD-Card

MMEMory
. :CATalog?

List the files in the current directory of the mass storage device.

Parameter

None

Result

<used_storage>, <available_storage> , <file_entry>

with <file_entry> = <file_name>, <file_type>, <file_size>, <file_date>, <file_time>

<used_storage>	Used storage in bytes
<available_storage>	Available storage in bytes
<file_name>	String of characters
<file_type>	The 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>
<file_time>	Time of file in format <hours>, <minutes>, <seconds>

Example

```
MMEMory:CATalog? ->
1944227840,83017728,bootloader_MR_1_22,bin,223983,2009,06,23,09,41,04,osimage_
MR_1_22,bin,24804971,2009,06,23,09,41,46
```

MMEMory
. :CATalog
. . :DIRectories?

List the directories in the current directory of the mass storage device.

Parameter

None

Result

<used_storage>, <available_storage> , <file_entry>

with <file_entry> = <file_name>, <file_type>, <file_size>

<used_storage>	Used storage in bytes
<available_storage>	Available storage in bytes
<file_name>	String of characters
<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

```
MMEMory:CATalog? ->
71663616,1895137280,PR100,2009,02,18,07,35,14,test,2009,06,23,10,14,28
```

MMEMory
. :CDIRectory <folder_name>

Change the default (current) folder (directory) to the specified one. The default folder is used for all other MMEMory commands and queries. In case the folder does not exist, an error is generated: .-292, “Referenced name does not exist”

Parameters

<folder_name>	String of characters (comma not allowed)

Example

```
MMEMory:CDIRectory “SomeFolder”
```

MMEMory
. :CDIRectory?

Returns the default (current) folder (directory).

Parameters

None

Result

<folder_name>	String of characters

Example

```
MMEMory:CDIRectory? -> "SomeFolder"
```

MMEMory
. :COPY <src_name>, <dest_name>

Copies the file or folder <src_name> to <dest_name>. In case <src_name> does not exist in the current folder, an error is generated: .-292, “Referenced name does not exist”. In case <dest_name> already exists in the current folder, an error is generated: .-293, “Referenced name already exists”.

Parameters

<src_name>	Source file/folder: String of characters (comma not allowed)
<dest_name>	Destination file/folder: String of characters (comma not allowed)

Example

```
MMEMory:COPY "file1", "file3"
```

MMEMory
. :DATA <file_name>, <block_data>

Creates a new file, or overwrites an existing one, with the name <file_name>, and fills it with the binary data in <block_data>

Parameters

<file_name>	String of characters (comma not allowed)
<block_data>	Block data

Example

```
MMEMory:DATA "test.txt", #15hello
```

MMEMory
. : DATA? <file_name>

Outputs the contents of the file <file_name> as block data. In case <file_name> does not exist, an error is generated: .-292, “Referenced name does not exist”.

Parameters

<file_name>	String of characters (comma not allowed)

Result

<block_data>	File contents

Example

```
MMEMory:DATA? "test.txt" -> #15hello
```

MMEMory
. :DELete < name>

Removes the file <name> from the current folder of the mass storage device. In case <name> does not exist, an error is generated: .-292, "Referenced name does not exist".

Parameters

<name>	String of characters (comma not allowed)

Example

```
MMEMory:DELete "file"
```

MMEMory
. :FILE <file_name>, <block_data>

Alias of MMEM:DATA

Remark

See MMEM:DATA

MMEMory
. :FILE? <file_name>

Alias of MMEM:DATA?

Remark

See MMEM:DATA?

MMEMory
. :FILE
. . :DATE <file_name>, <year>, <month>, <day>

Sets the modification date of an existing file. In case <file_name> does not exist, an error is generated: .-292, “Referenced name does not exist”.

Parameters

<file_name>	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]

Error

In case the date is invalid, an execution error -200,"Execution error" is generated.

Example

```
MMEMory:FILE:DATE “test.txt”, 2006, 12, 14
```

MMEMory
. :FILE
. . :DATE? <file_name>

Outputs the modification date of an existing file. In case <file_name> does not exist, an error is generated: .-292, “Referenced name does not exist”.

Parameters

<file_name> String of characters (comma not allowed)

Result

<year>, <month>, <day> (See MMEM:FILE:DATE)

Example

```
MMEMory:FILE:DATE? "test.txt" -> 2006, 14, 12, 14
```

MMEMory
. :FILE
. . :TIME <file_name>, <hours>, <minutes>, <seconds>

Sets the modification time of an existing file. In case <file_name> does not exist, an error is generated: .-292, "Referenced name does not exist".

Parameters

<file_name>	String of characters (comma not allowed)
<block_data>	Block data
<hours>	Integer number in the range [0:23]
<minutes>	Integer number in the range [0:59]
<seconds>	Any number in the range [0:60]

The seconds are specified by a real number that is rounded toward the resolution of the device's internal clock accuracy. The number 60 is allowed here, because rounding can yield a number larger than 59.5.

Error

In case the time is invalid, an execution error -200,"Execution error" is generated.

Example

```
MMEMory:FILE:TIME "test.txt", 22, 23, 24.09
```

MMEMory
. :FILE
. . :TIME? <file_name>

Outputs the modification time of an existing file. In case <file_name> does not exist, an error is generated: .-292, "Referenced name does not exist".

Parameters

<file_name> String of characters (comma not allowed)

Result

<hours>, <minutes>, <seconds> (See MMEM:FILE:TIME)

Example

```
MMEMory:FILE:TIME? "test.txt" -> 22, 23, 24.09
```

MMEMory
. :INIT [<label>]

Deletes all files and directories from the mass storage device. After that, it restores default directories and files that are needed for correct operation of the device, and assigns a label to the mass storage.

Parameters

None The existing label for the mass storage is not changed

<label> String of character for the new label for the mass storage

Example

```
MMEMory:INIT "Measurements"
```

MMEMory
. :MDIRectory <folder_name>

Creates a new folder <folder_name> in the current folder of the mass storage device. In case <folder_name> already exists in the current folder, an error is generated: .-293, "Referenced name already exists".

Parameters

<folder_name> String of characters (comma not allowed)

Example

```
MMEMory:MDIRectory "SomeFolder"
```

MMEMory
. :MOVE <src_name>, <dest_name>

Renames the file or folder <src_name> into <dest_name. In case <name> does not exist in the current folder, an error is generated: .-292, "Referenced name does not exist". In case <dest_name> already exists in the current folder, an error is generated: .-293, "Referenced name already exists".

Parameters

<src_name>	Source file/folder: String of characters (comma not allowed)
<dest_name>	Destination file/folder: String of characters (comma not allowed)

Example

```
MMEMory:MOVE "file1", "file2"
```

MMEMory
. :RDIRectory <folder_name>

Removes an existing folder <folder_name> in the current folder of the mass storage device. In case <name> does not exist in the current folder, an error is generated: .-292, "Referenced name does not exist".

Parameters

<folder_name>	String of characters (comma not allowed)

Example

```
MMEMory:MDIRectory "SomeFolder"
```

OUTPut subsystem

OUTPut
. :AUX
. . :AUTO <Boolean>

Sets whether the auxilary bits on AUX1 are automatically determined by the selected antenna or if they are manually affected by using the BITAux or BYTAux commands.

Parameters

ON	Automatic
OFF	Manual

Example

```
OUTPut:AUX:AUTO ON
```

OUTPut
. :AUX
. . :AUTO?

Queries whether the auxilary bits on AUX1 are automatically determined by the selected antenna or if they are manually affected by using the BITAux or BYTAux commands.

Parameters

0	Manual

1	Automatic

Example

```
OUTPut:AUX:AUTO? -> 1
```

OUTPut
. :BITaux[<numeric_suffix>]
. . [:STATe] <Boolean>

Sets the antenna-selection bits. In case another antenna is chosen, these settings are changed again.

<numeric_suffix>

1	Bit 1 corresponds to antenna bit 1
2	Bit 2 corresponds to antenna bit 2

Parameters

ON	Bit set to 1
OFF	Bit set to 0

Example

```
OUTPut:BITaux2 ON
```

OUTPut
. :BITaux[<numeric_suffix>]
. . [:STATe] ?

Query of the antenna-selection bits.

Result

0	OFF
1	ON

Parameters

None

Example

```
OUTPut:BITaux2? -> 1
```

OUTPut
. :BYTaux
. . [:STATe] <numeric_value>

Sets all antenna selection bits with a single command.

Parameters

<numeric_value>	Value of the antenna-selection bits (0 to 3, #H00 to #H03, #B0 to #B11, #Q0 to #Q3)

Example

```
OUTPut:BYTAux 7
```

OUTPut
. :BYTaux
. . [:STATe]?

Query of all antenna-selection bits by a single byte command.

Parameters

None

Result

The output format depends on the FORMat:SREG command.

Example

```
OUTPut:BYTAux? -> 3
```

OUTPut
. :IF
. . [:STATe] <Boolean>

Sets the IF output state. If it is ON, the receiver activates a separate output on which it puts the received-signal, that has been mixed downwards to the IF frequency and bandwidth limited to 10 MHz.

***Parameters**

ON IF output enabled

OFF IF output disabled

Example

```
OUTPut:IF:STATe ON
```

OUTPut
. :IF
. . [:STATe] ?

Query of IF output state

Result

0	OFF
1	ON

Parameters

None

Example

```
OUTPut:IF:STATe? -> 1
```

OUTPut
. :SQUelch
. . :CONTrol MEMory|NONE

When retrieving RX settings from a memory location, the squelch state and value are also retrieved when OUTP:SQU:CONT is set to MEMory. Otherwise, the squelch state and value are not retrieved and their settings remain unchanged.

Parameters

MEMory	Squelch state and squelch value are read out of the memory locations
NONE	Squelch state and squelch value are not read out of the memory locations

Example

```
OUTPut:SQUelch:CONTrol MEMory
```

OUTPut
. :SQUelch
. . :CONTrol?

Query of the source of squelch setting when reading memory locations.

Parameters

None

Result

MEM, NONE

Example

```
OUTPut:SQUelch:CONTrol? -> MEM
```

OUTPut
. :SQUelch
. . [:STATe] <Boolean>

Switch on/off of squelch.

Parameters

ON	Squelch on
OFF	Squelch off

Example

```
OUTPut:SQUelch ON
```

OUTPut
. :SQUelch
. . [:STATe]?

Query of squelch setting.

Parameters

None

Result

0	OFF
1	ON

Example

```
OUTPut:SQUelch? -> 1
```

OUTPut
. :SQUelch
. . :THReshold
. . . [:UPPer] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of squelch threshold.

Parameters

<numeric_value>	Squelch threshold in dBµV
UP	Increase squelch threshold by the value set with the command OUTPut:SQUelch:THReshold[:UPPer]:STEP[:INCRement].
DOWN	Decrease of squelch threshold by the value set with the command OUTPut:SQUelch:THReshold[:UPPer]:STEP[:INCRement].
MINimum	Setting the lowest squelch threshold
MAXimum	Setting the highest squelch threshold

Example

```
OUTPut:SQUelch:THReshold 35 dBµV
```

OUTPut
. :SQUelch
. . :THReshold
. . . [:UPPer]? [MINimum|MAXimum]

Query of squelch threshold.

Parameters

None	Query of current squelch threshold
MINimum	Query of lowest squelch threshold
MAXimum	Query of highest squelch threshold

Result

Squelch threshold value in dBµV

Example

```
OUTPut:SQUelch:THReshold? -> 35
```

OUTPut
. :SQUelch
. . :THReshold
. . . [:UPPer]
. . . . :STEP
. . . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command OUTP:SQU:THR[:UPP] UP|DOWN

Parameters

<numeric_value>	Stepwidth of squelch threshold in dBµV
MINimum	Setting the smallest stepwidth
MAXimum	Setting the largest stepwidth

Example

```
OUTP:SQU:THR:STEP 10 dBµV
```

OUTPut
. :SQUelch
. . :THReshold
. . . [:UPPer]
. . . . :STEP
. . . . . [:INCRement]? [MINimum|MAXimum]

Query of squelch stepwidth

Parameters

None	Query of currently set stepwidth
MINimum	Query of smallest stepwidth
MAXimum	Query of largest stepwidth

Result

Stepwidth of squelch threshold in dBµV

Example

```
OUTP:SQU:THR:STEP? -> 10
```

OUTPut
. :TONE
. . :CONTrol ONLY|WITHaf

It can be selected whether, in the TONE mode, only the level tone or also the AF is output via the audio channel.

Parameters

WITHaf	Level tone and AF is output.
ONLY	Level tone only is output.

Example

```
OUTPut:TONE:CONTrol ONLY
```

OUTPut
. :TONE
. . :CONTrol?

Query of whether in the TONE mode, only the level tone or also the AF is output via the audio channel.

Parameters

None

Result

ONLY, WITH

Example

```
OUTPut:TONE:CONTrol? -> ONLY
```

OUTPut
. :TONE
. . :GAIN <numeric_value>|MINimum|MAXimum|UP|DOWN

Setting of tone gain. See also OUTP:TONE:THR for a description of its use.

Parameters

<numeric_value>	Tone gain in Octave/<numeric_value>dB
MINimum	Setting the lowest tone gain
MAXimum	Setting the highest tone gain

Remark

The range can be set in discrete steps. Intermediate values are therefore rounded to the nearest discrete value.

Example

```
OUTPut:TONE:GAIN 20
```

OUTPut
. :TONE
. . :GAIN? [MINimum|MAXimum]

Query of tone gain

Parameters

None	Query of current tone gain
MINimum	Query of lowest tone gain
MAXimum	Query of highest tone gain

Result

Tone gain in Octave/<numeric_value>dB

Example

```
OUTPut:TONE:GAIN? -> 20
```

OUTPut
. :TONE
. . [:STATe] <Boolean>

Switch on/off of level tone function. When on, a tone is output depending on the level magnitude.

Parameters

ON	Level tone on
OFF	Level tone off

Example

```
OUTPut:TONE ON
```

OUTPut
. :TONE
. . [:STATe]?

Query of the TONE mode.

Parameters

None

Result

0	OFF
1	ON

Example

```
OUTPut:TONE? -> 1
```

OUTPut
. :TONE
. . :THReshold <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting the tone-level reference-threshold. It determines what signal level is to be output as 400 Hz: e.g. usually this is set to 0 dBµV, which means that a signal of that strength produces a tone of 400 Hz. Together with the settings OUTP:TONE:GAIN, this setting determines the frequency of the tone for each received signal level.

Parameters

<numeric_value>	Level tone reference threshold in dBµV
UP	Increase of level tone reference threshold by the value set in the OUTPut:TONE:THReshold:STEP[:INCRement] command.
DOWN	Decrease of level tone reference threshold by the value set in the OUTPut:TONE:THReshold:STEP[:INCRement] command.
MINimum	Setting the lowest level tone reference threshold
MAXimum	Setting the highest level tone reference threshold

Example

```
OUTPut:TONE:THReshold 35 dBµV
```

OUTPut
. :TONE
. . :THReshold? [MINimum|MAXimum]

Query of level tone reference threshold.

Parameters

None	Query of current level tone reference threshold
MINimum	Query of lowest level tone reference threshold
MAXimum	Query of highest level tone reference threshold

Result

Level tone reference threshold in dBµV

Example

```
OUTPut:TONE:THReshold? MIN -> 6
```

OUTPut
. :TONE
. . :THReshold
. . . :STEP
. . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the OUTP:TONE:THR UP|DOWN command.

Parameters

<numeric_value>	Stepwidth for level tone reference threshold in dBµV
MINimum	Setting the smallest stepwidth
MAXimum	Setting the largest stepwidth

Example

```
OUTP:TONE:THR:STEP 10 dBµV
```

OUTPut
. :TONE
. . :THReshold
. . . :STEP
. . . . [:INCRement]? [MINimum|MAXimum]

Query of tone-threshold stepwidth.

Parameters

None	Query of currently set stepwidth
MINimum	Query of smallest stepwidth
MAXimum	Query of largest stepwidth

Result

Stepwidth for level tone reference threshold in dBµV

Example

```
OUTP:TONE:THR:STEP? -> 10
```

Program preset subsystem

This sub-system allows saving of all settings of the device as a “preset”. The settings saved into a preset can be recalled, after which all the settings in the preset are restored. The commands below allow for saving to and recalling from presets.

PROGram
. :PRESet
. . :CATalog?

Query of available presets

Parameters

None

Remark

Beware that user defined preset names, using PROG:PRES:DEF <name>, are not visible in the User Interface of the instrument. The User Interface always display User Preset <nr> regardless the entered name via SCPI. The name display User Preset <nr> is used when the user stores a preset via the User Interface.

Result

Comma separated list of preset-names.

Example

```
PROG:PRES:CAT? -> "User Preset 1", "User Preset 2"
```

PROGram
. :PRESet
. . :DEFine <name>

Defines the name <name> for all current settings of the device.

Parameters

<name>	String of characters enclosed in double quotes

Remark

Beware that user defined preset names, using PROG:PRES:DEF <name>, are not visible in the User Interface of the instrument. The User Interface always display User Preset <nr> regardless the entered name via SCPI. The name display User Preset <nr> is used when the user stores a preset via the User Interface.

The name parameters has a limit of 20 characters.

Each name in the list should be unique.

Example

```
PROG:PRES:DEFine "User Preset 1"
```

PROGram
. :PRESet
. . :DELete <name>

Deletes a preset with the name <name>.

Parameters

<name> String of characters enclosed in double quotes

Error

-292 Referenced name, preset, does not exist.

Example

```
PROG:PRES:DELete "User Preset 1"
```

PROGram
. :PRESet
. . :DELete
. . . :ALL

Deletes all saved presets

Parameters

None

Example

```
PROG:PRES:DELete:ALL
```

PROGram
. :PRESet
. . :SELect <name>

Recalls all settings of a preset with the name <name>, and restores those settings in the device. When a preset with the specified name is not present, the error -292, “Referenced name does not exist” is generated.

Parameters

<name> String of characters enclosed in double quotes

Example

```
PROG:PRES:SELect "User Preset 1"
```

ROUTe subsystem

ROUTe
. :CLOSe <channel_list>

Selection of an antenna. When an antenna is selected, it is automatically included in the list of automatically selected antennas, which is equivalent to the command ROUT:SEL:AUTO. When the list of automatically selected antennas is full, an error is returned: error -200, “Execution error”.

Contrary to the use on the EB200, it is not necessary to deselect the old antenna (with ROUTe:OPEN:ALL) before selecting a new one.

An antenna must have been defined (by ROUT:PATH:DEF) before it can be selected, otherwise an error is returned: error -292, "Referenced name does not exist".

Parameters

<channel_list>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

Error

If <channel_list> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:CLOSe (@13)
```

ROUTe
. :CLOSe? <channel_list>

Query of whether the respective antenna is selected.

Parameters

<channel_list>	Contains one value for each antenna number to be queried

Error

If <channel_list> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Result:

0	For each non-selected antenna number
1	For each selected antenna number

Example

```
ROUTe:CLOSe? (@2, 6:8, 13) -> 0,0,0,0,1
```

ROUTe
. :CLOSe
. . :STATe? [MINimum|MAXimum]

Query of selected antenna.

Parameters

None	Query of currently selected antenna
MINimum	Query of smallest antenna number
MAXimum	Query of largest antenna number

Result

Antenna number as Block Data (see "Block Data

132))

Example

```
ROUTe:CLOSe:STATe? -> #15(@13)
```

ROUTe
. :OPEN
. . :ALL

Select no antenna.

Parameters

None

Example

```
ROUTe:OPEN:ALL
```

ROUTe
. :PATH
. . :BITPattern
. . . :ACTive <channel>, <numeric_value>

Sets the bit-pattern to access an active antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
<numeric_value>	2-bit integer: range [0,3]

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:BITPattern:ACTive (@1), #B10
```

ROUTe
. :PATH
. . :BITPattern
. . . :ACTive? <channel>

Retrieves the bit-pattern to access an active antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

Result

<numeric_value>	2-bit integer: range [0,3]

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:BITPattern:ACTive? (@1) -> #B10
```

ROUTe
. :PATH
. . :BITPattern
. . . :PASSive <channel>, <numeric_value>

Sets the bit-pattern to access a passive antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
<numeric_value>	2-bit integer: range [0,3]

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:BITPattern:PASSive (@1), #B01
```

ROUTe
. :PATH
. . :BITPattern
. . . :PASSive? <channel>

Retrieves the bit-pattern to access a passive antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

Result

<numeric_value>	2-bit integer: range [0,3]

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:BITPattern:PASSive? (@1) -> #B01
```

ROUTe
. :PATH
. . :CATalog?

Request of a list of the names of all defined antennas.

Parameters

None

Result

One string for each antenna name, separated by commas: <name_string1>,<name_string2>,... If no antenna name is defined, a zero string ("") is output.

Example

```
ROUTe:PATH:CATalog? -> "Omni", "", "Parabolic"
```

ROUTe
. :PATH
. . :CONFig
. . . :CATalog?

Outputs the name of the antenna configurations. This name can only be modified by uploading another configuration via the ROUTe:PATH:CONFig command.

Parameters

None

Result

Name of antenna configuration files, in a format identical to that of MMEM:CAT?
(see MMEMory
. **:CATalog?** (p. 200)).

Example

```
ROUTe:PATH:CONFig:CATalog? ->
3000, 120000000
SomeConfigurationName, .antlst, 500, 14-12-2006,  19:05:03
```

ROUTe
. :PATH
. . :CONFig <block_data>

Upload and activate a configuration for antennas.

Parameters

<block_data> Block data with antenna configurations

Example

```
ROUTe:PATH:CONFig <block-data specific for antenna configurations>
```

ROUTe
. :PATH
. . :CONFig?

Outputs the configuration of the antennas as block data.

Parameters

None

Result

<block_data> of file contents

Example

```
ROUTe:PATH:CONFig? -> <block-data specific for antenna configurations>
```

ROUTe
. :PATH
. . [:DEFine] <name>, <channel>

Set the name of an antenna.

Parameters

<name>	This is a quoted string of characters that contains the antenna name. If a path name has already been used, error -293, “Referenced name already exists” is generated.
<channel>	Antenna identifier in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

***RST state:**

All names are maintained after *RST.

Example

```
ROUTe:PATH “Omni”, (@10)
```

ROUTe
. :PATH
. [:DEFine]? <name>

Query of antenna identifier for an antenna name

Parameters

<name> This is a quoted string of characters that contains the antenna name.

Result

Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] as block data (see example)

Error

If <name> could not be found in the list of names, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH? “Omni” -> #15(@10)
```

ROUTe
. :PATH
. . :DELete
. . . :ALL

Clears all antenna names.

