

Operating Manual



Signal Analyzer

R&S® FSV3

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R&S® FSV7

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Grouped Safety Messages









Make sure to read through and observe the following safety instructions!







All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, 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 an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

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

Symbols and safety labels

							
Observe product documentation	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

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

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 putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety 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.

Grouped Safety Messages

Tags and their meaning

DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	NOTICE indicates a property damage message.

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 thus contribute to personal injury or material damage.

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
A tolerance of $\pm 10\%$ shall apply to the nominal voltage and of $\pm 5\%$ to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel 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).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.
4. If products/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, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

Grouped Safety Messages

5. If handling the product yields 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.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured 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.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. 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.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured 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. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. 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, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. 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).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. 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.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. 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.
19. 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 license electrician.

Grouped Safety Messages

20. 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 suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of liquids, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. 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).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.
34. Prior to cleaning, disconnect the product from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluent for cellulose lacquers.

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. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE 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 despreciando las informaciones de seguridad 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 dentro de las instrucciones de la correspondiente documentación de 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 profundos y conocimientos básicas del idioma inglés. Por eso se debe tener en cuenta que el producto sólo pueda ser operado por personal especializado o personas minuciosamente instruidas con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará 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 entréguela a usuarios posteriores.

Símbolos y definiciones de seguridad

							
Ver documentación de producto	Informaciones para maquinaria con un peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electroestática

					
Potencia EN MARCHA/PARADA	Indicación Stand-by	Corriente continua DC	Corriente alterna AC	Corriente continua/- alterna DC/AC	El aparato está protegido en su totalidad por un aislamiento de doble refuerzo

Informaciones elementales de seguridad

Tener en cuenta las informaciones de seguridad sirve para tratar de evitar daños y peligros de toda clase. Es necesario de que se lean las siguientes informaciones de seguridad concienzudamente y se tengan en cuenta debidamente antes de la puesta en funcionamiento del producto. También deberán ser tenidas en cuenta las informaciones para la protección de personas que encontrarán en el capítulo correspondiente de la documentación de producto y que también son obligatorias de seguir. En las informaciones de seguridad actuales hemos juntado todos los objetos vendidos por el grupo de empresas Rohde & Schwarz bajo la denominación de „producto“, entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Palabras de señal y su significado

PELIGRO	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
AVISO	Indica la posibilidad de utilizar mal el producto y a 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 de 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 malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S 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, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal.
2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal especializado autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de la corriente conductora, control de funcionamiento).

Informaciones elementales de seguridad

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se produjeran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.
 4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
 5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberán ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
 6. Ciertos productos, como por ejemplo las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética.
- El empresario/usuario está comprometido a valorar y señalar áreas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.
7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
 8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del producto.
 9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
 10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro que es controlado su estado técnico de seguridad.
 11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, 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 instalar el interruptor al nivel de la instalación.

Informaciones elementales de seguridad

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).
14. 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. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{eff} > 30 \text{ V}$ se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos del estándar IEC950/EN60950.
18. 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 heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir cortocircuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.
22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra líquidos si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usuario o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

Informaciones elementales de seguridad

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención células de litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.
28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.
29. El producto puede poseer un peso elevado. Muévelo con cuidado para evitar lesiones en la espalda u otras partes corporales.
30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).
31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetos de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean observadas. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.
32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.
33. Dado el caso de que esté integrado un producto de láser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo láser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo láser.
34. Antes de proceder a la limpieza, desconecte el producto de la red. Realice la limpieza con un paño suave, que no se deshilache. No utilice de ninguna manera agentes limpiadores químicos como, por ejemplo, alcohol, acetona o nitrodiluyente.



ROHDE & SCHWARZ

Kundeninformation zur Batterieverordnung (BattV)

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

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

Safety Regulations for Batteries (according to BattV)

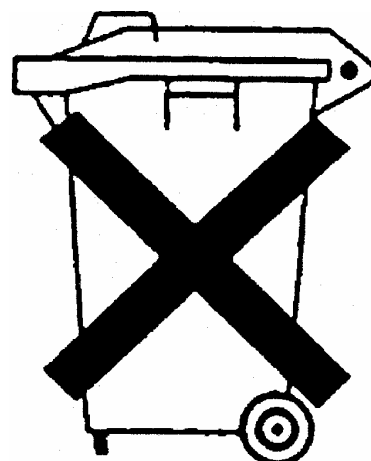
This equipment houses a battery containing harmful substances that must not be disposed of as normal household waste.

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

Normas de Seguridad para Baterías (Según BattV)

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

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



Consignes de sécurité pour batteries (selon BattV)

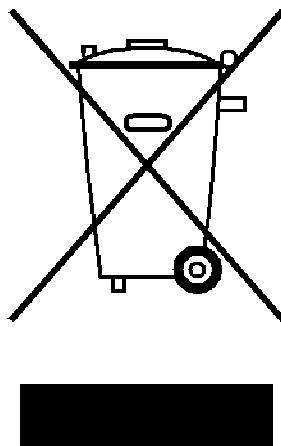
Cet appareil est équipé d'une pile comprenant des substances nocives. Ne jamais la jeter dans une poubelle pour ordures ménagères.