Parameters

None

Example

```
ROUTe:PATH:DELete:ALL
```

ROUTe
. :PATH
. . :DELete
. . . [:NAME] <name>

Clears a particular antenna name.

Parameters

<name> See ROUTe:PATH:DEFine

Error

If <name> could not be found in the list of names, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:DELete “Omni”
```

ROUTe
. :PATH
. . :FREQuency
. . . :OFFSet <channel>, <numeric_value>|MINimum| MAXimum

Sets the frequency offset for a specific antenna

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
<numeric_value>	Bandwidth in Hz
MINimum	Setting the lowest frequency
MAXimum	Setting the highest frequency

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:FREQuency:OFFSet (@10), 20 kHz
```

ROUTe
. :PATH
. . :FREQuency
. . . :OFFSet? <channel>|MINimum|MAXimum

Query of the frequency offset for a specific antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
MINimum	Retrieves the lowest frequency
MAXimum	Retrieves the highest frequency

Result

Frequency offset in Hz

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:FREQuency:OFFSet? (@10) -> 20000
```

ROUTe
. :PATH
. . :FREQuency
. . . :RANGe <channel>, <start_frequency>, <stop_frequency>

Sets the frequency range for a specific antenna by specifying a start and a stop frequency

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
<start_frequency>	Start frequency in Hz: <numeric_value>|MINimum|MAXimum
<stop_frequency>	Stop frequency in Hz: <numeric_value>|MINimum|MAXimum

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

A start frequency that is larger than the stop frequency is rejected with error -221(“Settings conflict”).

Example

```
ROUTe:PATH:FREQuency:RANGe (@10), 200 MHz, 750 MHz
```

ROUTe
. :PATH
. . :FREQuency
. . . :RANGe? <channel>|MINimum|MAXimum

Query of the frequency range for a specific antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
MINimum	Retrieves the smallest values for the start and stop frequencies
MAXimum	Retrieves the largest values for the start and stop frequencies

Result

Start frequency in Hz, Stop frequency in Hz

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:FREQuency:RANGe? (@10) -> 200000000, 750000000
```

ROUTe
. :PATH
. . :KFACtor <channel>, <table>

Sets the K-factor table for a specific antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.
<table>	Name of K-factor table, see also “ROUT:PATH:KFAC?”.

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:KFACtor (@10), “table 1”
```

ROUTe
. :PATH
. . :KFACtor? <channel>

Query of what K-factor table is set for a specific antenna.

Parameters

<channel>	Antenna identifier (see ROUT:PATH:DEF) in the range [0,99] The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

Result

Name of K-factor table as string enclosed in double quotes

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:PATH:KFACtor? (@10) -> “table 1”
```

ROUTe
. :PATH
. . :KFACtor
. . . :CATalog?

Request of a list with currently defined antenna K-factor tables. Putting K-factor tables onto the R&S PR100/EM100 is not possible via SCPI. It has to be done with a separate tool. Description of that tool is beyond the scope of this document.

Parameters

None

Result

One string for each K-factor table, separated by commas: <name_string1>,<name_string2>,... If no table is defined, a zero string ("") is output.

Example

```
ROUTe:PATH:KFACtor:CATalog? -> "table 1", "table 2”
```

ROUTe
. :PATH
. . :KFACtor
. . . :CONFig
. . . . :CATalog?

Outputs the file-names of the k-factor table configurations.

Parameters

None

Result

Comma-separated list of file-names, in a format identical to that of MMEM:CAT?
(see MMEMory
. :CATalog? (p. 200)).

Example

```
ROUTe:PATH:KFACtor:CONFig:CATalog? ->
3000, 120000000
config1, .kfactab, 200, 14-12-2006, 19:05:03,
config2, .kfactab, 300, 15-12-2006, 20:05:03
```

ROUTe
. :PATH
. . :KFACtor
. . . :CONFig <file_name>, <block_data>

Upload and activate a configuration file for a k-factor table. An existing file with the same name is overwritten.

Parameters

<file_name>	String of characters (comma not allowed)
<block_data>	Block data

Example

```
ROUTe:PATH:KFACtor:CONFig "config1.kfactab", <block-data specific for k-factor table>
```

ROUTe
. :PATH
. . :KFACtor
. . . :CONFig? <file_name>

Outputs the contents of the configuration file <file_name> as block data. In case <file_name> does not exist, an error is generated: -292, “Referenced name does not exist”.

Parameters

<file_name> String of characters (comma not allowed)

Result

<block_data> of file contents

Example

```
ROUTe:PATH:KFACtor:CONFig "config1.tab" -> <block-data specific for
configuration file>
```

ROUTe
. :PATH
. . :KFACtor
. . . :DELete <file_name>

Delete a configuration file for a k-factor table.

Parameters

<file_name> String of characters (comma not allowed)

Example

```
ROUTe:PATH:KFACtor:DELete "config1.kfactab"
```

ROUTe
. :SELect <channel>

Equivalent to the combination:

ROUTe:OPEN:ALL

ROUTe:CLOSe <channel>

Parameters

<channel> Antenna identifier (see ROUT:PATH:DEF) in the range [0,99]
The identifier must have the format of a channel list to remain compatible with SCPI (see example). However, only one identifier is allowed. If more than one identifier is offered, an execution error -221,"Settings conflict" is generated.

Error

If <channel> could not be found in the list of antennas, an execution error -292, "Referenced name does not exist" is generated.

Example

```
ROUTe:SELect (@13)
```

Sense Subsystem

[SENSe]
. :BANDwidth|BWIDth
. . [:RESolution] <numeric_value>|UP|DOWN|MINimum|MAXimum

Selection of bandwidth of demodulation path. Only certain bandwidths are allowed. If a number is specified, the smallest bandwidth that is still larger is selected.

Parameters

<numeric_value>	Bandwidth in Hz
UP	To next bandwidth
DOWN	To previous bandwidth
MINimum	Setting the narrowest bandwidth
MAXimum	Setting the widest bandwidth

Example

```
BANDwidth 2.4 kHz
```

[SENSe]
. :BANDwidth|BWIDth
. . [:RESolution]? [MINimum|MAXimum]

Query of current IF bandwidth.

Parameters

None	Query of current bandwidth
MINimum	Query of narrowest bandwidth
MAXimum	Query of widest bandwidth

Result

Bandwidth in Hz

Example

```
BANDwidth? -> 2400
```

[SENSe]
. :CORRection
. . :ANTenna ACTive|PASSive

Sets the mode of the selected antenna.

Parameters

ACTive	For active (= amplifying) antennas
PASSive	For passive (= non amplifying) antennas

Example

```
SENSe:CORRection:ANTenna ACT
```

[SENSe]
. :CORRection
. . :ANTenna?

Query of antenna mode

Parameters

None

Result

ACT, PASS

Example

```
SENSe:CORRection:ANTenna? -> ACT
```

[SENSe]
. :DATA? [<data_handle>]

Query of the most current measured values of active sensor functions.

Measurement values may not be available yet at the moment when this query is issued, for example. immediately after a receiver setting have been changed. If this is the case the query will block until the data will become available. If MEASurement:MODE is CONTinuous this may take up to 200 ms, if PERiodic it may take up to the measurement time (MEASurement:TIME).

The unit may actively report the end of measurement (MEASuring bit in operation status register becomes inactive) via SRQ if the status register has been configured accordingly (see also Section 10.1.7.4).

Remark

For this command the keyword SENSe must not be omitted as DATA? can be mixed up with the subsystem TRACe:DATA.

When the scan mode is PSCan, this command returns the error -221 (“Settings conflict”).

Parameters

None	Output of the measured values of all active sensor functions.
<data_handle>	See the command `SENS:FUNC:ON` for the available functions

Error

If a requested function is not switched on, or if no functions are switched on, error -221, "Settings Conflict" is generated.

Result

The values for the various data-handles are output in the order as specified under the SENS:FUNC:ON command. The output format (ASCii or block data) is determined by the command FORMat:DATA. If the output format is block data, the command FORMat:BORder defines whether the data is output in big- or little-endian byte order.

Table 12-3: Output data types for SENSe::DATA?

data_handle	C Data Type	Description
“VOLTage:AC"	signed short	level in 0.1 dBµV (block data) level in 1.0 dBµV (ASCii data)
"FREQuency:OFFSet"	signed long	Offset in Hz
“FSTRength"	signed short	field strength in 0.1 dBµV/m (block data) field strength in 1.0 dBµV/m (ASCii data)

Examples:

```
SENSe:DATA? -> 23.4, -2500
SENSe:DATA? "VOLT:AC" -> 23.4
SENSe:DATA? "FREQuency:OFFSet" -> -2500
SENSe:DATA? "FSTRength" -> 45.4
```

[SENSe]
. :DEModulation AM|FM| PULSe|CW|LSB|USB|IQ|ISB|A0|A1

Switchover of type of demodulation.

Parameters

FM	Switch on FM demodulator
AM	Switch on AM demodulator
PULSe	Switch on pulse demodulator
CW, A1	Switch on SSB demodulator with a beat frequency
USB	Switch on SSB demodulator upper sideband
LSB	Switch on SSB demodulator lower sideband
IQ, A0	Switch on IQ demodulator
ISB	Switch on ISB demodulator

Remark

For SSB demodulation (CW, LSB and USB,) the frequency stepwidth is set to 1 Hz.

Error

If the bandwidth exceeds 9 kHz at CW, LSB and USB, an error -221,"Settings conflict" is generated if one of the SSB operating modes is to be switched on.

Example

```
DEModulation AM
```

[SENSe]
. :DEModulation?

Query of demodulation type.

Parameters

None

Result

FM, AM, PULS, CW, USB, LSB, IQ, ISB

Example

```
DEModulation? -> AM
```

[SENSe]
. :DEModulation
. . :BFO
. . . :FREQuency <numeric_value>|MINimum|MAXimum

Set the beat frequency.

Parameters

<numeric_value>	Value of beat frequency
MINimum	Setting the lowest beat frequency
MAXimum	Setting the highest beat frequency

Example

```
SENSe:DEModulation:BFO:FREQuency 2.4 kHz
```

[SENSe]
. :DEModulation
. . :BFO
. . . :FREQuency? [MINimum|MAXimum]

Query of beat frequency.

Parameters

None	Query of current beat frequency
MINimum	Query of lowest beat frequency
MAXimum	Query of highest beat frequency

Result

Beat frequency in Hz

Example

```
SENSe:DEModulation:BFO:FREQuency? -> 2400
```

[SENSe]
. :DETector
. . [:FUNCtion] AVG|FAST|PEAK|RMS

Selecting the level-measuring process.

Parameters

AVG	Measure the average value
FAST	Measure the instantaneous value
PEAK	Measure the maximum peak-value
RMS	Measure the root-mean-square value

Example

```
DETector RMS
```

[SENSe]
. :DETector
. . [:FUNCtion]?

Query of the level-measuring process.

Parameters

None

Result

AVG, FAST, PEAK, RMS

Example

```
DETector? -> RMS
```

[SENSe]
. :FREQuency
. . :AFC <Boolean>

Switch on/off the AFC function. If AFC is not possible for the currently selected receiver mode, error -221,"Settings conflict" is generated.

Parameters

ON	AFC function on
OFF	AFC function off

Example

```
SENSe:FREQuency:AFC ON
```

[SENSe]
. :FREQuency
. . :AFC?

Query of AFC function.

Parameters

None

Result

0	OFF
1	ON

Example

```
SENSe:FREQuency:AFC? -> 1
```

[SENSe]
. :FREQuency
. . :CONVersion
. . . :THReshold <numeric_value>|MINimum|MAXimum

Set the conversion threshold. This determines at which frequency the device switches from normal to direct path reception. During normal reception, the signal is modulated downward to an intermediate frequency. When the frequency drops below the conversion threshold, the downward modulation is skipped, hence the name “direct path” reception.

Parameters

<numeric_value>	Value of conversion threshold
MINimum	Setting the lowest conversion threshold
MAXimum	Setting the highest conversion threshold

Example

```
SENSe:FREQuency:CONVersion:THReshold 27 MHz
```

[SENSe]
. :FREQuency
. . :CONVersion
. . . :THReshold? [MINimum|MAXimum]

Query of conversion threshold.

Parameters

None	Query of current conversion threshold
MINimum	Query of lowest conversion threshold
MAXimum	Query of highest conversion threshold

Result

Conversion threshold in Hz

Example

```
SENSe:FREQuency:CONVersion:THReshold? -> 27000000
```

[SENSe]
. :FREQuency
. . [:CW|FIXed] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of receiver frequency.

Parameters

<numeric_value>	Frequency value
UP	Increase of receiver frequency by the value set in the command SENS:FREQuency[:CW|FIX]:STEP[:INCRement]
DOWN	Decrease of receiver frequency by the value set in the command SENS:FREQuency[:CW|FIX]:STEP[:INCRement]
MINimum	Setting the lowest receiver frequency
MAXimum	Setting the highest receiver frequency

Example

```
FREQuency 101.2 MHz
```

[SENSe]
. :FREQuency
. . [:CW|FIXed]? [MINimum|MAXimum]

Query of receiver frequency.

Parameters

None	Query of current receiver frequency
MINimum	Query of lowest receiver frequency
MAXimum	Query of highest receiver frequency

Result

Frequency value in Hz

Example

```
FREQuency? -> 101200000
```

[SENSe]
. :FREQuency
. . [:CW|FIXed]
. . . :STEP
. . . . [:INCRement] <numeric_value>| MINimum|MAXimum

Setting of receiver frequency step size

Parameters

<numeric_value>	Frequency value
MINimum	Setting the lowest frequency step size
MAXimum	Setting the highest frequency step size

Example

```
FREQuency:STEP 1 MHz
```

[SENSe]
. :FREQuency
. . [:CW|FIXed]
. . . :STEP
. . . . [:INCRement]? [MINimum|MAXimum]

Query of receiver frequency.

Parameters

None	Query of current frequency step size
MINimum	Query of lowest frequency step size
MAXimum	Query of highest frequency step size

Result

Frequency value in Hz

Example

```
FREQuency:STEP? -> 1000000
```

[SENSe]
. :FREQuency
. . :MODE CW|FIXed|SWEep|MSCan|PSCan

Changing the operating mode of the receiver.

Parameters

CW|FIXed	Receiver monitors a frequency (CW and FIXed have equal meanings)
SWEep	Receiver is in frequency scan mode (see SENSe:SWEep)
MSCan	Receiver is in memory scan mode (see SENSe:MSCan)
PSCan	Receiver is in panorama-scan mode (see SENSe:PSCan)

Remark

The receiver stays on the CW frequency until it starts scanning.

Example

```
FREQuency:MODE SWEep
```

[SENSe]
. :FREQuency
. . :MODE?

Query of receiver operating mode.

Parameters

None

Result

CW, SWE, MSC, PSC

Example

```
FREQuency:MODE? -> SWE
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :CENTer <numeric_value>|MINimum|MAXimum

Setting of center frequency of an RF-panorama scan. This command uses “SENS:FREQ:PSC:SPAN?” to calculate new start and stop frequencies. It thus changes SENS:FREQ:PSC:STAR and SENS:FREQ:PSC:STOP.

Parameters

<numeric_value>	Center frequency
MINimum	Setting the lowest center frequency
MAXimum	Setting the highest center frequency

Example

```
FREQuency:PSC:CENTer 127 MHz
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :CENTer? [MINimum|MAXimum]

Query of center frequency of an RF-panorama scan.

Parameters

None	Query of current center frequency
MINimum	Query of lowest center frequency
MAXimum	Query of highest center frequency

Result

Frequency in Hz

Example

```
FREQuency:PSC:CENTer? -> 127000000
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :SPAN <numeric_value>|MINimum|MAXimum

Setting the frequency span of an RF-panorama scan.This command uses “SENS:FREQ:PSC:CENT?” to calculate new start and stop frequencies. It thus changes SENS:FREQ:PSC:STAR and SENS:FREQ:PSC:STOP.

Parameters

<numeric_value>	Frequency span
MINimum	Setting the lowest frequency span
MAXimum	Setting the highest frequency span

Example

```
FREQuency:SPAN 2 MHz
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :SPAN? [MINimum|MAXimum]

Query of the frequency span of an RF-panorama scan.

Parameters

None	Query of current frequency span
MINimum	Query of lowest frequency span
MAXimum	Query of highest frequency span

Result

Frequency in Hz

Example

```
FREQuency:SPAN? -> 2000000
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :STARt <numeric_value>|MINimum|MAXimum

Setting of start frequency of an RF-panorama scan. This value is mapped onto the same variable as the frequency scan start frequency, meaning that if the start frequency changes for PSCan it automatically changes for frequency scan, SWE, as well. This setting modifies SENS:FREQ:PSC:SPAN and SENS:FREQ:PSC:CENT.

The start frequency must be smaller than the stop frequency. A start frequency that is larger than the stop frequency is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Frequency
MINimum	Setting the lowest start frequency
MAXimum	Setting the highest start frequency

Example

```
FREQuency:STARt 118 MHz
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :STARt? [MINimum|MAXimum]

Query of start frequency of an RF-panorama scan.This command is alias for SENS:FREQ:STAR?.

Parameters

None	Query of current start frequency
MINimum	Query of lowest start frequency
MAXimum	Query of highest start frequency

Result

Frequency in Hz

Example

```
FREQuency:STARt? -> 118000000
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :STOP <numeric_value>|MINimum|MAXimum

Setting the stop frequency of an RF-panorama scan. This value is mapped onto the same variable as the frequency scan stop frequency, meaning that if the stop frequency changes for PSCan it automatically changes for frequency scan, SWE, as well. This setting modifies SENS:FREQ:PSC:SPAN and SENS:FREQ:PSC:CENT.

The start frequency must be smaller than the stop frequency. A start frequency that is larger than the stop frequency is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Frequency
MINimum	Setting the lowest stop frequency
MAXimum	Setting the highest stop frequency

Example

```
FREQuency:STOP 136 MHz
```

[SENSe]
. :FREQuency
. . :PSCan
. . . :STOP? [MINimum|MAXimum]

Query of a stop frequency of an RF-panorama scan. This command is alias for SENS:FREQ:STOP?

Parameters

None	Query of current stop frequency
MINimum	Query of lowest stop frequency
MAXimum	Query of highest stop frequency

Result

Frequency in Hz

Example

```
FREQuency:STOP? -> 136000000
```

[SENSe]
. :FREQuency
. . :SPAN <numeric_value>|UP|DOWN |MINimum|MAXimum

Selection of frequency span for IF panorama. Only certain discrete ranges are offered. If an unavailable frequency range is entered it will be brought up to the next higher discrete range.

Parameters

<numeric_value>	Frequency range
UP	Taking the range after the current bandwidth
DOWN	Taking the range before the current bandwidth
MINimum	Setting the minimum frequency range
MAXimum	Setting the maximum frequency range

Example

```
FREQuency:SPAN 25 kHz
```

[SENSe]
. :FREQuency
. . :SPAN? [MINimum|MAXimum]

Query of frequency span for IF panorama.

Parameters

None	Query of current frequency range
MINimum	Query of minimum frequency range
MAXimum	Query of maximum frequency range

Result

Frequency value Hz

Example

```
FREQuency:SPAN? 25000
```

[SENSe]
. :FREQuency
. . :STARt <numeric_value>|MINimum|MAXimum

Setting of start frequency of a frequency scan. This value is mapped onto the same variable as the PSCan start frequency, meaning that if the start frequency changes for frequency scan, SWE, it automatically changes for PSCan as well. The start frequency must be smaller than the stop frequency. A start frequency that is larger than the stop frequency is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Frequency
MINimum	Setting the lowest start frequency
MAXimum	Setting the highest start frequency

Example

```
FREQuency:STARt 118 MHz
```

[SENSe]
. :FREQuency
. . :STARt? [MINimum|MAXimum]

Query of start frequency of a frequency scan.

Parameters

None	Query of current start frequency
MINimum	Query of lowest start frequency
MAXimum	Query of highest start frequency

Result

Frequency in Hz

Example

```
FREQuency:STARt? -> 118000000
```

[SENSe]
. :FREQuency
. . :STOP <numeric_value>|MINimum|MAXimum

Setting the stop frequency of a frequency scan. This value is mapped onto the same variable as the PSCan stop frequency, meaning that if the stop frequency changes for frequency scan, SWE, it automatically changes for PSCan as well. The start frequency must be smaller than the stop frequency. A start frequency that is larger than the stop frequency is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Frequency
MINimum	Setting the lowest stop frequency
MAXimum	Setting the highest stop frequency

Example

```
FREQuency:STOP 136 MHz
```

[SENSe]
. :FREQuency
. . :STOP? [MINimum|MAXimum]

Query of a stop frequency of a frequency scan.

Parameters

None	Query of current stop frequency
MINimum	Query of lowest stop frequency
MAXimum	Query of highest stop frequency

Result

Frequency in Hz

Example

```
FREQuency:STOP? -> 136000000
```

[SENSe]
. :FUNCtion
. . :CONCurrent <Boolean>

Determines whether several sensor functions can at the same time be switched or not. If CONCurrent = OFF, the command SENSe:FUNCtion[:ON] has the effect of a 1-out-of-n selection (one is switched on, the previously activated is automatically switched off). If CONCurrent = ON, the command SENSe:FUNCtion[:ON] switches the corresponding function on, while all the other functions remain unchanged. If CONCurrent is switched from ON to OFF, the function "VOLTage:AC" is switched on and all other functions are switched off.

Parameters

ON	CONCurrent on
OFF	CONCurrent off

Example

```
FUNCtion:CONCurrent ON
```

[SENSe]
. :FUNCtion
. . :CONCurrent?

Query of several sensor functions that, at the same time, can be switched or not.

Parameters

None

Result

0	OFF
1	ON

Example

```
FUNCtion:CONCurrent? -> 1
```

[SENSe]
. :FUNCtion
. . :OFF <sensor_function> ,<sensor_function>

Switch off oo one or several sensor functions. See SENS:FUNC:ON for a list of functions.

Parameters

<sensor_function>	See SENS:FUNC:ON

Remark

If any of the sensor functions is changed, the trace data set MTRACE is always deleted.

see SENSe:FUNCtion[:ON]

***RST state**

"FREQ:OFFS", “FSTR”

Example

```
FUNCtion:OFF "FREQ:OFFS"
```

[SENSe]
. :FUNCtion
. . :OFF?

Query of the sensor functions being switched off.

Parameters

None

Result

List of the sensor functions being switched off. For a list see SENSe:FUNCtion[:ON] .

Example

```
FUNCtion:OFF? -> "FREQ:OFFS"
```

[SENSe]
. :FUNCtion
. . :OFF
. . . :COUNt?

Query of the number of sensor functions being inactive.

Parameters

None

Result

Number of sensor functions being inactive

Example

```
FUNCtion:OFF:COUNt? -> 2
```

[SENSe]
. :FUNCtion
. . [:ON] <sensor_function> ,<sensor_function>

Switch on of one or several sensor functions.

Parameters

<sensor_function>	Is one of the following strings:
"VOLTage:AC"	Switch on level measurement
"FREQuency:OFFSet"	Switch on offset measurement
"FSTRength"	Switch on field strength measurement

Remark

If any of the sensor functions is changed, the trace data set MTRACE is always deleted.

Error message:

If CONCurrent = OFF, an error -108, "Parameter not allowed" will be generated for two or several parameters.

***RST state**

"VOLTage:AC"

Example

```
FUNCtion "VOLT:AC", "FREQ:OFFS"
```

[SENSe]
. :FUNCtion
. . [:ON]?

Query of sensor functions being switched on.

Parameters

None

Result

List of sensor functions switched on. If no function is active, a zero string ("") is output. The list has a specific order:

1. "VOLT:AC"	Level measurement switched on
2. "FREQ:OFFS"	Offset measurement switched on
3. "FSTR"	Field strength measurement switched on

Example

```
FUNCtion? -> "VOLT:AC", "FREQ:OFFS"
```

[SENSe]
. :FUNCtion
. . [:ON]
. . . :COUNt?

Query of the number of sensor functions being active.

Parameters

None

Result

Number of sensor functions being active

Example

```
FUNCtion:Count? -> 2
```

[SENSe]
. :GCONtrol
. . [:FIXed|MGC] <numeric_value>|UP|DOWN|MINimum|MAXimum

Setting of MGC value.

Parameters

<numeric_value>	Gain control factor in dB
UP	Increase of the MGC value by the value set in the command SENSe:GCONtrol[:FIXed|MGC]:STEP[:INCRement].
DOWN	Decrease of the MGC value by the value set in the command SENSe:GCONtrol[:FIXed|MGC]:STEP[:INCRement].
MINimum	Setting the smallest MGC value (no gain control -> max. sensitivity)
MAXimum	Setting the largest MGC value (max. gain control -> min. sensitivity)

Example

```
GCONtrol 50
```

[SENSe]
. :GCONtrol
. . [:FIXed|MGC]? [MINimum|MAXimum]

Query of the MGC value.

Parameters

None	Query of current MGC value
MINimum	Query of smallest MGC value
MAXimum	Query of largest MGC value

Result

Gain control

Example

```
GCONtrol? -> 50
```

[SENSe]
. :GCONtrol
. . [:FIXed|MGC]
. . . :STEP
. . . . [:INCRement] <numeric_value>|MINimum|MAXimum

Setting the stepwidth for the command SENSe:GCONtrol[:FIXed|MGC] UP|DOWN.

Parameters

<numeric_value>	MGC stepwidth
MINimum	Setting smallest stepwidth
MAXimum	Setting largest stepwidth

Example

```
GCONtrol:STEP 10
```

[SENSe]
. :GCONtrol
. . [:FIXed|MGC]
. . . :STEP
. . . . [:INCRement]? [MINimum|MAXimum]

Query of the MGC stepwidth.

Parameters

None	Query of currently set stepwidth
MINimum	Query of smallest stepwidth
MAXimum	Query of largest stepwidth

Result

MGC stepwidth in dB

Example

```
GCONtrol:STEP? -> 10
```

[SENSe]
. :GCONtrol
. . :MODE FIXed|MGC|AUTO|AGC

Type of gain control

Parameters

FIXed|MGC	Control is determined by MGC value
AUTO|AGC	Control is automatically generated (AGC)

Example

```
GCONtrol:MODE AUTO
```

[SENSe]
. :GCONtrol
. . :MODE?

Query of type of gain control.

Parameters

None

Result

FIX, AUTO

Example

```
GCONtrol:MODE? -> AUTO
```

12.1.3 Sense Memory Scan subsystem MSC

The MSCan system controls the memory-scan function of the device, provided the memory scan has been activated by SENSe:FREQuency:MODE MSCan. Each scan is started by INITiate[:IMMediate]. The memory locations are placed in the MEMory subsystem and are set for query during the scan.

[SENSe]
. :MSCan
. . :CHANnel <mem_loc>|UP|DOWN|NEXT

Setting of current memory location. During the memory scan, this command is not permitted and generates error -200 , “Execution error”

Parameters

<mem_loc>	Memory location in the range [0...1023]
UP	The next memory location
DOWN	The previous memory location
NEXT	The next free memory location is selected, starting from and including the current location. If the end of the memory list is reached without finding a free location, the search continues at the beginning of the list. If no free location is available an error -223 "Too much data" is generated.

Example

```
MSCan:CHANnel 357
```

[SENSe]
. :MSCan
. . :CHANnel?

Output of current memory location.

Parameters

None

Result

Index of current memory location.

Example

```
MSCan:CHANnel?  357
```

[SENSe]
. :MSCan
. . :CONTrol
. . . :OFF <control_function> ,<control_function>

Switches off one or more scan-control mechanisms. This value is mapped onto the same variable as the frequency scan control mechanism variable, meaning that a change affects both scan modes.

Parameters

See SENSe:MSCan:CONTrol[:ON]

***RST state**

All control mechanisms ON

Example

```
MSCan:CONTrol:OFF "STOP:SIGN"
```

[SENSe]
. :MSCan
. . :CONTrol
. . . :OFF?

Query of scan control mechanisms that are switched OFF.

Parameters

None

Result

A list of the scan control mechanisms that are switched off, is output. For strings see SENSe:MSCan:CONTrol[:ON].

Example

```
MSCan:CONTrol:OFF? -> "STOP:SIGN"
```

[SENSe]
. :MSCan
. . :CONTrol
. . . :[ON] <control_function> ,<control_function>

Command for switch-on of the 'STOP:SIGNal' function. When this function is off, the memory scan stops at each location with a signal for the dwell-time. When this function is on, the dwell-time is controlled by the presence of a signal stronger than the threshold level:

During a memory-scan, the receiver moves from one memory location to another, loading the settings into the receiver. If a memory location has a signal that is stronger than the threshold level, the receiver stays on that memory location for a certain time, called dwell time. When the signal disappears during that dwell time, the receiver stays on the same location for a while, called hold time, to see if the signal re-appears. When either the hold-time or the dwell-time has elapsed, scanning continues.

If the signal does re-appear, the receiver continues the dwell time again (the dwell-time never stopped), otherwise it moves to the next memory location.

This value is mapped onto the same variable as the frequency scan control mechanism variable, meaning that a change affects both scan modes.

Parameters

<control_function> is the following string:

“STOP:SIGNal”	Switches the signal-controlled dwell time on

***RST state**

All control mechanisms ON

Example

```
MSCan:CONTrol "STOP:SIGN"
```

[SENSe]
. :MSCan
. . :CONTrol
. . . [:ON]?

Query of scan-control mechanisms that are switched ON.

Parameters

None

Result

A list of the scan control mechanisms that are switched on, is output. If no mechanisms are switched on, a zero string ("") is output. The following strings can be expected:

""	No mechanism switched on
"STOP:SIGN"	Signal controlled dwelltime is switched on

Example

```
MSCan:CONTrol? -> "STOP:SIGN"
```

[SENSe]
. :MSCan
. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

The number of MSCans to be done in response to the command “INIT:IMM”. Note that the scan mode must be MSCan. This value is mapped onto the same variable as the frequency scan and pscan count variable, meaning that a change affects all scan modes.

Parameters

<numeric_value>	Number of scans
MINimum	Minimum number of scans
MAXimum	Maximum number of scans
INFinity	Infinite number of scans

Example

```
MSCan:COUNt 100
```

[SENSe]
. :MSCan
. . :COUNt? [MINimum|MAXimum]

Query of number of MSCans. This command is an alias of SENS:SWE:COUN?.

Parameters

None	Query of current number of scans
MINimum	Query of minimum number of scans
MAXimum	Query of maximum number of scans

Result

Number of scans; 9.9E37 is output for an infinite number

Example

```
MSCan:COUNt? -> 100
```

[SENSe]
. :MSCan
. . :DIRection UP|DOWN

Sets scan direction. This value is mapped onto the same variable as the frequency scan direction variable, meaning that a change affects both scan modes.

Parameters

UP	Scans in direction of ascending memory numbers
DOWN	scans in direction of descending memory numbers

Example

```
MSCan:DIRection DOWN
```

[SENSe]
. :MSCan
. . :DIRection?

Query of scan direction. This command is an alias of SENS:SWE:DIR?.

Parameters

none

Result

UP, DOWN

Example

```
MSCan:DIRection? DOWN
```

[SENSe]
. :MSCan
. . :DWELl <numeric_value>|MINimum|MAXimum|INFinity

Setting the dwell time. This value is mapped onto the same variable as the frequency scan dwell variable, meaning that a change affects both scan modes.

Parameters

<numeric_value>	Dwell time in seconds
MINimum	Minimum dwell time
MAXimum	Maximum dwell time
INFinity	Infinite dwell time

Remark

This command is used to set the dwell time per scan step, ie the time required by a step, if the squelch is switched off.

Example

```
SWEep:DWEL 100 ms
```

[SENSe]
. :MSCan
. . :DWELl? [MINimum|MAXimum]

Query of dwell time. This command is an alias of SENS:SWE:DWEL?.

Parameters

None	Query of current dwell time
MINimum	Query of minimum dwell time
MAXimum	Query of maximum dwell time

Result

Dwell time in seconds; 9.9E37 is output for an infinite number

Example

```
MSCan:DWEL? 0.10
```

[SENSe]
. :MSCan
. . :HOLD
. . . :TIME <numeric_value>|MINimum|MAXimum

Setting the hold time for a signal-controlled scan continuation. If the signal disappears during the dwell time, the hold time is started. After completion of the hold time, the scan is continued with the next frequency even if the dwell time has not yet been completed. If the signal exceeds the squelch threshold during the hold time, the hold time is reset and the end of the dwell time or the renewed disappearance of the signal is awaited. The hold time is only used if the control function "STOP:SIGNal" (see SENSe:MSCan:CONTrol) is switched on.

Setting the time to 0 (zero) has the same effect as switching off the control function with SENS:MSC:CONT:OFF “STOP:SIGN”.

This value is mapped onto the same variable as the frequency scan hold time variable, meaning that a change affects both scan modes.

Parameters

<numeric_value>	Hold time in seconds
MINimum	Minimum hold time
MAXimum	Maximum hold time

Example

```
SWEep:HOLD:TIME 100 ms
```

[SENSe]
. :MSCan
. . :HOLD
. . . :TIME? [MINimum|MAXimum]

Query of hold time. This command is an alias of SENS:SWE:HOLD:TIME?.

Parameters

None	Query of current hold time
MINimum	Query of minimum hold time
MAXimum	Query of maximum hold time

Result

Hold time in seconds

Example

```
MSCan:HOLD:TIME? 0.10
```

[SENSe]
. :MSCan
. . :LIST
. . . :STARt <numeric_value>|MINimum|MAXimum

Sets the memory list item from which a memory scan starts. A start location that is larger than the stop location is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Integer number in the range [0,1023]
MINimum	Set lowest start location
MAXimum	Set highest start location

Example

```
SENSe:MSCan:LIST:STARt 60
```

[SENSe]
. :MSCan
. . :LIST
. . . :STARt? [MINimum|MAXimum]

Query of first memory list item for a scan.

Parameter

<numeric_value>	Query of current start location
MINimum	Query of lowest possible start location
MAXimum	Query of highest possible start location

Result

Integer number in the range [0,1023]

Example

```
SENSe:MSCan:LIST:STARt? -> 60
```

[SENSe]
. :MSCan
. . :LIST
. . . :STOP <numeric_value>|MINimum|MAXimum

Sets the last memory-list item that is used for a memory scan. The first list item is set with SENS:MSC:LIST:STAR. A start location that is larger than the stop location is rejected with error -221(“Settings conflict”).

Parameters

<numeric_value>	Integer number in the range [0,1023]
MINimum	Set lowest possible stop location
MAXimum	Set highest possible stop location

Example

```
SENSe:MSCan:LIST:STOP 120
```

[SENSe]
. :MSCan
. . :LIST
. . . :STOP? [MINimum|MAXimum]

Query of number of memory list items used for direct save

Parameter

<numeric_value>	Query of current stop location
MINimum	Query of lowest possible stop location
MAXimum	Query of highest possible stop location

Result

Integer number in the range [0,1023]

Example

```
SENSe:MSCan:LIST:STOP? -> 120
```

12.1.4 Sense Panorama Scan subsystem PSC

The PSCan system controls the panorama-scan function of the device, provided the panorama scan has been activated by SENSe:FREQuency:MODE PSCan. Each scan is started by INITiate[:IMMediate].

[SENSe]
. :PSCan
. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

Sets the number of RF-panorama scans. This command is an alias of SENS:SWE:COUN and also changes its setting. This value is mapped onto the same variable as the frequency scan and pscan count variable, meaning that a change affects all scan modes.

Parameters

<numeric_value>	Number of scans
MINimum	Minimum number of scans
MAXimum	Maximum number of scans
INFinty	Infinite number of scans

Example

```
PSCan:COUN 100
```

[SENSe]
. :PSCan
. . :COUNt? [MINimum|MAXimum]

Output of number of RF-panorama scans.

Parameters

None	Query of current number of scans
MINimum	Query of minimum number of scans
MAXimum	Query of maximum number of scans

Result

Number of scans; 9.9E37 is output for an infinite number

Example

```
PSCan:COUN? -> 100
```

[SENSe]
. :PSCan
. . :DIRection UP|DOWN

Sets scan direction. This value is mapped onto the same variable as the frequency scan direction variable, meaning that a change affects both scan modes.

Parameters

UP	Scan with increasing frequency
DOWN	Scan with decreasing frequency

Example

```
PSCan:DIRection DOWN
```

[SENSe]
. :PSCan
. . :DIRection?

Query of scan direction. This command is an alias of SENS:SWE:DIR?.

Parameters

None

Result

UP, DOWN

Example

```
PSCan:DIRection? DOWN
```

[SENSe]
. :PSCan
. . :STEP <numeric_value>|UP|DOWN|MINimum|MAXimum

Sets the resolution of an RF-panorama scan. Essentially, it sets the channel-spacing of the FFT samples: i.e. the FFT-bin width.

Parameters

<numeric_value>	Frequency spacing of FFT samples
UP	Next possible resolution
DOWN	Previous possible resolution
MINimum	Set to narrowest possible resolution
MAXimum	Set to widest possible resolution

Example

```
SENSe:PSCan:STEP 10 kHz
```

[SENSe]
. :PSCan
. . :STEP? [MINimum|MAXimum]

Output of current channel spacing for PSCan.

Parameters

None	Query of current resolution
MINimum	Query of narrowest possible resolution
MAXimum	Query of widest possible resolution

Result

Bandwidth in Hz

Example

```
SENSe:PSCan:STEP?  10000
```

[SENSe]
. :ROSCillator
. . :EXTernal
. . . :FREQuency?

Query of what the external reference frequency must be.

Parameters

None

Result

10000000

Example

```
ROSCillator:EXTernal:FREQuency? -> 10000000
```

[SENSe]
. :ROSCillator
. . :INTernal
. . . :FREQuency?

Query of what the internal reference frequency must be.

Parameters

none

Result

10000000

Example

```
ROSCillator:INTernal:FREQuency? -> 10000000
```

[SENSe]
. :ROSCillator
. . :SOURce INTernal|EXTernal

Setting whether external or internal reference frequency is to be used.

Parameters

INTernal	Internal reference oscillator
EXTernal	External reference oscillator

Example

```
ROSCillator:SOURce EXTernal
```

[SENSe]
. :ROSCillator
. . :SOURce?

Query of reference oscillator to be used.

Parameters

None

Result

INT	Internal reference oscillator
EXT	External reference oscillator

Example

```
ROSCillator:SOURce? -> EXT
```

12.1.5 Sense Frequency Scan subsystem SWE

The SWEep system controls the frequency function of the device if the frequency scan has been activated by the SENSe:FREQuency:MODE SWEep command. Each scan is initiated by INITiate[:IMMediate].

[SENSe]
. :SWEep
. . :CONTrol
. . . :OFF <control _function> ,<control_function>

Command for switch-off of the STOP:SIGNalfunctions. See also SENS:SWE:CONT:ON. This value is mapped onto the same variable as the memory scan control mechanism variable, meaning that a change affects both scan modes.

Parameters

<control_function> is the following string:

"STOP:SIGNal" Switch-on signal-controlled dwell-time

***RST state**

All control mechanisms ON

Example

```
SWEep:CONTrol:OFF "STOP:SIGN"
```

[SENSe]
. :SWEep
. . :CONTrol
. . . :OFF?

Query of scan control mechanisms that are switched OFF.

Parameters

None

Result

A list of the scan control mechanisms that are switched off, is output. For strings see SENSe:SWEep:CONTrol[:ON].

Example

```
SWEep:CONTrol:OFF? -> "STOP:SIGN"
```

[SENSe]
. :SWEep
. . :CONTrol
. . . :[ON] <control _function>{ ,<control_function> }

Command for switch-on of the STOP:SIGNalfunctions. With "STOP:SIGNal" the disappearance of the signal during the dwell time signals the start of the hold-time. When either the hold-time or the dwell-time has elapsed, scanning continues. If the signal re-appears during the hold-time, the hold-time is aborted. The dwell-time though, never stopped and continues. The hold time after the disappearance of the signal is set with SENSe:SWEep:HOLD:TIME.

This value is mapped onto the same variable as the memory scan control mechanism variable, meaning that a change affects both scan modes.

Parameters

<control_function> is one of the following strings:

"STOP:SIGNal"	Switch-on signal-controlled dwell-time

***RST state**

All control mechanisms ON

Example

```
SWEep:CONTrol "STOP:SIGN"
```

[SENSe]
. :SWEep
. . :CONTrol
. . . [:ON]?

Query of scan-control mechanisms that are switched ON.

Parameters

None

Result

A list of the scan control mechanisms that are switched on, is output. If no mechanisms are switched on, a zero string ("") is output. The following strings can be expected:

""	No mechanism switched on
"STOP:SIGN"	Signal controlled dwelltime is switched on

Example

```
SWEep:CONTrol? -> "STOP:SIGN"
```

[SENSe]
. :SWEep
. . :COUNt <numeric_value>|MINimum|MAXimum|INFinity

Sets the number of sweeps. This value is mapped onto the same variable as the memory scan and panorma scan count variable, meaning that a change affects all scan modes.

Parameters

<numeric_value>	Number of sweeps
MINimum	Minimum number of sweeps
MAXimum	Maximum number of sweeps
INFinity	Infinite number of sweeps

Example

```
SWEep:COUNt 100
```

[SENSe]
. :SWEep
. . :COUNt? [MINimum|MAXimum]

Query of number of sweeps.

Parameters

None	Query of current number of sweeps
MINimum	Query of minimum number of sweeps
MAXimum	Query of maximum number of sweeps

Result

Number of sweeps; 9.9E37 is output for an infinite number

Example

```
SWEep:COUNt? -> 100
```

[SENSe]
. :SWEep
. . :DIRection UP|DOWN

Setting the scan direction. This value is mapped onto the same variable as the memory scan direction variable, meaning that a change affects both scan modes.

Parameters

UP	Scan with increasing frequency
DOWN	Scan with decreasing frequency

Example

```
SWEep:DIRection DOWN
```

[SENSe]
. :SWEep
. . :DIRection?

Query of scan direction

Parameters

None

Result

UP, DOWN

Example

```
SWEep:DIRection? -> DOWN
```

[SENSe]
. :SWEep
. . :DWELl <numeric_value>|MINimum|MAXimum|INFinity

Setting the dwell time. This value is mapped onto the same variable as the memory scan dwell time variable, meaning that a change affects both scan modes.

Parameters

<numeric_value>	Dwell time in seconds
MINimum	Minimum dwell time
MAXimum	Maximum dwell time
INFinity	Infinite dwell time

Remark

This command is used to set the dwell time per scan step, if the squelch is switched off.

Example

```
SWEep:DWEL 100 ms
```

[SENSe]
. :SWEep
. . :DWELl? [MINimum|MAXimum]

Query of dwell time with hold criterion fulfilled.

Parameters

None	Query of current dwell time
MINimum	Query of minimum dwell time
MAXimum	Query of maximum dwell time

Result

Dwell time in seconds; 9.9E37 is output for an infinite number.

Example

```
SWEep:DWEL? -> 0.10
```

[SENSe]
. :SWEep
. . :HOLD
. . . :TIME <numeric_value>|MINimum|MAXimum

Setting the hold time for a signal-controlled scan continuation. If the signal disappears during the dwell time, the hold time is started. After completion of the hold time, the scan is continued with the next frequency even if the dwell time has not yet been completed. If the signal exceeds the squelch threshold during the hold time, the hold time is reset and the end of the dwell time or the renewed disappearance of the signal is awaited. The hold time is only used if the control function "STOP:SIGNal" (see SENSe:SWEep:CONTrol) is switched on.

Setting the time to 0 (zero) has the same effect as switching off the control function with SENS:SWE:CONT:OFF “STOP:SIGN”.

This value is mapped onto the same variable as the memory scan hold time variable, meaning that a change affects both scan modes.

Parameters

<numeric_value>	Hold time in seconds
MINimum	Minimum hold time
MAXimum	Maximum hold time

Example

```
SWEep:HOLD:TIME 10 ms
```

[SENSe]
. :SWEep
. . :HOLD
. . . :TIME? [MINimum|MAXimum]

Query of hold time during signal-controlled scan continuation.

Parameters

None	Query of current hold time
MINimum	Query of minimum hold time
MAXimum	Query of maximum hold time

Result

Hold time in seconds

Example

```
SWEep:HOLD:TIME? -> 0.010
```

[SENSe]
. :SWEep
. . :STEP <numeric_value>|MINimum|MAXimum

Setting the frequency stepwidth for the frequency scan.

Parameters

<numeric_value>	Frequency value
MINimum	Setting the smallest frequency stepwidth
MAXimum	Setting the largest frequency stepwidth

Example

```
SWEep:STEP 25 kHz
```

[SENSe]
. :SWEep
. . :STEP? [MINimum|MAXimum]

Query of frequency stepwidth of a frequency scan.

Parameters

None	Query of current frequency stepwidth
MINimum	Query of smallest frequency stepwidth
MAXimum	Query of largest frequency stepwidth

Result

Stepwidth in Hz

Example

```
SWEep:STEP? -> 25000
```

[SENSe]
. :SWEep
. . :SUPPress

Insert current frequency into suppress list. The range is obtained from the bandwidth according to the following formulae:

SSTARTn = SENSn:FREQ - SENSn:BAND/2
SSTOPn = SENSn:FREQ + SENSn:BAND/2

The frequency pair is inserted into an empty space of the trace. Free spaces (gaps) are characterized by a frequency pair with each having the value 0 (zero).

Error

If the corresponding suppress trace has no free space, an error -223 "Too much data" is generated.

Parameters

None

Example

`SWEep:SUPPress`

[SENSe]
. :SWEep
. . :SUPPress
. . . :SORT

Sort and condense suppress list. The frequency pairs are sorted in ascending order of the start frequency. Overlapping is eliminated by extending one frequency pair, and deleting the other. Gaps in the suppress list are put to the end of the list.

Parameters

None

Example

`SWEep:SUPPress:SORT`

STATus subsystem

In the descriptions of the SCPI commands in this section the placeholder <RegisterName> is used. Where it occurs the actual register name must be used, which is one of the following:

OPERation
OPERation:SWEep
TRACe
QUEStionable
EXTension

STATus
. :<RegisterName>
. . :CONDition?

Query of the condition section of a status register.

Parameters

None

Remark

Leading zero's are not displayed.

Result

Numerical value in a format determined by the FORMat:SREGister command.

Example

```
STATus:<RegisterName>:CONDition? -> #H8
```

STATus
. :<RegisterName>
. . :ENABle <numeric_value>

Setting the enable section of a status register.

Parameters

<numeric_value> Value of the enable section (e.g. 0..65535 or #H0..#HFFFF)

***RST state**

Will not be changed by *RST

Example

```
STATus:<RegisterName>:ENABle #H8
```

STATus
. :<RegisterName>
. . :ENABle?

Query of the enable section of a status register.

Parameters

None

Remark

Leading zero's are not displayed.

Result

Numerical value in a format determined by the FORMat:SREGister command.

Example

```
STATus:<RegisterName>:ENABle? -> #H8
```

STATus
. :<RegisterName>
. . [:EVENt]?

Query of the event section of a status register.

Parameters

None

Result

Numerical value in a format determined by the FORMat:SREGister command.

Example

```
STATus:<RegisterName>? -> #H8
```

STATus
. :<RegisterName>
. . :NTRansition <numeric_value>

Setting the negative transition filter of a status register.

Parameters

<numeric_value> Value of the NTRansition section (e.g. 0..65535 or #H0..#HFFFF)

***RST state**

Will not be changed by *RST

Example

```
STATus:<RegisterName>:NTRansition #H0
```

STATus
. :<RegisterName>
. . :NTRansition?

Query of the negative transition filter of a status register.

Parameters

None

Remark

Leading zero's are not displayed.

Result

Numerical value in a format determined by the FORMat:SREGister command.

Example

```
STATus:<RegisterName>:NTRansition? -> 0
```

STATus
. :<RegisterName>
. . :PTRansition <numeric_value>

Setting the positive transition filter of the OPERation status register.

Parameters

<numeric_value> Value of the PTRansition section (e.g. 0..65535 or #H0..#HFFFF)

***RST state**

Will not be changed by *RST

Example

```
STATus:<RegisterName>:PTRansition #B1111111111111111
```

STATus
. :<RegisterName>
. . :PTRansition?

Query of the positive transition filter of the OPERation status register.

Parameters

None

Remark

Leading zero's are not displayed.

Result

Numerical value in a format determined by the FORMat:SREGister command..

Example

```
STATus:<RegisterName>:PTRansition? -> 255
```

STATus
. :PRESet

Setting the STATus registers with default values according to:

Table 12-4: STATus register default values

Register	ENABle/PTR/NTR	PRESet value
STATus:OPERational	ENABle	0
	PTR	65535
	NTR	0
STATus:QUEStionable	ENABle	0
	PTR	65535
	NTR	0
STATus:TRACe	ENABle	65535

	PTR	65535
	NTR	0
STATus:EXTension	ENABle	65535
	PTR	65535
	NTR	0
STATus:OPERation:SWEep	ENABle	65535
	PTR	65535
	NTR	0

Parameters

None

Example

```
STATus:PRESet
```

STATus
. :QUEue?
. . [:NEXT]?

Reads the next entry from the Error Queue. This is an alias of SYST:ERR?

Parameters

None

Result

Next entry of Error Queue

Example

```
STATus:QUEue? -> 0, "No error"
```

SYSTem subsystem

SYSTem
. :AUDio
. . :BALance <numeric_value>|MINimum|MAXimum

Sets the balance of AF for the headphones.

Parameters

<numeric_value>	Balance of AF from -0.5 to +0.5	
	-0.50	Only left channel
	0.00	Mid position
	0.50	Only right channel
MINimum	Only left AF channel	
MAXimum	Only right AF channel	

Example

```
SYSTem:AUDio:BALAnce 0.5
```

SYSTem
. :AUDio
. . :BALance? MINimum|MAXimum

Query of AF balance.

Parameters

None	Query of current balance value
MINimum	Query of minimum balnce value
MAXimum	Query of maximum balance value

Result

Audio balance

Example

```
SYSTem:AUDio:BALAnce? -> 0.50
```

SYSTem
. :AUDio
. . :OUTPut AUTO|HPHone

Switches between automatic selection of the audio output (via the speaker or via the headphone), or always output via the headphone.

Parameters

AUTO	Output is directed to a headphone when connected, to the speaker otherwise
HPHone	Output is always directed to a headphone

Example

```
SYSTem:AUDio:OUTPut HPHone
```

SYSTem
. :AUDio
. . :OUTPut?

Query of audio output selection.

Parameters

None

Result

AUTO, HPH

Example

```
SYSTem:AUDio:OUTPut? -> HPH
```

SYSTem
. :AUDio
. . :REMote
. . . :MODE <audio_mode>

Sets the audio mode for audio recording and audio streaming.

Parameters

<audio_mode>	A valid audio data format ID as defined by Table 13-8 (p. 359)

Example

```
SYSTem:AUDio:REMote:MODE 12
```

SYSTem
. :AUDio
. . :REMote
. . . : :MODE?

Query of audio mode.

Parameters

None

Result

The currently configured audio mode

Example

```
SYSTem:AUDio:REMote:MODE? -> 1
```

SYSTem
. :AUDio
. . :VOLume <numeric_value>|MINimum|MAXimum

Sets the volume of AF for loudspeakers and headphones.

Parameters

<numeric_value>	Volume of AF from 0.00 to 1.00	
	0.00	No volume of AF
	1.00	Full volume of AF
MINimum	No volume of AF	
MAXimum	Full volume of AF	

Remark

The parameter is rounded to the next internally possible discrete value.

Example

```
SYSTem:AUDio:VOLume 0.50
```

SYSTem
. :AUDio
. . :VOLume? [MINimum|MAXimum]

Query of AF volume.

Parameters

None	Query of the current volume
MINimum	Query of the minimum posible volume
MAXimum	Query of the maximum possible volume

Result

Audio volume

Example

```
SYSTem:AUDio:VOLume? -> 0.50
```

SYSTem
. :BEEPer
. . :VOLume <numeric_value>|MINimum|MAXimum

Sets the volume of the beeper.

Parameters

<numeric_value>	Volume of beeper from 0.00 to 1.00
MINimum	Beeper off
MAXimum	Beeper on with maximum volume

Example

```
SYSTem:BEEPer:VOLume 0.50
```

SYSTem
. :BEEPer
. . :VOLume? [MINimum|MAXimum]

Query of volume of beeper.
0.00 = beeper off
1.00 = beeper on with maximum volume

Parameters

None	Query of the current beeper volume
MINimum	Query of the minimum beeper volume
MAXimum	Query of the maximum beeper volume

Result

Beeper volume

Example

```
SYSTem:BEEPer:VOLume? -> 0.50
```

SYSTem
. :COMMunicate
. . :GPIB
. . . :SELF
. . . . :RTERmintator EOI

This command is only provided to remain compatible with specific R&S tools that send this command. It does nothing, but does not return an error either.

Parameters

EOI

Example

```
SYSTem:COMMunicate:GPIB:SELF:RTER EOI
```

SYSTem
. :COMMunicate
. . :LAN
. . . :ETHernet?

Produces the MAC address of the ethernet interface

Parameters

None

Result

Ethernet address, 6 bytes in hexadecimal notation

Remark

When no ethernet interface is available, the result is: “00-00-00-00-00-00”

Example

```
SYSTem:COMMunicate:LAN:ETHernet? -> "A1-B2-C3-D4-E5-F6"
```

SYSTem
. :COMMunicate
. . :LAN
. . . :GATeway <ip-address>

Sets the default gateway address for IP communication.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. “172.17.75.50”)

Error

In case the <ip-address> string is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The default gateway address is maintained after reset.

Example

```
SYSTem:COMMunicate:LAN:GATeway "172.17.75.50"
```

SYSTem
. :COMMunicate
. . :LAN
. . . :GATeway?

Query the default gateway address.

Parameters

None

Result

String representing IP dot notation of the default gateway (e.g. “172.17.75.50”)

Example

```
SYSTem:COMMunicate:LAN:GATeway? -> “172.17.75.50”
```

SYSTem
. :COMMunicate
. . :LAN
. . . :SUBMask <subnetmask>

Sets the subnet mask of all IP communication. Note that setting this to another subnet might result in losing connection with the device.Therefore, it is most convenient to change all communication settings on the same line. The settings will not take effect until the new-line has been received.

Parameters

<subnetmask> String representing IP dot notation of subnet mask (e.g. “255.255.255.0”)

The subnetmask must be a valid subnet mask according to IP specifications.

Error

In case the subnet mask is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The subnet mask is maintained after reset

Example

```
SYSTem:COMMunicate:LAN:SUBMask “255.255.255.0”
```

SYSTem
. :COMMunicate
. . :LAN
. . . :SUBMask?

Query of the subnet mask

Parameter

None

Result

String representing IP dot notation of IP subnet mask (e.g. “255.255.255.0”)

Example

```
SYSTem:COMMunicate:LAN:SUBMask? -> “255.255.255.0”
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :ADDRess <ip-address>

Sets the IP-address of the ethernet connection of the device. Note that setting this to another address results in losing connection with the device.Therefore, it is most convenient to change all communication settings on the same line. The settings will not take effect until the new-line has been received.

This only changes the address of the ethernet connection, it does not influence the USB connection. The default IP-Address is 172.17.75.1

Parameters

<ip-address> String representing IP dot notation of IP address (e.g. “172.17.75.18”)

Error

In case the IP address is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The IP address is maintained after reset

Example

```
SYSTem:COMMunicate:SOCKET:ADDRess “172.17.75.18”
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :ADDRess?

Query the IP address of the device

Parameter

None

Result

String representing IP dot notation of IP address (e.g. “172.17.75.18”)

Example

```
SYSTem:COMMunicate:SOCKet:ADDRess? -> "172.17.75.18"
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :DHCP
. . . . [:STATe] <Boolean>

Determines whether the IP address is set automatically by the DHCP protocol.

The DHCP hostname of the PR100 / EM100 is composed from the serial number (Example : serial number 102007) as follows :

PR100: rs-pr100-102007-002
EM100: rs-em100-102007-002

Parameters

ON	Turn DHCP on (IP address determined by DHCP server in network)
OFF	Turn DHCP on (IP address must be set manually)

Example

```
SYSTem:COMMunicate:SOCKET:DHCP:STATe ON
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :DHCP
. . . . [:STATe]?

Query state of DHCP.

Parameter

None

Result

0	OFF

1	ON

Example

```
SYSTem:COMMunicate:SOCKet:DHCP:STATe? -> 1
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :PORT <numeric_value>

Sets the IP-port number of the SCPI parser. Note that setting this to another address results in losing connection with the device.Therefore, it is most convenient to change all communication settings on the same line. The settings will not take effect until the new-line has been received.

Parameters

<numeric_value>	Integer port number in the range [0,65535] (16 bit)

Error

In case the port number is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The port number is maintained after reset

Example

```
SYSTem:COMMunicate:SOCKet:PORT 5555
```

SYSTem
. :COMMunicate
. . :SOCKet
. . . :PORT?

Query the IP-port number of the SCPI parser

Parameter

None

Result

Integer port number in the range [0,65535] (16 bit)

Example

```
SYSTem:COMMunicate:SOCKet:PORT? -> 5555
```

SYSTem
. :DATE <year>, <month>, <day>

Sets the current date for the device

Parameters

<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]

Error

In case the date is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The date is maintained after reset

Example

```
SYSTem:DATE 2008, 12, 21
```

SYSTem
. :DATE?

Query the current date of the device

Parameter

None

Result

<year>, <month>, <day> (see SYST:DATE)

Example

```
SYSTem:DATE? -> 2008, 12, 21
```

SYSTem
. :ERRor
. . [:NEXT]?

Returns the error code and description of the error at the front of the queue. The error is also removed from the queue.

Parameters

None

Result

Next entry of Error Queue. If the Error Queue is empty, 0, "No error" is output

Example

```
SYSTem:ERRor? -> 0, "No error"
```

SYSTem
. :ERRor
. . :ALL?

Returns all error codes and descriptions from the Error Queue. The queue is emptied.

Parameters

None

Result

Comma-separated list of errod-codes and strings. If the Error Queue is empty, 0, "No Error" is output

Example

```
SYSTem:ERRor:ALL? -> -292, “Referenced name does not exist”, -293, “Referenced
name already exists”
```

SYSTem
. :ERRor
. . :CODE
. . . [:NEXT]?

Returns just the error code of the error at the front of the queue. The error is also removed from the queue.

Parameters

None

Result

Error code. If the Error Queue is empty, 0 is output

Example

```
SYSTem:ERRor:CODE? -> 0
```

SYSTem
. :ERRor
. . :CODE
. . . :ALL?

Returns just the error codes of all errors in the queue, and empties the queue.

Parameters

None

Result

Comma-separated list of error codes. If the Error Queue is empty, 0 is output

Example

```
SYSTem:ERRor:CODE:ALL? -> -292, -293
```

SYSTem
. ERRor
. . :COUNt?

Returns the number of error messages in the queue. The queue is not emptied.

Parameters

None

Result

Number of errors in the queue

Example

```
SYSTem:ERRor:COUNt? -> 0
```

SYSTem
. :FIRMware
. . :UPDate

This command will update the firmware of the instrument.

Remark

The instrument will look for a new firmware version on the SD-Card. If correct firmware is found, than the firmware will be installed without any user-confirmation.

Parameters

None

Example

```
SYSTem:FIRMware:UPDate
```

SYSTem
. :KCLick
. . :VOLume <numeric_value>|MINimum|MAXimum

Sets the volume of the key clicks.

Parameters

<numeric_value>	Volume of key clicks from 0.00 to 1.00 0 Key clicks off 1 key clicks at maximum volume
MINimum	Key clicks off
MAXimum	Key clicks on at maximum volume

Example

```
SYSTem:KCLick:VOLume 0.5
```

SYSTem
. :KCLick
. . :VOLume? [MINimum|MAXimum]

Query of volume of key clicks.

Parameters

None	Query current key click volume
MINimum	Query minimum key click volume
MAXimum	Query maximum key click volume

Result

Key click volume

Example

```
SYSTem:KCLick:VOLume? -> 0.50
```

SYSTem
. :KLOCk [<Boolean>|FRONt]

Locks or unlocks the front keyboard or both front keyboard and top panel.

Parameters

ON	Lock both front keyboard and top panel.
OFF	Unlock both front keyboard and top panel.
FRONt	Lock only front keyboard.

Example

```
SYSTem:KLOCk FRONt
```

SYSTem
. :KLOCk?

Query if front keyboard and/or top panel is locked.

Parameters

None

Result

0	OFF
1	ON
FRONt	

Example

```
SYSTem:KLOCk? -> FRONt
```

SYSTem
. :PRESet
. . :FACTory

Resets the device to factory settings by executing the command sequence:

`*RST`

`STATus:PRESet`

followed by resetting the following settings:

- IP Subnet mask (see `SYST:COMM:LAN:SUBM`)
- IP Address (see `SYST:COMM:SOCK:ADDR`)
- IP Port (see `SYST:COMM:SOCK:PORT`)
- DHCP state (see `SYST:COMM:SOCK:DHCP:STAT`)
- Clear memory lists: `MEM:CLE 0, MAX`
- Clear antenna lists
- Clear suppress lists: `TRAC:DATA SSTART, 0; :TRAC:DATA SSTOP, 0`
- Clear presets: `PROG:PRES:DEL:ALL`
- Clear UDP addresses: `TRAC:UDP:DEL ALL`
- Clear traces

Note that the security and password settings (`SYST:SEC` and `SYST:PASS` subsystems) are not reset. Any device specific behaviour is described under this same command in the specific documentation.

Parameters

None

Example

`SYSTem:PRESet:FACTory`

SYSTem
. :PRESet
. . :MEASurements

Reset only measurement related settings of the device.

Parameters

None

Example

```
SYSTem:PRESet:MEASurements
```

SYSTem
. :RESet
. . :[WARM]

Restarts the device (power off/on).

Parameters

None

Example

```
SYSTem:RESet:WARM
```

SYSTem
. :RESet
. . :COLD

Restarts the device (power off/on) and resets the instrument state to its default settings.

Parameters

None

Example

```
SYSTem:RESet:COLD
```

SYSTem
. :SECurity
. . :OPTion <code>

A special optional firmware can be activated by entering a certain option code. The unit must be rebooted to activate this optional software. For a list of possible options, see the common command “*OPT?”.

Remark

The SCPI interface itself is also an option. If this option is not active, none of the commands in this interface work. However, this command is an exception. When the SCPI option is not active, this command can be used to activate it. Note that no error reports can be retrieved via “SYST:ERR?”, and none of the other options can be activated as long as the SCPI option is not active.

Parameters

<code>	10-digit number

Error

-220	Parameter error in case option code is incorrect.

***RST state**

The options are maintained after a reset.

Example

```
SYSTem:SECurity:OPTion "1234567890"
```

SYSTem
. :TIME <hours>, <minutes>, <seconds>

Sets the current time for the device

Parameters

<hours>	Integer number in the range [0:23]
<minutes>	Integer number in the range [0:59]
<seconds>	Any number in the range [0:60]

The seconds are specified by a real number that is rounded toward the resolution of the device's internal clock accuracy. The number 60 is allowed here, because rounding can yield a number larger than 59.5.

Error

In case the time is invalid, an execution error -200,"Execution error" is generated.

***RST state**

The time is maintained after reset

Example

```
SYSTem:TIME 15, 17, 01.876
```

SYSTem
. :TIME?

Query the current time of the device

Parameter

None

Result

<hours>, <minutes>, <seconds> (see SYST:TIME)

Example

```
SYSTem:TIME? -> 15, 20, 31.546
```

SYSTem
. :VERSion?

Query of SCPI standard used by the device.

Parameters

None

Result

Version in format YYYY.V, where YYYY stands for the corresponding version year and V for the corresponding revision number of this year.

Example

```
SYSTem:VERSion? -> 2008.1
```

TRACe|DATA subsystem

Instead of the command word TRACe, DATA can also be used. Traces are used for summarizing data. Several predefined traces are available. Each one is described below.

Result Traces: MTRACE, ITRACE

For the results, two predefined traces (MTRACE = Measurement Trace and ITRACE = Information Trace) are available. They cannot be deleted. MTRACE receives its data from the SENSe:FUNCtion block. All sensor functions switched on deliver their measured values to the MTRACE where they are stored. ITRACE receives its data from the SENSe:FREQuency block. In addition to the current receiver frequency the corresponding channel number is also stored. The start command to initiate measurement (INITiate[:IMMediate]) clears the MTRACE (or ITRACE) data set.

Via the control instruction(TRAC:FEED:CONT), a condition can be defined that selects the data to be written into the MTRACE or ITRACE. If the control conditions of the two traces are identical, each TRACE value has a corresponding information value in the ITRACE. When the maximum data set length is attained, MTRACE and ITRACE are closed down. Any subsequent data are thus lost.

In the status reporting system the state of this traces is available in the status bits (see Section 10.1.7.6).

IF Panorama Trace: IFPAN

The command TRACe:FEED:CONTrol IFPAN, ALWays starts loading of the IFPAN Trace. The command DISPlay:MENU IFPAN starts the IF panorama, and the data levels are output. The spectrum length depends on the bandwidth chosen. The current number of pixels can be queried by the command TRACe:POINts? IFPAN

In the status reporting system the state of this traces is available in the status bits (see Section 10.1.7.6).

Suppress Traces: SSTART, SSTOP

Suppress lists are stored as two predefined traces, SSTART (= Suppress START) and SSTOP (=Suppress STOP). The suppress list has 100 elements with each element consisting of two frequencies. The frequency pair specifies a frequency range which is suppressed during the scan. It is irrelevant that the 1st frequency is lower than the 2nd frequency. The sequence in the list is irrelevant, too. Gaps are specified by the frequency pair 0.0. If one frequency of the frequency pair is 0, the other frequency of the pair is seen as a single frequency.

Examples:

Table 12-5: Suppress list example

1st Frequency	2nd Frequency	Description
118000000	136000000	Suppression of range 118 to 136 MHz
98550000	98450000	Suppression of range 98,450 to 98,550 MHz
0	0	Empty frequency pair (irrelevant)
118375000	0	Suppress single frequency 118,375 MHz
0	123400000	Suppress single frequency 123,400 MHz
127675000	127675000	Suppress single frequency 127,675 MHz

When retrieving the above list via the two queries “TRAC:DATA? SSTART” and “TRAC:DATA? SSTOP”, the list is slightly corrected: All single frequencies get the same frequency value in the SSTART and the SSTOP list. Clearing the suppress lists must always include both commands (TRAC SSTART, 0; TRAC SSTOP, 0).

Table 12-6: Suppress list example, query results

1st Frequency	2nd Frequency
118000000	136000000
98450000	98550000
0	0
118375000	118375000
123400000	123400000
127675000	127675000

In the status reporting system the state of these traces is available in the status bits (see Section 10.1.7.6).

TRACe|DATA
. :CATalog?

Query of all defined trace names

Parameters

None

Result

"MTRACE", "ITRACE", "IFPAN", "SSTART", "SSTOP", “UDP”

TRACe|DATA
. [:DATA] <trace_name>, <numeric_value> {, <numeric_value>} | <block>

Writing data to a trace. Existing data is lost.

Remark

Only the suppress traces can be written to.

Error

If the trace name is unknown or not identical with a suppress trace, error -141 "Invalid character data" is generated. If too many data are loaded in a suppress trace, error -223 "Too much data" is generated.

If FScan or MScan are active, TRAC:DATA SSTART nnn and
TRAC:DATA SSTOP, nnn generate -221, "settings conflict",

Parameter

<trace-name>	Name of the trace to be written to Note: These are not strings but predefined keywords. I.e.: They cannot be included in quotes.
<numeric_value>	List of frequencies. If the list is not complete, the rest of the trace is filled with 0. Note: In contrast to the SCPI standard a single value is not used for the complete trace!
<block>	As an alternative to the frequency list, a <Definite Length Block> can be transmitted with the following structure: Frequency list with frequencies in Hz, 8 bytes per frequency.

***RST state**

No change of trace contents at *RST.

Example

```
TRACe SSTART, 123.475 MHz, 118000000, 98550 kHz
```

TRACe|DATA
. [:DATA]? <trace_name>

Query of trace data. After the query, the trace is cleared, except for the SSTART and SSTOP traces.

Parameters

<trace_name>	Name of desired trace (MTRACE, ITRACE, IFPAN or SSTART, SSTOP)

Error

If the trace name is unknown, an error -141,"Invalid character data" will be generated.

Result

The output format is defined by the FORM:DATA command:

ASCii	Normal ASCII output
PACKed	Block Data, see section 10.1.5 .

The possible data-types that can be output are listed below:

Table 12-7: output types for TRACe:DATA?

Data Type	C Data Type	Description
“VOLTage:AC"	signed short	level in 1/10 dBµV
"FREQuency:OFFSet"	signed long	offset in Hz
“FSTRength"	signed short	field strength in 1/10 dBµV/m
Channel Number	unsigned short	channel number
Frequency	unsigned long long	frequency in Hz

What data and in what order belong to a trace, is specified for each trace separately:

MTRACE

Output of measured values of all sensor functions switched on. If no function is switched on, NaN (Not a Number) is output. The INF value 9.9E37 is entered into the result buffers MTRACE and ITRACE to mark the end of the trace.

1. “VOLTage:AC" (if the associated function is switched on via SENS:FUNC:ON)
2. "FREQuency:OFFSet" (if the associated function is switched on via SENS:FUNC:ON)
3. “FSTRength" (if the associated function is switched on via SENS:FUNC:ON)

The end of each sweep (if SENS:SWE:CNT is set to 10, then there are 10 sweeps in a scan) is marked by the values 2000 for “VOLTage:AC" and 0 for Frequency.

ITRACE

1. Channel Number
2. Frequency

The end of each sweep (if SENS:SWE:CNT is set to 10, then there are 10 sweeps in a scan) is marked by the value 0 for Frequency.

IFPAN

If there are no data available then a NaN (Not a Number) will be output.

1. “VOLTage:AC"

Suppress Traces

Output the list of frequencies contained in the trace.

1. Frequency

Remark

INF (range limit flag) will be coded in the PACKed format as follows:

INF level = 2000

INF offset = 10000000

INF FSTR = 0x7FFF

INF freq = 0

INF channel = 0

NINF (no measurement possible) will be coded in the PACKed format as follows:

NINF offset = 10000000-1

NINF FSTR = 0x7FFE

NINF AM = 0x7FFE

NINF FM = 0x7FFF FFFE

NINF PM = 0x7FFE

NINF BW = 0x7FFF FFFE

NaN is output as #110 in the PACKed format

To ensure that for the two traces MTRACE and ITRACE the same number of points is output, the two queries have to be one directly behind the other on the same command line (e.g. "TRACE? MTRACE;TRACE? ITRACE").

Example

```
TRACe? MTRACE -> 23.4, -2500, 18.5, 1500
TRACE? SSTART -> 123475000, 118000000, 98550000, 0, 0, 0,…
```

TRACe|DATA
. :FEED? <trace_name>

Query of data block connected with the trace. Does not apply to SSTART and SSTOP traces.

Parameters

<trace_name>	See TRACe[:DATA]?

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Result

Name of the block coupled to the trace.

MTRACE:	"SENS"
ITRACE:	"FREQ"
IFPAN:	"SENS"

Example

```
TRACe:FEED? MTRACE -> "SENS"
```

TRACe|DATA
. :FEED
. . :CONTrol <trace_name>, ALWays|SQUelch|NEVer

Determines how a trace is loaded with data. Data are always added to a trace; i.e. the trace is not emptied first (see also TRAC:FEED:CONT:RECM). To empty a trace, it must be read with TRACe?

Parameters

<trace-name>	See TRACe[:DATA]?
ALWays	Each measurement is stored in the trace. This starts recording.
SQUelch	Data are first stored, if the signal has exceeded the squelch threshold defined in the OUTPut:SQUelch subsystem. This starts recording.
NEVer	Do not store any data in the trace. This stops recording.

Remark

For IFPAN Trace, only ALWays or NEVer can be selected.

Error

If trace name is unknown, an error -141, "Invalid character data" will be generated.

***RST state**

NEVer

Example

```
TRACe:FEED:CONTrol MTRACE, ALWays
```

TRACe|DATA
. :FEED
. . :CONTrol? <trace_name>

Query of how a trace is loaded with data.

Parameters

<trace_name>	See TRACe[:DATA]?

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Result

ALW, SQU, NEV

Example

```
TRACe:FEED:CONTrol? MTRACE -> ALW
```

TRACe|DATA
. :LIMit
. . [:UPPer] <trace_name>, <numeric_value>|MINimum|MAXimum

Setting the limit of a trace. If the limit is exceeded, the Limit exceeded Flag will be set in the STATus:TRACe register.

Parameters

<trace_name>	See TRACe[:DATA]?
<numeric_value>	Limit in percentage of the maximum trace length
MINimum	Setting the smallest limit
MAXimum	Setting the largest limit

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

***RST state**

50 PCT

Example

```
TRACe:LIMit MTRACE, 50 PCT
```

TRACe|DATA
. :LIMit
. . [:UPPer]? <trace_name>[,MINimum|MAXimum]

Query of trace limit

Parameters

<trace_name>	See TRACe[:DATA]?
No further	Query of current limit
MINimum	Query of smallest limit
MAXimum	Query of largest limit

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Result

Limit in percent

Example

```
TRACe:LIMit? MTRACE -> 50
```

TRACe|DATA
. :POINts? <trace_name>[,MINimum|MAXimum]

Query of number of values stored in a trace. The number of values stored in the suppress traces is always 100. Thus, the MAXimum and MINimum value is also 100.

Parameters

<trace_name>	See TRACe[:DATA]?
No further	Query of current number
MINimum	Query of lowest number
MAXimum	Query of highest number

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Result

Number of values

Example

```
TRACe:POINts? MTRACE, MAX -> 2048
```

TRACe|DATA
. :POINts
. . :AUTO? <trace_name>

Query of auto-adjust of trace length. This command is present to remain backward compatible. A 0 (no auto-adjust for trace length) is always output for a suppress trace, and a 1 (auto-adjust) for other traces.

Parameters

<trace_name>	See TRACe[:DATA]?

Error

If the trace name is unknown, an error -141, "Invalid character data" will be generated.

Result

0	No auto adjust for trace length
1	Auto adjust for trace length

Example

```
TRACe:POINts:AUTO? MTRACE;AUTO? ITRACE -> 1;1
```

TRACe|DATA
. :RECord
. . :SOURce IQ|AUDio|AOS|TRACes

Command requires option "Internal Recording"
Setup data source of recorder.

Parameters

IQ	IQ data
AUDio	AUDio data
AOS	Audio On Squelch
TRACes	IF/RF-Traces

Error

Nr	Description	Condition
-221	Setting conflict	Recording data in progress.

Example

```
TRACe:RECord:SOURce AUDio
```

TRACe|DATA
. :RECord
. . :SOURce?

Command requires option "Internal Recording".
Query recorded data-source.

Parameters

None

Result

IQ, AUD, AOS, TRAC

Example

```
TRACe:RECord:SOURce? -> AUD
```

TRACe|DATA
. :RECord
. . :STORage MEMory|FILE

Command requires option "Internal Recording".
Setup storage medium where recorded data is stored.

Parameters

MEMory	Store recorded data in internal memory
FILE	Store recorded data in file on the SD-Card

Error

Nr	Description	Condition
-221	Setting conflict	Recording data in progress.

Example

```
TRACe:RECord:STORage MEMory
```

TRACe|DATA
. :RECord
. . :STORage?

Command requires option "Internal Recording".
Query storage medium where recorded data is stored.

Parameters

None

Result

MEM, FILE

Example

```
TRACe:RECord:STORage? -> MEM
```

TRACe|DATA
. :RECord
. . : MEMory
. . . :SIZE <size>|MINimum|MAXimum

Command requires option "Internal Recording".
Setup internal memory size where recorded data is stored. Changing memory size destroys the recorded memory data . The available memory size may change and a situation can arise where the requested size is not available.

Parameters

<size> 8MB|16MB|32MB|64MB

MINimum Minimum size of memory that can be reserved for recording

MAXimum Maximum size of memory that can be reserved for recording

Error

Nr	Description	Condition
-221	Setting conflict	Memory size is changed while record destination is RAM and recording is active.
-291	Out of memory	Requested size not available.

Example

```
TRACe:RECord:MEMory:SIZE 16 MB
```

TRACe|DATA
. :RECord
. . : MEMory
. . . :SIZE? [MINimum|MAXimum]

Command requires option "Internal Recording".
Query internal memory size where recorded data is stored.

Parameters

None	Query current memory size reserved for recording
MINimum	Query minimum memory size which can be reserved for recording
MAXimum	Query maximum memory size which can be reserved for recording

Result

8MB, 16MB, 32MB, 64MB

Example

`TRACe:RECord:MEMory:SIZE? 16 MB`

TRACe|DATA
. :RECord
. . : MEMory
. . . :MODE CYCLic|ONCE

Command requires option "Internal Recording".
If memory mode is set to ONCE, the recorder stops when the internal memory is full. The size of internal memory is set by `TRACe:RECord:MEMory:SIZE`.

If memory mode is set to CYCLic, the internal memory is used as a ring buffer and overwrites old values when it is full.

Parameters

CYCLic	Internal memory used as ring buffer
ONCE	Internal memory used as linear buffer, recording stops when buffer is full

Error

Nr	Description	Condition
-221	Setting conflict	Memory mode is changed while record destination is RAM and recording is active.

Example

`TRACe:RECord:MEMory:MODE CYClic`

TRACe|DATA
. :RECord
. . : MEMory
. . . :MODE?

Command requires option "Internal Recording".
Queries the internal memory recording mode.

Parameters

None

Return

CYCL, ONCE

Example

```
TRACe:RECord:MEMory:MODE? -> CYCl
```

TRACe|DATA
. :RECord
. . : MEMory
. . . :SAVE <filename>

Command requires option "Internal Recording".
This SCPI command functions as a trigger which saves internally recorded data into a file, with entered filename, on the SD-card. This command overwrites a file if it exists with the same name as the entered filename. The filename-extension is added automatically and depends on the type of record data as indicated in the list below:

- Traces record data .rtr
- IQ record data .riq
- Audio record data .wav

If <filename> is relative (not starting with “\”), its location is taken relative from the current mass memory directory (see MMEMory:CDIRectory).

If <filename> is absolute (starting with “\”) it must begin with “\Storage Card\”, else it fails with error -257,"File name error".

The directory part of <filename> must already exist; if not the command with fail with error -292,"Referenced name does not exist.

Parameters

<filename> "filename"

Error

Nr	Description	Condition
-221	Setting conflict	Internal memory is being used in the process of internal memory recording. Remark: This command remains available when the recording destination is SDCard and being used in the process of recording data.
-257	File name error	Incorrect file name
-292	Referenced name does not exist	The directory part of <filename> does not exist

Remark
This command remains available when the recording destination is SDCard and being used in the process of recording data.

Example

```
TRACe:RECord:MEMory:SAVE "trace_record"
```

TRACe|DATA
. :RECord
. . :STARt

Command requires option "Internal Recording".
Recording data is started. The data is stored in internal memory or on the SD-card depending on the selected record destination. If the record is stored onto the SD-card, the record data is stored in a file having a naming format as described below. Data recorded into internal memory does not use a naming scheme and can be transferred to SD-card via the TRACe:RECord:MEMory:SAVE command described above.

The filename being used for the current recording, when writing to SD-card, depends on the type of recording, IQ, TRACes or AUDio, and the number of recordings of the same type stored on the present SD-card. The filename consists of three parts where the first part is the actual filename. The seconds part is the filename discriminator ended with a filename extension.

The filename discriminator, nnn, is a number added to the name of the file in order to save multiple recordings of the same type. The number being used for the current recording equals the highest number of the same recording type, incremented by one. The file extension identifies the recording type as indicated in the list below. Both filename discriminator and extension are marked bold.

- RecTrace_**nnn.rtr**
- RecIQ_**nnn.riq**
- RecAudio_**nnn.wav**

If recording to memory in STOP_ON_FULL mode, recording will stop automatically if memory becomes full.

If an error occurs while recording to file (e.g. SD becomes full or is removed) recording will stop automatically, and an error -250, “Mass storage error” is put into the error queue of all SCPI clients.

Parameters

None

Error

Nr	Description	Condition
-221	Setting conflict	Record could not be started while replaying data.
-250	Mass Storage Error	Error related to the SD Card, e.g. SD Card missing or full.

Example

```
TRACe:RECord:STARt
```

TRACe|DATA
. :RECord
. . :STARt?

Querries whether recording is started.

Parameters

None

Result

0	Recording not active
1	Recording active

Example

```
TRACe:RECord:STARt? -> 1
```

TRACe|DATA
. :RECord
. . :STOP

Command requires option "Internal Recording".
Recording data is stopped.

Parameters

None

Error

Nr	Description	Condition
-221	Setting conflict	No recording started.

Example

```
TRACe:RECord:STOP
```

TRACe|DATA
. :RECord
. . :STOP?

Querries whether recording is stopped.

Parameters

None

Result

0	Recording active
1	Recording not active

Example

```
TRACe:RECord:STOP? -> 1
```

TRACe|DATA
. :RECord
. . : OVERruns?

This command returns the number of overruns occurred during the recording process. It furthermore resets the active status of bit 12 in the TRACe status register for the client issuing this command if set active.

Parameters

None

Result

Number of overruns during recording

Example

```
TRACe:RECord:OVERruns? -> 0
```

TRACe|DATA
. :REPLay
. . :SEEK <position>|MINimum|MAXimum

Repositions the replay index from where replaying starts or continues.

Parameters

<position>	For audio replay position in seconds, for trace replay line number
MINimum	Shortcut for position = 0
MAXimum	Shortcut for position = end of file

Error

Nr	Description	Condition
-221	Setting conflict	Replay not started.
-222	Data out of range	Seek position is not in recorded data.

Example

```
TRACe:REPLay:SEEK 365
```

TRACe|DATA
. :REPLay
. . :SEEK? [MINimum|MAXimum]

Returns current/minimum/maximum replay position in seconds for audio recordings, in line numbers for trace recordings.

Parameters

None	Query current replay position
MINimum	Query minimum possible replay position (0).
MAXimum	Query maximum possible replay position (end of file).

Error

Nr	Description	Condition
-221	Setting conflict	Replay not started.

Example

```
TRACe:REPLay:SEEK? MAX -> 4620
```

TRACe|DATA
. :REPLay
. . :STARt [<filename>]

Command requires option "Internal Recording".
Replays the recorded trace or audio data upto the last recorded item. Replay start at the beginning of the record when the replay is stopped and continues from the pause-position when replay was in pause.

If <filename> is not specified, replay record in internal RAM.

If <filename> is specified, replay record-file on SD-card.

Parameters

<filename>	String specifying the record-filename stored on the SD-Card. If the filename is omitted, internal RAM is used as recorded data source.

Error

Nr	Description	Condition
-200	Execution error	No recorded data in internal memory, or <filename> is not accessible. Record file does not contain trace or audio data.
-221	Setting conflict	Recorder is active in the process of recording data.

Example

```
TRACe:REPLay:STARt "Record_Trace_003.rtr"
```

TRACe|DATA
. :REPLay
. . :STARt?

Querries whether replay is started.

Parameters

None

Result

0	Replay stopped or off
1	Replay paused or playing

Example

```
TRACe:REPLay:STARt? -> 1
```

TRACe|DATA
. :REPLay
. . :STOP

Command requires option "Internal Recording".
Stops replaying a record.

Parameters

None

Error

Nr	Description	Condition
-221	Setting conflict	Recorder is not active in the process of replaying data.

Example

```
TRACe:REPLay:STOP
```

TRACe|DATA
. :REPLay
. . :STOP?

Querries whether replay is stopped.

Parameters

None

Result

0	Replay paused or playing
1	Replay stopped or off

Example

```
TRACe:REPLay:STOP? -> 1
```

TRACe|DATA
. :REPLay
. . :PAUSe

Command requires option "Internal Recording".
Pause a playing record.

Parameters

None

Error

Nr	Description	Condition
-221	Setting conflict	Replay is not started.

Example

```
TRACe:REPLay:PAUSe
```

TRACe|DATA
. :REPLay
. . :PAUSE?

Command requires option "Internal Recording".
Querries whether replay is paused.

Parameters

None

Result

0	Replay not paused
1	Replay paused

Example

```
TRACe:REPLay:PAUSe? -> 1
```

TRACe|DATA
. :REPLay
. . :RESume

Command requires option "Internal Recording".
Resumes the currently paused replay session.

Parameters

None

Error

Nr	Description	Condition
-200	Execution Error	Replayed data is not audio data.
-221	Setting conflict	Replay is not active or not paused

Example

```
TRACe:REPLay:RESume
```

TRACe|DATA
. :SUPPress
. . :CONFig
. . . :CATalog?

Outputs the name of the frequency suppress-list. This name can only be modified by uploading another configuration via the TRACe:SUPP:CONFig command.

Parameter

None

Result

Name of suppress list files, in a format identical to that of MMEM:CAT? .

Example

```
TRACe:SUPP:CONFig:CATalog? ->
3000, 120000000
Default, .suplst, 600, 00-00-0000, 00:00:00
```

TRACe|DATA
. :SUPPress
. . :CONFig <block_data>

Upload and activate a frequency suppress-list.

Parameters

<block_data> Block data with frequency suppress-list

Example

```
TRACe:SUPP:CONFig <block data specific for frequency suppress list>
```

TRACe|DATA
. :SUPPress
. . :CONFig?

Outputs the frequency suppress list as block data.

Parameters

None

Result

<block_data> of file contents

Example

```
TRACe:SUPP:CONFig? -> <block data specific for frequency suppress list>
```

TRACe|DATA
. :VALue <trace_name>, <index>, <numeric_value>

Setting an element of a trace.

Parameters

<trace_name>	Name of the trace, only SSTART and SSTOP are allowed
<index>	Index of the element within the trace that is to be set. The first element of a trace has index 0
<numeric _value>	Frequency value of the element

Remark

Only suppress traces can be set.

Error

Error -141, "Invalid character data" if the trace name is unknown or not equal to a suppress trace name.

***RST state**

see TRACe:DATA

Example

```
TRACe:VALue SSTART, 13, 98.550 MHz
```

TRACe|DATA
. :VALue? <trace_name>, <index>

Query of an element of a trace.

Parameters

<trace_name>	Name of the trace
<index>	Index of the element within the trace that is to be set. The first element of a trace has index 0.

Remark

Only elements of the suppress traces can be queried.

Error

Error -141, "Invalid character data" if the trace name is unknown or not equal to a suppress trace name.

Result

Frequency value of the element of a trace in Hz

Example

```
TRACe:Value? SSTART, 13 -> 98550000.000000
```

TRACe|DATA:UDP subsystem

This sub-system controls what trace data are sent over UDP to a remote client. Each destination to which UDP data can be sent is called a UDP-address (which is equivalent to an IP address and port number). This sub-system keeps a list of all UDP-addresses that are used. The first item in this list is the default UDP-address, which is always present, and is retained after a power down and up.

For a description of how trace data are sent over UDP see Section "UDP Data Streams" (p. 354).

TRACe|DATA
. :UDP? [<numeric_value>|MINimum|MAXimum|DEFault]

Query of available UDP-addresses and flags and tags that are set by the user.
See Table 13-2 (p. 354) for attribute tags and Table 13-3 (p. 355) for flags in Section "Stream Packet Structure" (p. 354).

Note that there are no predefined UDP-addresses. Each one must be entered by the user via a TRAC:UDP[:DEF]:TAG:ON and TRAC:UDP[:DEF]:FLAG:ON command.

Parameters

None	Lists all UDP addresses as in TRACe:UDP? <numeric_value>, each on a new line
<numeric_value>	Integer in the range [MIN, MAX]
MINimum	Minimum index in the list of UDP-addresses (always 0)
MAXimum	Maximum index in the list of UDP-addresses
DEFault	Index of the default UDP-address (always 0)

Result

DEF, <numeric_value> [<ip-address>, <ip-port> {, tag} {, flag}]

Example

`TRACe:UDP? MAX -> 3`

`TRACe:UDP? DEF -> 0`

`TRACe:UDP? 0 -> DEF`

This means that the default UDP address has not yet been defined.

`TRACe:UDP? 0 -> DEF "123.456.789.012", 5555, FSC, MSC, "FSTRength"`

This means that field strength data is output in F-scan and M-scan data packets to port 5555 on IP address “123.456.789.012”.

`TRACe:UDP? 3 -> 003 "012.123.456.789", 4444, FSC, MSC, "VOLTage:AC"`

This means that received-level data is output in F-scan and M-scan data packets to port 4444 on IP address “012.123.456.789”.

TRACe|DATA
. :UDP
. . :DEFault
. . . :FLAG
. . . . :OFF <ip-address> , <ip-port>, <flag> , <flag>

Changes the UDP-address of the default address and removes the specified flags if present.

Parameters

<ip-address> String representing IP dot notation of IP address (e.g. 172.17.75.18)

<numeric_value> Integer port number in the range [0,65535] (16 bit)

<flag> See Table 13-3 (p. 355) for flags
in Section "Stream Packet Structure" (p. 354).

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:DEFault:FLAG:OFF “123.456.789.012”, 5555, “VOLT:AC”, “SWAP”
```

TRACe|DATA
. :UDP
. . :DEFault
. . . :FLAG
. . . . [:ON] <ip-address> , <ip-port>, <flag> {, <flag>}

Changes the UDP-address of the default address and adds the specified flags that determine what data is included in traces. In case a flag is added to the default address that has tags that are incompatible with this flag (e.g. “FSTRength” flag and AUDio tag), these flags are ignored for those tags.

Parameters

<ip-address> String representing IP dot notation of IP address (e.g. 172.17.75.18)

<numeric_value> Integer port number in the range [0,65535] (16 bit)

<flag> See Table 13-3 (p. 355) for flags in Section "Stream Packet Structure" (p. 354).

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:DEFault:FLAG:ON "123.456.789.012", 5555, "VOLT:AC", "SWAP"
```

TRACe|DATA
. :UDP
. . :DEFault
. . . :TAG
. . . . :OFF <ip-address> , <ip-port>, <tag> {, <tag>}

Changes the UDP-address of the default address and removes the specified tags if present.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<tag>	See Table 13-2 (p. 354) for attribute tags in Section "Stream Packet Structure" (p. 354).

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:DEFault:TAG:OFF "123.456.789.012", 5555, MSC, FSC
```

TRACe|DATA
. :UDP
. . :DEFault
. . . :TAG
. . . . [:ON] <ip-address> , <ip-port>, <tag> {, <tag>}

Changes the UDP-address of the default address and adds the specified tags that determine what data is included in traces. In case a tag is added to the default address that has flags that are incompatible with this tag (e.g. “FSTRength” flag and AUDio tag), these flags are ignored for those tags.

All tags and flags are off by default, but specifying the IFPan tag automatically includes the flag “VOLTage:AC”.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<tag>	See Table 13-2 (p. 354) for attribute tags in Section "Stream Packet Structure" (p. 354).

***RST state**

The "*RST" command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:DEFault:TAG:ON "123.456.789.012", 5555, MSC, FSC
```

TRACe|DATA
. :UDP
. . :DELete ALL| (<ip-address>, <ip-port>)

Deletes one UDP-addresses from the list, or all of them including the default one (index 0).

Parameters

ALL	All UDP-addresses are deleted, including the default one (index 0)
<ip-address>, <ip-port>	The UDP-address that matches the IP address and the port is deleted.

***RST state**

None, as command is an event

Example

```
TRACe:UDP:DELete ALL
TRACe:UDP:DELete "012.123.456.789", 4444
```

TRACe|DATA
. :UDP
. . :FLAG
. . . :OFF <ip-address> , <ip-port>, <flag> , <flag>...

Sets a UDP-address and removes the specified flags if present. If the maximum number of UDP addresses (TRACe:UDP? MAX) has been reached an error is generated: -310, "Maximum number of UDP addresses exceeded".

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<flag>	See Table 13-3 (p. 355) for flags in Section "Stream Packet Structure" (p. 354).

Remark

If the UDP-address is not in the list, it is added to it. Otherwise, it is modified.

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:FLAG:OFF "123.456.789.012", 5555, "VOLT:AC", "SWAP"
```

TRACe|DATA
.   :UDP
.   .   :FLAG
.   .   .   [:ON] <ip-address> , <ip-port>, <flag> , <flag>...

Sets a UDP-address and adds the specified flags that determine what data is included in traces. If the maximum number of UDP addresses (TRACe:UDP? MAX) has been reached an error is generated: -310, “Maximum number of UDP addresses exceeded”.

In case a flag is added to a UDP address that has tags that are incompatible with this flag (e.g. “FSTRength” flag and AUDio tag), these flags are ignored for those tags.

All tags and flags are off by default, but specifying the IFPan tag automatically includes the flag “VOLTage:AC”.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<flag>	See Table 13-3 (p. 355) for flags in Section "Stream Packet Structure" (p. 354).

Remark

If the UDP-address is not in the list, it is added to it. Otherwise, it is modified

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:FLAG:ON “123.456.789.012”, 5555, “VOLT:AC”, “SWAP”
```

TRACe|DATA
. :UDP
. . :TAG
. . . :OFF <ip-address> , <ip-port>, <tag> , <tag>...

Sets a UDP-address and removes the specified tags if present. If the maximum number of UDP addresses (TRACe:UDP? MAX) has been reached an error is generated: -310, “Maximum number of UDP addresses exceeded”.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<tag>	See Table 13-2 (p. 354) for attribute tags in Section "Stream Packet Structure" (p. 354).

Remark

If the UDP-address is not in the list, it is added to it. Otherwise, it is modified

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:TAG:OFF “123.456.789.012”, 5555, MSC, FSC
```

TRACe|DATA
. :UDP
. . :TAG
. . . [:ON] <ip-address> , <ip-port>, <tag> , <tag>...

Sets a UDP-address and adds the specified tags that determine what data is included in traces. If the maximum number of UDP addresses (TRACe:UDP? MAX) has been reached an error is generated: -310, “Maximum number of UDP addresses exceeded”.

In case a tag is added to a UDP address that has flags that are incompatible with this tag (e.g. “FSTRength” flag and AUDio tag), these flags are ignored for those tags.

Parameters

<ip-address>	String representing IP dot notation of IP address (e.g. 172.17.75.18)
<numeric_value>	Integer port number in the range [0,65535] (16 bit)
<tag>	See Table 13-2 (p. 354) for attribute tags in Section "Stream Packet Structure" (p. 354).

Remark

If the UDP-address is not in the list, it is added to it. Otherwise, it is modified

***RST state**

The “*RST” command has no effect on these settings.

After a power down, the UDP-address list only contains the default entry (index 0). The default is retained.

Example

```
TRACe:UDP:TAG:ON “123.456.789.012”, 5555, MSC, FS
```

TRIGger subsystem

This sub-system controls trigger sequences. SCPI instruments may perform several different device actions. If these actions are dependent on different set of occurrences, an SCPI instrument will extend the number of trigger sequences. Both PR100 and EM100 do not support multiple sequences. The optional SEQuence statement is used for compatibility reasons but can be omitted.

TRIGger[:SEQuence]
. :ENABle <Boolean>

Enables or disables the trigger functionality.

Parameters

OFF	Disables trigger functionallity
ON	Enables trigger functionallity

***RST state**

OFF

Example

```
TRIGger:ENABle ON
```

TRIGger[:SEQuence]
. :ENABle?

Query whether trigger functionality is enabled or disabled.

Parameters

None

Result

0	Trigger functionality disabled
1	Trigger functionallity enabled

Example

```
TRIGger:ENABle? -> 1
```

TRIGger[:SEQuence]
. :STATe?

Query whether the trigger state is ON or OFF.

Parameters

None

Remark

The trigger-state is OFF if triggering is disabled.

Result

0	Trigger state is OFF
1	Trigger state is ON

Example

```
TRIGger:STATe? -> 1
```

TRIGger[:SEQuence]
. :LOCK <Boolean>

This command locks the instrument when the trigger state is ON, meaning triggered. When the trigger state transitions from ON to OFF the instrument is unlocked. All keys except the lock key and all SCPI commands except a subset, are disabled when the instrument is locked.

Parameters

OFF	Instrument is locked when trigger state is ON.
ON	Instrument is not locked when trigger state is ON.

Remark

On disabling trigger functionality the trigger state will be forced to OFF causing the instrument to be unlocked.

The following subset of SCPI commands is supported while the instrument is locked:

*RST

TRIGger:LOCK OFF

All SCPI queries

The Service request message mechanism, &SRQ, is still active when the instrument is locked.

***RST state**

OFF

Example

```
TRIGger:LOCK ON
```

TRIGger[:SEQuence]
. :LOCK?

Query whether trigger lock functionality is enabled or disabled.

Parameters

None

Result

0	Trigger lock functionality disabled
1	Trigger lock functionallity enabled

Example

```
TRIGger:LOCK? -> 1
```

TRIGger[:SEQuence]
. :BEEP <Boolean>

Enables or disables generation of a beep sound in case of a trigger.

Parameters

OFF	Beep sound OFF
ON	Beep sound ON

***RST state**

OFF

Example

```
TRIGger:BEEP ON
```

TRIGger[:SEQuence]
. :BEEP?

Query whether trigger beep sound is enabled or disabled.

Parameters

None

Result

0	Trigger beep sound disabled
1	Trigger beep sound enabled

Example

```
TRIGger:BEEP? -> 1
```

TRIGger[:SEQuence]
. :STARt
. . :SOURce ROTary|AUX|SQUelch|TIME|SCPI

Selection of the trigger source which initiates the start of an action.

Parameters

ROTary	The action is started by pressing rotary button.
AUX	The action is started when the signal on AUX2, pin7, transitions from logical “0” to “1” and the selected trigger slope is positive or from “1” to “0” and the selected slope is negative.
SQUelch	The action is started when the signal-level transitions from below to above the selected squelch-level and the selected slope is positive or from above to below the selected squelch-level and the selected slope is negative.
TIME	The action is started when the entered start time is reached.
SCPI	The action is started when a TRIGger:IMMediate SCPI command is entered and the instrument is not locked.

***RST state**

ROTary

Example

```
TRIGger:STARt:SOURce TIME
```

TRIGger[:SEQuence]
. :STARt
. . :SOURce?

Query the selected trigger source which initiates the start of an action.

Parameters

None

Result

ROT, AUX, SQU, TIME, SCPI

Example

```
TRIGger:STARt:SOURce? -> SCPI
```

TRIGger[:SEQuence]
. :STOP
. . :SOURce NONE|AUTO|ROTary|AUX|SQUelch|TIME|TDURation|SCPI

Selection of the trigger source which initiates the the trigger state to transition from On to OFF which results in the selected action being stopped.

Parameters

NONE	The action is never stopped.
AUTO	The action is automatically stopped
ROTary	The action is stopped by pressing the rotary button
AUX	The action is stopped when the signal on AUX2, pin7, transitions from logical “0” to “1” and the selected trigger slope is positive or from “1” to “0” and the selected slope is negative.
SQUelch	The action is stopped when the signal-level transitions from below to above the selected squelch-level and the selected slope is positive or from above to below the selected squelch-level and the selected slope is negative.
TIME	The action is stopped when the entered start time is passed.
TDURation	The action is stopped after being executed for TDURation time.
SCPI	The action is stopped when a TRIGger:IMMediate SCPI command is entered and the instrument is not locked.

***RST state**

AUTO

Example

```
TRIGger:STOP:SOURce TIME
```

TRIGger[:SEQuence]
. :STOP
. . :SOURce?

Query the selected trigger source which initiates the trigger state to transition from On to OFF which results in the selected action being stopped.

Parameters

None

Result

NONE, AUTO, ROT, TIME, AUX, SQU, TDUR, SCPI

Example

```
TRIGger:STOP:SOURce? -> TDUR
```

TRIGger[:SEQuence]
. :STARt
. . :SLOPe POSitive|NEGative

Setting of the slope initiating a trigger on event if the selected trigger start source is edge sensitive.

Parameters

POSitive	Trigger at positive slope
NEGative	Trigger at negative slope

Remark

This setting has only effect if the selected trigger start source is edge sensitive, e.g. Aux or Squelch.

***RST state**

POSitive

Example

```
TRIGger:STARt:SLOPe NEGative
```

TRIGger[:SEQuence]
. :STARt
. . :SLOPe?

Query of the selected trigger slope initiating a trigger on event when the trigger start source is edge sensitive.

Parameters

None

Result

POS, NEG

Example

`TRIGger:STARt:SLOPe? -> NEG`

TRIGger[:SEQuence]
. :STOP
. . :SLOPe POSitive|NEGative

Setting of the slope initiating a trigger off event if the selected trigger stop source is edge sensitive.

Parameters

POSitive	Trigger at positive slope
NEGative	Trigger at negative slope

Remark

This setting has only effect if the selected trigger stop source is edge sensitive, e.g. Aux or Squelch.

***RST state**

POSitive

Example

`TRIGger:STOP:SLOPe NEGative`

TRIGger[:SEQuence]
. :STOP
. . :SLOPe?

Query of the selected trigger slope initiating a trigger off event when the trigger stop source is edge sensitive.

Parameters

None

Result

POS, NEG

Example

`TRIGger:STOP:SLOPe? -> NEG`

TRIGger[:SEQuence]
. :STARt
. . :TIME <dd>,<mm>,<yyyy>,<hh>,<mm>,<ss>

This SCPI command is used to specify the time which initiates the trigger state to transition from trigger state OFF to ON when the trigger start source is set to time.

Parameters

<dd>	Day
<mm>	Month
<yyyy>	Year
<hh>	Hours
<mm>	Minutes
<ss>	Seconds

Remark

The trigger state transitions immediately from trigger state OFF to ON if the entered time is in the past.

Example

```
TRIGger:STARte:TIME 25,09,2009,15,30,00
```

TRIGger[:SEQuence]
. :STARt
. . :TIME?

This SCPI command is used to query the time which initiates the trigger state to transition from trigger state OFF to ON when the trigger start source is set to time.

Parameters

None

Result

<dd>,<mm>,<yyyy>,<hh>,<mm>,<ss>

Remark

The format of the date <dd>,<mm>,<yyyy>,<hh>,<mm>,<ss> or <mm>,<dd>,<yyyy>,<hh>,<mm>,<ss> depends on the date format selected by DISPlay:DATE:FORMat.

Example

```
TRIGger:STARte:TIME? -> 25,09,2009,15,30,00
```

TRIGger[:SEQuence]
. :STOP
. . :TIME <dd>,<mm>,<yyyy>,<hh>,<mm>,<ss>

This SCPI command is used to specify the time which initiates the trigger state to transition from trigger state ON to OFF when the trigger stop source is set to time.

Parameters

<dd>	Day
<mm>	Month
<yyyy>	Year
<hh>	Hours
<mm>	Minutes
<ss>	Seconds

Example

```
TRIGger:STOP:TIME 25,09,2009,15,30,00
```

TRIGger[:SEQuence]
. :STOP
. . :TIME?

This SCPI command is used to query the time which initiates the trigger state to transition from trigger state ON to OFF when the trigger stop source is set to time.

Parameters

none

Result

<dd>,<mm>,<yyyy>,<hh>,<mm>,<ss>

Remark

The format of the date <dd>,<mm>,<yyyy>,<hh>,<mm>,<ss> or <mm>,<dd>,<yyyy>,<hh>,<mm>,<ss> depends on the date format selected by DISPlay:DATE:FORMat.

Example

```
TRIGger:STOP:TIME? -> 25,09,2009,15,30,00
```

TRIGger[:SEQuence]
. :STOP
. . :TDURation <numeric_value>|MAXimum|MINimum

This SCPI command is used to specify the time in which the trigger state remains ON after transitioning from trigger state OFF to ON.

Parameters

<numeric_value>	Duration in seconds
MINimum	Setting shortest duration (1 second)
MAXimum	Setting longest duration (999 seconds)

***RST state**

MINimum

Example

```
TRIGger:STOP:TDURation 10
```

TRIGger[:SEQuence]
. :STOP
. . :TDURation? [MINinum|MAXimum]

This SCPI command is used to query the time in which the trigger state remains ON after transitioning from trigger state OFF to ON.

Parameters

None	Query of the current duration
MINimum	Query of the shortest possible duration (1)
MAXimum	Query of the longest possible duration (999)

Result

Duration in seconds

Example

```
TRIGger:STOP:TDURation? -> 10
```

TRIGger[:SEQuence]
. :ACTion NONE|SCReen|TRACe|GPS|SCAN|RECord

The action specified by this command is executed while being in the trigger state ON.

Parameters

NONE	No action
SCREen	Save Screen
TRACe	Save Trace
GPS	Save current GPS position and azimuth on the GPS map
SCAN	Run+ SCAN (FSCAN, MSCAN, PSCAN)
RECord	Enable/Disable Internal recording.

Remark

Continuous actions, like scanning and recording, are stopped when the trigger state transitions to OFF.

Enabling the FSCAN, MSCAN stream does not imply that the scanner is started

***RST state**

TRACe

Error

Nr	Description	Condition
-210	Trigger error	Error related to the SD Card, e.g. SD Card missing or full.
-211	Trigger ignored	Indicates that a triggering signal was received and recognized by the device but was ignored because of device timing considerations, for example the device was not ready to respond.
-221	Setting conflict	Action could not be started, e.g. FSCan and MGC are both selected.

Example

```
TRIGger:ACTion RECord
```

TRIGger[:SEQuence]
. : ACTion?

This query returns the action being executed when entering the trigger state ON.

Parameters

None

Result

NONE, SCRE, TRAC, GPS, SCAN, RECord

Example

```
TRIGger:ACTion? -> REC
```

TRIGger[:SEQuence]
. :IMMediate

The trigger state switches immediately from ON to OFF or vise versa when the TRIGger:IMMediate command is entered.

Parameters

None

Remark

TRIGger:IMMediate does only work when the selected trigger source is SCPI.

Example

```
TRIGger:IMMediate
```

13 UDP Data Streams

This section describes the data streams that can be output by the R&S PR100. All data streams have a similar (general) structure, which is described in section "Stream Packet Structure" (p. 354) . After that, each data stream is described in a separate section.

Stream Packet Structure

Each stream consists of a number of UDP packets, and each packet has a similar structure that is shown in Table 13-1 (p. 354). The first part (before optional header) is the common header which is the same for all stream types. Its <attribute tag> determines the stream type, and its <trace selector flags> determines what data are included.

The <optional header> and the <trace data> are different for each stream type. Each stream type is further described in a separate section.

The <trace selector flags> shown in Table 13-3 (p. 355) define the data items that are included in a data stream. The R&S PR100 does not support all data items that the ESMB version of its predecessor, the EB200, supported. The following items are not supported: AM, AM_POS, AM_NEG, FM, FM_POS, FM_NEG, PM, and BANDWIDTH.

The data items as defined by the <trace selector flags> are not included automatically, but must be selected through an SCPI command (see TRACe:UDP:FLAGs). Not all items are possible with every data stream type. For every data stream type, the items that are allowed are mentioned explicitly.

Table 13-1: UDP Stream Format

(Table is 4 bytes wide, data types are described in Table 13-2 (p. 354))

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
header magic_number			
header minor_version_number		header major_version_number	
header sequence_number		header reserved	
header reserved			
attribute tag		attribute length	
trace number of items		trace reserved	trace optional-header length
trace selector flags , see Table 13-3 (p. 355)			
optional header: Size and structure depend on the type of stream. Each stream type has its own section, see sections "Audio Streaming" (p. 357) through "PSCAN streaming" (p. 365).			
trace data: Format depends on type of stream, see sections "Audio Streaming" (p. 357) through "PSCAN streaming" (p. 365).			

Table 13-2: UDP Stream Data Types

Terminal	C Data Type	Remarks
<header magic number>	unsigned long	Always 0x000EB200
<header minor version-number>	unsigned short	Version that is incremented for small changes in format that maintain compatibility. For the traces in this document, the minor version is "0x40".
<header major version-number>	unsigned short	Constant specific for devicezz Only incremented when changes in format cause incompatibility. For the traces in this document, the major version is "2".
<header sequence number>	unsigned short	Incremented for each UDP packet sent. After reaching its highest value, it starts at 0 again. Each UDP address has its own sequence number.
<header reserved>	character[6]	not used
<attribute tag>	unsigned short	101 = FSCan 201 = MSCan 401 = Reserved for AUDio 501 = IFPan 801 = CW 901 = IF 1201 = PSCan
<attribute length>	unsigned short	number of bytes following this field: from <trace number of items> to "trace data" inclusive
<trace number of items>	Short	number of measurements in <trace data>. E.g. a value of 100 with LEVEL and OFFSET selected, means there are 100 LEVEL values followed by 100 OFFSET values in <trace data>.
<trace reserved>	character	not used
<trace optional-header length>	unsigned character	number of bytes in <optional header>
<trace selector flags>	unsigned long	See Table 13-3 (p. 355)

The data fields in the common header are always sent in Big Endian order (= most significant byte first). For <optional header> and <trace data> the order is determined by the selector flag SWAP (see Table 13-3 (p. 355)): if SWAP is not set the order is Big Endian, if set the order is Little Endian.

The selector flags OFFSET and FSTRENGTH shown in Table 13-3 (p. 355) only have an effect if the corresponding measurement functions are switched on:

OFFSET requires `SENS:FUNC:ON "FREQuency:OFFSet"`

FSTRENGTH requires `SENS:FUNC:ON "FSTRength"`

Note that LEVEL does not require the corresponding measurement function.

The selector flag CHANnel only contains the channel number when the frequency mode is MSCan or FSCAN. Otherwise, it contains the value zero.

Table 13-3: UDP Stream, settings for < flags>

The "C Data Type" column is the data type of the data that are included by setting the associated flag. It is not the data type of the flag itself.

Selector Flag	Hex Value	C Data Type	SCPI parameter	Remarks
LEVEL	0x00000001	short	"VOLTage:AC"	Unit:1/10 dBµV
OFFSET	0x00000002	long	"FREQuency:OFFSet"	Unit: Hz
FSTRENGTH	0x00000004	short	"FSTRength"	Unit:1/10 dBµV
CHANNEL	0x00010000	short	"CHANnel"	See SENS: MSC:CHAN
FREQ_LOW	0x00020000	unsigned long	"FREQuency:RX" or "FREQuency:LOW:RX"	Unit: Hz
FREQ_HIGH	0x00200000	unsigned long	"FREQuency:HIGH:RX"	Unit: Hz
SWAP	0x20000000	N.A.	"SWAP"	Data order: Little Endian if set; else Big Endian
SIGNAL_GREATER_SQUELCH	0x40000000	N.A.	"SQUelch"	Only data that exceed the squelch level are included
OPTIONAL_HEADER	0x80000000	N.A.	"OPTional"	Optional header is included
TRIGGER_CONTROLLED	N.A.	N.A.	“TRIGger”	Not sent in data stream.

Note:

The Selector flag "FREQuency:LOW:RX" and "FREQuency:RX" are the same. The "FREQuency:RX" flag is compatible with the older receivers and supports frequencies < 4 GHz.

Since the R&S PR100 frequency range is > 4 GHz a new flag FREQuency:HIGH:RX is introduced. Backwards compatibility is realized by adding the higher 32 bits of a frequency at the end of the optional header.

Empty packets (also those with an optional header but without data) are not transmitted.

The SWAP flag ON or OFF has no effect if the selected stream is an IQ-stream. The stream is always returned with swapped data regardless whether the setting is SWAP ON or SWAP OFF.

When the flag TRIGGER_CONTROLLED is set, and external triggering is enabled, the stream will only produce data if trigger state is ON; this flag is not sent in the data stream.

For packets that contain scan data (for FSCan, MSCan, and PSCan), the end of a sweep (scan) is marked: The last item in a scan is always followed by an end-marker. This end-marker is another item with unrealistic values:

Table 13-4: UDP Stream, End Markers

Data Type	Value	Unit
LEVEL	2000	dBµV
OFFSET	10 000 000	Hz
FSTRENGTH	32 767	dBµV /m
CHANNEL	0	

FREQ_LOW	0	Hz
FREQ_HIGH	0	Hz

Note that the end-marker is counted in the header field <trace number of items>. E.g.: An FSCan from 100 MHz to 110 MHz with a 1 MHz step width outputs 12 items: 11 measured items and 1 end-marker.

Note:
For trace recording (CW, FSCAN,MSCAN and PSCAN) some additional administration packets shall be added to the record data to speed up the trace replay performance.

The structure of the administration packets will be equal to the UDP stream packages, only an (new) unique "header magic number" shall be used. In this way it shall be simple to skip these packets for post processing software.

One example for such a header is waterfall pixel data in the trace stream. Waterfall pixel data are inserted if the ratio between frequency points and pixels (aka "compression") exceeds a certain value, to avoid calculation overhead during replay. Timestamps

The optional header for several streams contains a timestamp counter. (Timestamp in Audio stream only after firmware version 2.0)

The time stamp counter is a 64 bits counter, represents the number of ns elapsed since midnight January 1st ,1970 (not counting leap seconds). This is similar to the POSIX time or Unix epoch time, except that the stored timestamp is in ns (the POSIX time is in seconds).

Remark:
The epoch time is 00:00:00 UTC on January 1, 1970.
Since the PR100 has no Time zone setting, assumed is that the user has configured the PR100 with the UTC time. If different time zones are used it is impossible to compare the timestamps without time zone correction.

Note:
The representation of the time stamp is in ns, the granularity is 1 ms. For IF-PAN, PSCAN and AUDIO the timestamp is the time at reading the FFT or AUDIO stream packet from the DSP.

Example Timestamp:

Timestamp counter = 1240930200000000000
=> UTC time = 1240930200000000000 ns passed passed January 1st 1970.
=> Timestamp = April 28th 2009, 14:50:00 (UTC)

Audio Streaming

Data is output when the following conditions are all true:

- Audio stream is enabled
- Audio mode is not equal to zero
- Audio recording is not active
- Audio replay is not active
- PSCan is not running
- FSCan and MSCan are not in the running state, see Figure 11-2 (p. 156)
- Trace replay is not active

The only applicable selector flag is “OPTIONAL_HEADER”. All other flags have no influence on the format of the audio stream. Data is always sent with the SWAP flag set, independent of whether the SWAP flag has been configured for this stream or not. The header field <trace number of items> is the number of audio frames (see Table 13-8 *(p. 359)*) in a packet.

Table 13-5: UDP Stream, Audio Format

(<optional header> and <trace data>)

32-bit aligned	**8-bit aligned**	**16-bit aligned**	**8-bit aligned**
Audio mode		Audio frame len	
Audio frequency low (4 bytes)			
Audio bandwidth			
Audio demodulation id		Audio demodulation mode (8 bytes)	
		Audio frequency high (4 bytes)	
		Reserved (6 bytes)	
Audio timestamp (8 bytes)			
Trace data: n audio frames (**byte**, **short** or **long**, depending on audio frame length , see Table 13-8 (p. 359)			

(Format Trace for 1 channel, 8 bits)

8-bit aligned
(Left & Right)$_n$

(Format Trace for 2 channels, 8 bits)

16-bit aligned	
MSB	LSB
Right $_n$	Left $_n$

(Format Trace for 1 channel, 16 bits)

16-bit aligned
(Left & Right)$_n$

(Format Trace for 2 channels, 16 bits)

32-bit aligned	
MSB	LSB
Right $_n$	Left $_n$

Table 13-6: UDP Stream, Audio Data Types

Terminal	**C Data Type**	**Remarks**
<AUDio audio mode>	short	See Table 13-8 (p. 359) (Format ID)

<AUDio frame len>	short	See See Table 13-8 (p. 359) (Frame Length)
<AUDio frequency low>	unsigned long	Lower 32 bits of output of SENS:FREQ:CW? in Hz
<AUDio bandwidth>	unsigned long	Output of SENS:BAND:RES? in Hz
<AUDio demodulation id>	unsigned short	Output of SENS:DEM? acc. to Table 13-7 (p. 359) (Identifier column)
<AUDio demodulation mode>	char[8]	See column “Demodulation-Mode” in Table 13-7 (p. 359).
<AUDio frequency high>	unsigned long	Upper 32 bits of output of SENS:FREQ:CW? in Hz
<AUDio timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

Table 13-7: UDP Stream, Demodulation Modes and Identifiers

(modes 0 – 6 are compatible with EB200)

Demodulation-Mode	Identifier	EB200
FM	0	Compatible
AM	1	Compatible
PULS	2	Compatible
CW	3	Compatible
USB	4	Compatible
LSB	5	Compatible
IQ	6	Compatible
ISB	7	New

Table 13-8: UDP Stream, Audio Data Formats

(All compatible with EB200, except 1 for the GSM format that is not supported in the PR100).
Each channel is sampled at a certain rate (second column) with a number of bits accuracy (third column).
There is one special format in this table, mode 0, in which no data is sent.

Format ID	Sample Rate	Bit per Sample	Channels	Data Rate	Frame Length
	[kHz]			[kByte/s]	[Bytes]
0	-	-	-	0	-
1	32	16	2	128	4
2	32	16	1	64	2
3	32	8	2	64	2
4	32	8	1	32	1
5	16	16	2	64	4
6	16	16	1	32	2
7	16	8	2	32	2

8	16	8	1	16	1
9	8	16	2	32	4
10	8	16	1	16	2
11	8	8	2	16	2
12	8	8	1	8	1

FScan streaming

All selector flags (see Table 13-3 (p. 355)) are applicable for this stream.

Data is output when the following conditions are all true:

- Frequency Mode equals SWEep (state is not stopped, see Figure 11-2 (p. 156)
- Trace replay is not active

Table 13-9: FScan UDP Format

(<optional header> and <trace data>)

32-bit aligned	**8-bit aligned**	**16-bit aligned**	**8-bit aligned**
FScan cycle count		FScan hold time	
FScan dwell time		FScan direction up	
FScan stop signal		FScan start frequency low (4 bytes)	
		FScan stop frequency low (4 bytes)	
		FScan frequency step (4 bytes)	
		FScan start frequency high (4 bytes)	
		FScan stop frequency high (4 bytes)	
		reserved (2bytes)	
FSCAN timestamp (8 bytes)			
trace data: (where n = <trace number of items>) n times **short**, in case <trace selector flags> has LEVEL set			
n times **long**, in case <trace selector flags> has OFFSET set			
n times **short**, in case <trace selector flags> has FSTRENGTH set			
n times **short**, in case <trace selector flags> has CHANNEL set			
n times **unsigned long**, in case <trace selector flags> has FREQ_LOW set			
n times **unsigned long**, in case <trace selector flags> has FREQ_HIGH set			

Table 13-10: FScan UDP Data Types

Terminal	C Data Type	Remarks
<FScan cycle count>	short	Output of "SENS:SWE:COUN"? Range: [1, 1000] Infinity: 1001
<FScan hold time>	short	Output of "SENS:SWE:HOLD:TIME"? in ms
<FScan dwell time>	short	Output of "SENS:SWE:DWEL"? in ms Infinity: 65535 (0xFFFF)
<FScan direction up>	short	Output of "SENS:SWE:DIR"? acc. to 1 = Increasing frequency 0 = Decreasing frequency
<FScan stop signal>	short	Output of "SENS:SWE:CONT:ON"? acc, to 0 = Off 1 = On
<FScan start frequency low>	unsigned long	Lower 32 bits of output of "SENS:FREQ:STAR"? in Hz
<FScan stop frequency low>	unsigned long	Lower 32 bits of output of "SENS:FREQ:STOP"? in Hz
<FScan frequency step>	unsigned long	Output of "SENS:FREQ:STEP:INCR"? in Hz
<FScan start frequency high>	unsigned long	Upper 32 bits of output of "SENS:FREQ:STAR"? in Hz
<FScan stop frequency high>	unsigned long	Upper 32 bits of output of "SENS:FREQ:STOP"? in Hz
<FScan timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

MScan streaming

All selector flags (see Table 13-3 (p. 355)) are applicable for this stream.

Data is output when the following conditions are all true:

- Frequency Mode equals MSCan (state is not stopped, see Figure 11-2 (p. 156)
- Trace replay is not active

Table 13-11: MScan UDP Format

(<optional header> and <trace data>)

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
MScan cycle count		MScan hold time	
MScan dwell time		MScan direction up	
MScan stop signal		reserved (2 bytes)	
trace data: (where n = <trace number of items>): n times **short**, in case <trace selector flags> has LEVEL set			
n times **long**, in case <trace selector flags> has OFFSET set			
n times **short**, in case <trace selector flags> has FSTRENGTH set			
n times **short**, in case <trace selector flags> has CHANNEL set			
n times **unsigned long** in case <trace selector flags> has FREQ_LOW set			

n times **unsigned long** in case <trace selector flags> has FREQ_HIGH set

Table 13-12: MScan UDP Data Types

Terminal	C Data Type	Remarks
<MScan cycle count>	short	Output of "SENS:MSC:COUN"? Range: [1, 1000] Infinity: 1001
<MScan hold time>	short	Output of "SENS:MSC:HOLD:TIME"? in ms
<MScan dwell time>	short	Output of "SENS: MSC:DWEL"? in ms Infinity: 65535 (0xFFFF)
<MScan direction up>	short	Output of "SENS:MSC:DIR"?: 1 = Increasing frequency 0 = Decreasing frequency
<MScan stop signal>	short	Output of "SENS:MSC:CONT:ON"?: 0 = Off 1 = On

CW streaming

All selector flags (see Table 13-3 (p. 355)) are applicable for this stream.

Data is output when the following conditions are all true:

- Frequency Mode equals CW
- Measurement Mode is PERiodic
- Trace replay is not active

Table 13-13: CW UDP Format

(<optional header> and <trace data>)

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
CW frequency low (4 bytes)			
CW frequency high (4 bytes)			
CW timestamp (8 bytes)			
trace data: (where n = <trace number of items>) n times **short**, in case <trace selector flags> has LEVEL set			
n times **long**, in case <trace selector flags> has OFFSET set			
n times **short**, in case <trace selector flags> has FSTRENGTH set			

n times **short**, in case <trace selector flags> has CHANNEL set
n times **unsigned long**, in case <trace selector flags> has FREQ_LOW set
n times **unsigned long**, in case <trace selector flags> has FREQ_HIGH set

Table 13-14: CW UDP Data Types

Terminal	C Data Type	Remarks
<CW frequency low>	unsigned long	Lower 32 bits of output of SENS:FREQ:CW in Hz
<CW frequency high>	unsigned long	Upper 32 bits of output of SENS:FREQ:CW in Hz
<CW timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

IFPan streaming

The IFPan stream contains the level information for all frequencies of an IF panorama (not just the visible ones). That way, a program on a remote client can display the panorama view itself in its own way. The number of frequencies in an IFPan packet varies with the screen resolution.

The applicable selector flags (see in Table 13-3 (p. 355)) are "LEVEL", "SWAP" and "OPTIONAL_HEADER".

Data is output when the following conditions are all true:

- Frequency Mode equals CW
- Trace replay is not active

Table 13-15: IFPan UDP Format

(<optional header> and <trace data>)

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
IFPan frequency low (4 bytes)			
IFPan span frequency (4 bytes)			
IFPan reserved (2 bytes)		IFPan average type (2 bytes)	
IFPan measure time (4 bytes)			
IFPan frequency high (4 bytes)			
IFPan selected channel (4 bytes)			
IFPan demodulation frequency low (4 bytes)			
IFPan demodulation frequency high (4 bytes)			
IFPan timestamp (8 bytes)			
trace data: (where n = <trace number of items>) n times **short**, in case <trace selector flags> has LEVEL set			

Table 13-16: IFPan UDP Data Types

Terminal	C Data Type	Remarks
<IFPan frequency low>	unsigned long	Lower 32 bit of center of IFPan span ("SENS:FREQ:CW"?) in Hz
<IFPan span frequency>	unsigned long	Output of "SENS:FREQ:SPAN"? in Hz
<IFPan reserved>	Short	Always 0; this field is not used
<IFPan average type>	Short	Always set to OFF (3), regardless of the output of "CALC:IFP:AVER:TYPE"?.
<IFPan measure time>	unsigned long	Output of "MEAS:TIME"? in µs. 0 µs is used for DEFault.
<IFPan frequency high>	unsigned long	Upper 32 bit of center of IFPan span ("SENS:FREQ:CW"?) in Hz
<IFPan selected channel>	unsigned long	Always 800 (0x320)
<IFPan demodulation freq. low>	unsigned long	Same as <IFPan frequency low>
<IFPan demodulation freq. high>	unsigned long	Same as <IFPan frequency high>
<IFPan timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

IF streaming

The IF stream contains source IQ data. Although the Audio stream can also contain data in IQ form, it is not the same as this stream. This stream is the source for the audio demodulation: The Audio IQ is obtained by processing this stream. For the IF stream, the data rate can be very high: 640 kSamples/second. It has 2 channels and 16 bit per sample. At the maximum sample rate of 640k per second, the total data-rate is 2.56 MByte/s.

The only applicable selector flag is "OPTIONAL_HEADER". All other flags have no influence on the format of the IF stream. Data is always sent with the SWAP flag set, independent of whether the SWAP flag has been configured for this stream or not.

Data is output when the following conditions are all true:

- PSCan state is not running, see Figure 11-2 (p. 156)
- FSCan state is not running, see Figure 11-2 (p. 156)
- MSCan state is not running, see Figure 11-2 (p. 156)
- Trace replay is not active
- IQ-data recording is not active

Table 13-17: IF UDP Format

(<optional header> and <trace data>)

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
IF mode		IF frame length	
IF sample rate			

IF frequency low (4 bytes)	
IF bandwidth	
IF demodulation id	IF RX attenuation
IF flags	IF reserved (2 bytes)
IF demodulation mode (8 bytes)	
IF sample count (8 bytes)	
IF frequency high (4 bytes)	
IF reserved2 (4 bytes)	
IF timestamp (8 bytes)	
I sample nr 1	Q sample nr 1
I sample nr 2	Q sample nr 2
.....	.....
I sample nr <trace number of items>	Q sample nr <trace number of items>

Table 13-18: IF UDP Data Types

Terminal	C Data Type	Remarks
<IF mode>	short	Always 1
<IF frame length>	short	Number of bytes for each IQ sample-pair: always 4.
<IF sample rate>	long	Sampling rate in samples/s
<IF frequency low>	unsigned long	Lower 32 bits of output of "SENS:FREQ:CW"? in Hz
<IF bandwidth>	unsigned long	Output of "SENS:BAND:RES"? in Hz
<IF demodulation id>	unsigned short	Output of SENS:DEM" acc. to Table 13-7 (p. 359) (Identifier column)
<IF RX attenuation>	short	Always 0
<IF flags>	short	Validity flags: 0 during instrument settling, 1 otherwise
<IF reserved>	char[2]	reserved for 64-bit alignment
<IF demodulation mode>	char[8]	
<IF sample count>	long long	Sequence number of first sample in packet
<IF frequency high>	unsigned long	Higher 32 bits of output of "SENS:FREQ:CW"? in Hz
<IF reserved2>	char[4]	Reserved
<IF timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

PSCAN streaming

A PSCAN in consists of several FFT measurements in a row. Each FFT consists of x samples, where x depends on the RF Panorama Scan Resolution BW. Max x = 3199 and Min x = 99 samples, with 16 bit per sample.

The applicable selector flags (see Table 13-3 (p. 355)) are "LEVEL", "FREQ_LOW", "FREQ_HIGH", "SWAP" and "OPTIONAL_HEADER".

Data is output when the following conditions are all true:

- PSCan state is running, see Figure 11-2 (p. 156)
- Trace replay is not active
- Trace recording is not active

Table 13-19: Pscan UDP Format

(<optional header> and <trace data>)

32-bit aligned	8-bit aligned	16-bit aligned	8-bit aligned
PSCAN start frequency low (4 bytes)			
PSCAN stop frequency low (4 bytes)			
PSCAN step frequency (4 bytes)			
PSCAN start frequency high (4 bytes)			
PSCAN stop frequency high (4 bytes)			
PSCAN reserved (4 bytes)			
PSCan timestamp (8 bytes)			
FFT LEVEL nr 1 (in case <trace selector flags> has LEVEL set)		FFT LEVEL nr <trace number of items> (in case <trace selector flags> has LEVEL set)	
FFT FREQUENCY LOW nr 1 (in case <trace selector flags> has FREQ_LOW set)			
FFT FREQUENCY LOW nr <trace number of items> (in case <trace selector flags> has FREQ_LOW set)			
FFT FREQUENCY HIGH nr 1 (in case <trace selector flags> has FREQ_HIGH set)			
FFT FREQUENCY HIGH nr <trace number of items> (in case <trace selector flags> has FREQ_HIGH set)			

To indicate the end of the PSCAN, a unique "end marker" sample for each trace is inserted into the stream. The marker sample value depends on the trace and is specified in Table 13-4 (p. 356).

Note1:

Analyzer 2000 uses the trace selector flag LEVEL, FREQ_LOW and FREQ_HIGH to support frequencies > 4 GHz. Analyzer 2000 V5.05 + patch is required.
The patch contains RSRxDrv.dll date 9-oct-2007, size 92Kbyte.

Note2:

Analyzer 2000 supports the PSCAN stream RUN+ only.

Table 13-20: Pscan UDP Data Types

Terminal	C Data Type	Remarks
<PSCAN start frequency low>	unsigned long	Lower 32 bits of output of "SENS:FREQ:STAR"? in Hz
<PSCAN stop frequency low>	unsigned long	Lower 32 bits of output of

		"SENS:FREQ:STOP"? in Hz
<PSCAN step frequency>	unsigned long	Output of "SENS:FREQ:STEP:INCR"? in Hz
<PSCAN start frequency high>	unsigned long	Higher 32 bits of output of "SENS:FREQ:STAR"? in Hz
<PSCAN stop frequency high>	unsigned long	Higher 32 bits of output of "SENS:FREQ:STOP"? in Hz
<PSCAN fft level> (x time)	short	Level (n) in dBµV
<PSCAN frequency low> (x time)	unsigned long	Lower 32 bits of the frequency of level (n)
<PSCAN frequency high> (x time)	unsigned long	higher 32 bits of the frequency of level (n)
<PSCAN reserved>	char[4]	Reserved
<PSCan timestamp>	unsigned long long	64 bit timestamp counter, indicates #ns after January 1, 1970.

x = the FFT length. This depends on the RBW.
n = sample number. 0 <= n < FFT length

The start and stop frequency stored in the option header are the start and stop frequency the user has configured for PSCAN. The first sample of the PSCAN stream will be the level at the start frequency. Since it is possible to configure a stop frequency which is not a multiple of the PSCAN RBW, the last sample is not measured at the PSCAN stop frequency. The PR100 will round off the PSCAN nrOfSamples to + 1 if the span is not a multiple of the PSCAN RBW.

A PR100 PSCAN stream client knows the frequency of a level by:
(assuming the scan direction is RUN(+))

1) Use the trace selector flag FREQ_LOW and FREQ_HIGH.

2) If the trace selector flag FREQ_LOW and FREQ_HIGH are not used, by calculating:

$$f(level\ n) = f(start) + n\ * RBW$$

where:

n = PSCAN sample number, starting from 0 at the PSCAN start frequency.

$f(start)$ = PSCAN start frequency,

RBW = "RF Panorama Scan Resolution BW"

Figure 13-1 (p. 368) shows the payload of a PSCAN UDP package where the trace selector flags "LEVEL", "FREQ_LOW", "FREQ_HIGH", and "OPTIONAL_HEADER" are set.

A PSCAN cycle is a single scan from start till the stop frequency.
The last sample of a cycle will be the "end marker" value.
A single PSCAN cycle consist of 1 or more PSCAN UDP packges.

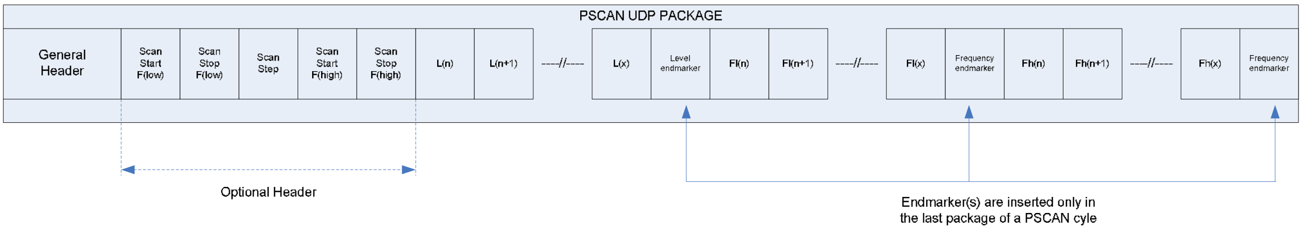


Figure 13-1: Payload PSCAN UDP Package

Note

The PSCAN stream is available during a running PSCAN only.

- To enable a PSCAN stream including LEVEL, FREQ_LOW and FREQ_HIGH:
  If stream client is 172.17.75.50:19000 :
  `Trace:Udp:Tag:On "172.17.75.50", 19000, PSCAN`
  `Trace:Udp:flag:on "172.17.75.1", 19000, "FREQ:LOW:rx", "FREQ:HIGH:rx", "VOLT:AC"`
- * To get an overview of all UDP streams:
  `Trace:Udp?`
- * To delete all UDP streams:
  `Trace:Udp:Delete ALL`

14 Data structure recorded files

IQ record files

For IQ recording the IQ UDP stream is stored in a file. So the structure is equal to the IF UDP data stream defined in section “IF streaming” (p. 364).

Trace record files

For trace recording the IF-PAN and RF-PAN data streams are stored in a file. If the user change between PSCAN and FFM the record file will contain RF-PAN (for PSCAN mode) and IF-PAN (for FFM mode) packets. The stored IF-PAN / RF-PAN packets are equal to the UDP IF-PAN and RF-PAN packets as defined in section “IFPan streaming” (p. 363) and section “PSCAN streaming” (p. 365).

Except the IF-PAN and RF-PAN packets, “Trace Info” packets are stored into the file. These packets are used for the PR100 internal trace replay functionality only and are not specified in this document. The “Trace Info” packets can be recognized by the header field <magic number> = 0xFF100. To use the recorded trace data on a PC the “trace info” packets shall be skipped.

The figure below gives a representation of a trace record file. In this example the first packet of the stream is a “Trace info” Packet. The packet header contains the field <attribute_length>, see also section “Stream Packet Structure” (p. 354). By using the <attribute_length> the location of the next packet can be calculated. In this example the next packet is a RF-PAN or IF-PAN packet. The <attribute tag> field in the header indicates if it is a RF- or IF-PAN trace packet. See also section “Stream Packet Structure” (p. 354).

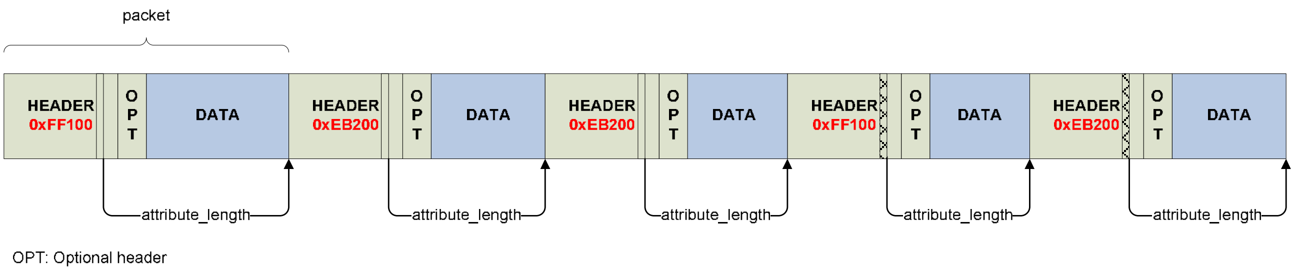


Figure 14-1: Trace record file contents

Audio record files

For audio recording the audio data is stored in a .WAV (PCM) format.

A proprietary subchunk with identification string “rsti” (Rohde&Schwarz Timestamp Information) is used to store timestamps. The resulting WAV file structure is as follows:

Table 14-1: WAV file structure

Offset	Size	Name	Description
0	4	ChunkID	Contains the string "RIFF" (0x52494646 big-endian)
4	4	ChunckSize	36 + SubChunk2Size
8	4	Format	Contains the string "WAVE" (0x57415645 big-endian)

12	4	SubChunck1ID	Contains the string "fmt " (0x666d7420 big-endian)
16	4	SubChunk1Size	16
20	2	AudioFormat	1 (= PCM)
22	2	NumOfChannels	1 (mono) or 2 (stereo), depending on audio format
24	4	SampleRate	Number of frames per second: 32000, 16000 or 8000, depending on audio format
28	4	ByteRate	Number of bytes per second: SampleRate * BlockAlign
32	2	BlockAlign	Frame length (number of bytes per frame): 1, 2 or 4, depending on audio format
34	2	BitsPerSample	Number of bits per (single channel) sample: 8 or 16, depending on audio format
36	4	SubChunck2ID	Contains the string "data" (0x64617461 big-endian)
40	4	SubChunck2Size	Number of audio data bytes following this header (n1)
44	<n1>	Audio data	Audio data samples
44+<n1>	4	SubChunk3ID	Contains the string “rsti” (0x72737469 big endian)
48+<n1>	4	SubChunk3Size	8 + n2, where n2 = 16 * <nr. of timestamps>
52+<n1>	4	TimestampVersion	1
56+<n1>	4	AudioDataSize	Copy of Subchunk2Size (for sanity check)
60+<n1>	<n2>	TimestampList	List of timestamps (see below)

Each timestamp entry in the TimestampList has the following structure:

Table 14-2: WAV file timestamp structure

Offset	Size	Name	Description
0	8	Timestamp	Timestamp value (in nanoseconds)
4	4	Offset	Byte offset from the beginning of audio data of the audio data sample for which this timestamp applies
8	4	Size	Nr. of bytes for which the timestamp is valid

15 Default Values

CALCulation subsystem

Table 15-1: CALCulation default values

Description	Command [CALC:]	Factory Default	Min	Max	Unit	*RST	PWR ON
IFPAN Average type	IFP:AVER:TYPE	MAX	NA	NA	enum	+	-
PSCAN Average type	PSC:AVER:TYPE	MAX	NA	NA	enum	+	-

DISPlay subsystem

Table 15-2: DISPlay default values

Item	Command [DISP:]	Factory Default	Min	Max	Unit	*RST	PWR ON
Brightness	BRIG	0.5	0.01	1.0	steps	+	-
Color map	CMAP	IND			enum	+	-
Date format	DATE:FORM	DDMM			date	-	-
Display fieldstrength information	FSTR	0			bool	+	-
IFPAN level range	IFP:LEV:RANG	60.0	10.0	140.0	steps	+	-
IFPAN signal level max	IFP:LEV:REF	50.0	-30.0	110.0	dBµV	+	-
Level bar lower limit	LEV:LIM:MIN	-10.0	-30.0	110.0	dBµV	+	-
Level bar range	LEV:RANG	60.0	30.0	90.0	dB	+	-
PSCAN signal level range	PSC:LEV:RANG	60.0	10.0	140.0	dB	+	-
PSCAN signal level max	PSC:LEV:REF	50.0	-30.0	110.0	dBµV	+	-
Waterfall signal level range	WAT:CMAP:RANG	60.0	10.0	140.0	dB	+	-
Waterfall signal level threshold	WAT:CMAP:THR	50	-30	110	dBµV	+	-
Waterfall hold	WAT:HOLD	1	0	1	bool	+	-
Waterfall speed	WAT:SPEE	20			lines/s	+	-
Window mode	WIND	RX +Spectrum			enum	+	-

FORMat subsystem

Table 15-3: FORMat default values

Item	Command [FORM:]	Factory Default	Min	Max	Unit	*RST	PWR ON
Binary data byte order	BORD	NORM	NA	NA	NA	+	+
Binary output data format	DATA	ASC	NA	NA	NA	+	+
Binary memory data format	MEM	ASC	NA	NA	NA	+	+
Status register data format	SREG	ASC	NA	NA	NA	+	+

INPut subsystem

Table 15-4: INPut default values

Item	Command [INP:]	Factory Default	Min	Max	Unit	*RST	PWR ON
Input attenuation	ATT	0	0	1	bool	+	-

MEASurement subsystem

Table 15-5: MEASurement default values

Item	Command [MEAS:]	Factory Default	Min	Max	Unit	*RST	PWR ON
Measurement Mode	MODE	CONT	None	None	enum	+	-
Measurement Time	TIME	DEF	0.5m	900	s	+	-

MEMory subsystem

Table 15-6: MEMory default values

Item	Command: [MEM:]	Factory Default	Min	Max	Unit	*RST	PWR ON
First mem save location direct	SAVE:DIR:STAR	600	0	1023		+	-
Last mem save location direct	SAVE:DIR:STOP	799	0	1023		+	-

OUTPut subsystem

Table 15-7: OUTPut default values

Item	Command: [OUTP:]	Factory Default	Min	Max	Unit	*RST	PWR ON
antenna selection bits	BITA:STAT	0	-	-	-	+	-
Antenna selection bits	BYTA:STAT	0	-	-	-	+	-
IF state	IF:STAT	0	-	-	bool	+	-
Squelch from memory	SQU:CONT	NONE	-	-	enum	+	-
Squelch state	SQU:STAT	0	-	-	bool	+	-
Squelch autosave	SQU:STOR	0	-	-	bool	+	-
Squelch threshold	SQU:THR	0.0	-30.0	110.0	dBµV	+	-
Tone control	TONE:CONT	ONLY	-	-	enum	+	-
Tone gain	TONE:GAIN	-	-	-	oct/dB	+	-
Tone state	TONE:STAT	0	-	-	bool	+	-
Tone threshold	TONE:THR	0.0	-14.0	94.0	dBµV	+	-

SENSe subsystem

Table 15-8: SENSe default values

Item	Command: [SENS:]	Factory Default	Min	Max	Unit	*RST	PWR ON
Current IF bandwidth	BAND	150k	150	500k	Hz	+	-
Selected antenna correction	CORR:ANT	PASS	-	-	enum	+	-
Demodulation type	DEM	FM	-	-	enum	+	-
Beat frequency	DEM:BFO:FREQ	1k	-8k	8k	Hz	+	-
Detector function	DET	PEAK	-	-	enum	+	-
AFC function	FREQ:AFC	0	-	-	bool	+	-
Frequency conversion threshold	FREQ:CONV:THR	25M	9k	30M	Hz	+	-

RX frequency	FREQ	100M	9k	7.5G	Hz	+	-
Receiver mode	FREQ:MODE	CW	-	-	enum	+	-
PSCAN frequency center	FREQ:PSC:CENT	-	-	-	-	+	-
PSCAN frequency span	FREQ:PSC:SPAN	-	-	-	-	+	-
PSCAN frequency start	FREQ:PSC::STAR	88M	9K	100G	Hz	+	-
PSCAN frequency stop	FREQ:PSC::STOP	108M	9K	100G	Hz	+	-
IFPAN frequency span	FREQ:SPAN	10M	10k	10M	Hz	+	-
FSCAN frequency start	FREQ:STAR	88M	9K	100G	Hz	+	-
FSCAN frequency stop	FREQ:STOP	108M	9K	100G	Hz	+	-
Detector functions concurrent	FUNC:CONC	1	-	-	bool	+	-
Detector functions off	FUNC:OFF	(1)	-	-	string	+	-
Detector functions off counter	FUNC:OFF:COUN	3	-	-	-	+	-
Detector functions on	FUNC:ON	""	-	-	string	+	-
Detector functions on counter	FUNC:ON:COUN	0	-	-	-	+	-
Gain control	GCON	50	-30	110	dB	+	-
Gain control mode	GCON:MODE	AUTO	-	-	enum	+	-
MSCAN current mem location	MSC:CHAN	0	-	-	-	+	-
MSCAN control mechanisms off	MSC:CONT:OFF	""	-	-	string	+	-
MSCAN control mechanisms on	MSC:CONT:ON	STOP:SIGN	-	-	string	+	-
MSCAN number of scans	MSC::COUN	INF	1	1000/INF	-	+	-
MSCAN scan direction	MSC:DIR	UP	-	-	enum	+	-

MSCAN dwell time	MSC:DWEL	0.5	0.0	60.0/INF	s	+	-
MSCAN hold time	MSC:HOLD:TIME	0.0	0.0	60.0	s	+	-
MSCAN memory list start	MSC:LIST:STAR	0	-	-	-	+	-
MSCAN memory list stop	MSC:LIST:STOP	99	-	-	-	+	-
PSCAN number of scans	PSC:COUN	INF	1	1000/INF		+	-
PSCAN FFT bin width	PSC:STEP	12.5k	125	100k	Hz	+	-
Oscillator ext reference frequency	ROSC:EXT:FREQ	-	-	-	Hz	+	-
Oscillator int reference frequency	ROSC:INT:FREQ	-	-	-	Hz	+	-
Oscilator source	ROSC:SOUR	INT	-	-	enum	+	-
FSCAN control mechanisms off	SWE:CONT:OFF	""	-	-	string	+	-
FSCAN control mechanisms on	SWE:CONT:ON	STOP:SIG N	-	-	string	+	-
FSCAN number of scans	SWE::COUN	INF	1	1000/INF	-	+	-
FSCAN scan direction	SWE:DIR	UP	-	-	enum	+	-
FSCAN dwell time	SWE:DWEL	0.5	0.0	60.0/INF	s	+	-
FSCAN hold time	SWE:HOLD:TIME	0.0	0.0	60.0	s	+	-
FSCAN step	SWE:STEP	100k	1	1G	Hz	+	-

STATus subsystem

Table 15-9: STATus default values

Item	Command: [STAT:]	Factory Default	Min	Max	Unit	*RST	PWR ON	*CLS
operation condition section	OPER:COND	0	0	65535	value	-	-	-
operation enable section	OPER:ENAB	0	0	65535	value	-	+	-

operation event section	OPER:EVEN	0	0	65535	value	-	+	-
operation negative transition	OPER:NTR	0	0	65535	value	-	+	-
operation positive transition	OPER:PTR	65535	0	65535	value	-	+	-
error queue	QUE	0,"No error"	-	-	string	-	+	+

SYSTem subsystem

Table 15-10: SYSTem default values

Item	Command: [SYST:]	Factory Default	Min	Max	Unit	*RST	PWR ON
audio balance	AUD:BAL	0.0	-0.5	0.5	-	+	-
audio volume	AUD:VOL	0.30	0.00	1.00	-	+	-
audio output	AUD:OUTP	-	-	-	-	+	-
beep volume	BEEP:VOL	0.30	0.00	1.00	-	+	-
LAN MAC address	COMM:LAN:ETH	mac address	-	-	-	-	-
LAN submask	COMM:LAN:SUBM	255.255.255.0	-	-	-	-	-
LAN socket address	COMM:SOCK:ADDR	172.17.75.1	-	-	-	-	-
LAN DHCP protocol enabled	COMM:SOCK:DHCP	0	-	-	bool	-	-
LAN socket port	COMM:SOCK:PORT	5555	0	65535	16 bit	-	-
keyclick volume	KCL:VOL	-	-	-	-	-	-

TRACe subsystem

Table 15-11: TRACe default values

Item	Command: [TRAC:]	Factory Default	Min	Max	Unit	*RST	PWR ON
data catalog	CAT	-	-	-	-	-	-
data memory fill mode	FEED:CONT	-	-	-	-	-	-

16 References

Reference	Version	Title
[SCPI]	v1999.0	Standard Commands for Programmable Instruments. IVI Foundation, http://www.ivifoundation.org/docs/SCPI-99.PDF