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

Customer Information Regarding Product Disposal

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

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



Product labeling in accordance with EN 50419

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

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

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



Certified Quality System

DIN EN ISO 9001 : 2000
DIN EN 9100 : 2003
DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

QUALITÄTSZERTIFIKAT

Sehr geehrter Kunde,
Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Managementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz Managementsystem ist zertifiziert nach:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICATE OF QUALITY

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

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICAT DE QUALITÉ

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

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004





ROHDE & SCHWARZ
EC Certificate of Conformity



Certificate No.: 2008-44

This is to certify that:

Equipment type	Stock No.	Designation
FSV3	1307.9002.03	Signal Analyzer
FSV7	1307.9002.07	
FSV-B3	1310.9516.02	Audio Demodulator
FSV-B4	1310.9522.02	OCXO Reference Frequency
FSV-B5	1310.9539.02	Additional Interfaces
FSV-B19	1310.9574.02	Second Hard Disk

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

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

Conformity is proven by compliance with the following standards:

EN 61010-1 : 2001
EN 61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003
EN 55011 : 1998 + A1 : 1999 + A2 : 2002, Klasse A
EN 61000-3-2 : 2000 + A2 : 2005
EN 61000-3-3 : 1995 + A1 : 2001

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

Affixing the EC conformity mark as from 2008

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

Munich, 2008-06-18

Central Quality Management MF-QZ / Radde

Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

USA & Canada

Monday to Friday (except US public holidays)
8:00 AM – 8:00 PM Eastern Standard Time (EST)

Tel. from USA 888-test-rsa (888-837-8772) (opt 2)
From outside USA +1 410 910 7800 (opt 2)
Fax +1 410 910 7801
E-mail CustomerSupport@rohde-schwarz.com

East Asia

Monday to Friday (except Singaporean public holidays)
8:30 AM – 6:00 PM Singapore Time (SGT)

Tel. +65 6 513 0488
Fax +65 6 846 1090
E-mail CustomerSupport@rohde-schwarz.com

Rest of the World

Monday to Friday (except German public holidays)
08:00 – 17:00 Central European Time (CET)

Tel. from Europe +49 (0) 180 512 42 42*
From outside Europe +49 89 4129 13776
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* 0.14 €/Min within the German fixed-line telephone network, varying prices for the mobile telephone network and in different countries.



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Please refer to our homepage: www.rohde-schwarz.com

- ◆ Sales Locations
- ◆ Service Locations
- ◆ National Websites

Documentation Overview

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

- ◆ Quick Start Guide
- ◆ ["Operating Manual"](#)
- ◆ ["Service Manual"](#)
- ◆ ["Online Help"](#)
- ◆ ["Release Notes"](#)

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. The manual includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Front and Rear Panel
Chapter 2	Putting into Operation
Chapter 3	Firmware Update and Installation of Firmware Options
Chapter 4	Basic Operations
Chapter 5	Basic Measurement Examples
Chapter 6	Brief Introduction to Remote Control
Appendix A	Printer Interface
Appendix B	LAN Interface

Operating Manual

This manual is a supplement to the Quick Start Guide and is available in PDF format on the CD delivered with the instrument. To retain the familiar structure that applies to all operating manuals of Rohde&Schwarz Test & Measurement instruments, the chapters 1 and 3 exist, but only in form of references to the corresponding Quick Start Guide chapters.

In this manual, all instrument functions are described in detail. For additional information on default settings and parameters, refer to the data sheets. The set of measurement examples in the Quick Start Guide is expanded by more advanced measurement examples. In addition to the brief introduction to remote control in the Quick Start Guide, a description of the commands and programming examples is given. Information on maintenance, instrument interfaces and error messages is also provided.

The manual includes the following chapters:

Chapter 1	Putting into Operation, see Quick Start Guide chapters 1 and 2
Chapter 2	Advanced Measurement Examples
Chapter 3	Manual Operation, see Quick Start Guide chapter 4
Chapter 4	Instrument Functions
Chapter 5	Remote Control - Basics
Chapter 6	Remote Control - Commands
Chapter 7	Remote Control - Programming Examples
Chapter 8	Maintenance
Chapter 9	Error Messages
Chapter 10	Firmware Option Analog Demodulation R&S FSV-K7
Chapter 11	Firmware Option Power Sensor R&S FSV-K9
Chapter 12	Firmware Option 3GPP BS Measurement R&S FSV-K72
Chapter 13	Firmware Option WiMAX, WiBro Measurements R&S FSV-K93

This manual is delivered with the instrument on CD only. The printed manual can be ordered from Rohde & Schwarz GmbH & Co. KG.

Service Manual

This manual is available in PDF format on the CD delivered with the instrument. It informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FSV by the replacement of modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

Online Help

The Online Help is part of the firmware. It provides a quick access to the description of the instrument functions and the remote control commands. For information on other topics refer to the Quick Start Guide, Operating Manual and Service Manual provided in PDF format on CD or in the Internet. For detailed information on how to use the Online Help, refer to the chapter "Basic Operations" in the Quick Start Guide.

Release Notes

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

Conventions Used in the Documentation

The following conventions are used throughout the R&S FSV Documentation:

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 parenthesis.
"KEYS"	Names of hardkeys are written in capital letters and enclosed by parenthesis.
<i>Input</i>	Input to be entered by the user is displayed in italics.
Program code	Coding samples, file extracts and screen output is displayed in Courier font.
→ Remote commands	Remote commands are introduced by a dash.
File names Commands	File names and commands are distinguished by their font.
"References"	References to other parts of the documentation are enclosed by parenthesis.
"Links"	Links that you can click to access the target are displayed in blue font and are enclosed by parenthesis.

Procedure descriptions

When describing how to operate the device, several alternative methods may be available to perform the same task. In this case, the procedure using the touchscreen is described first, where available. Any elements that can be activated by touching can also be clicked using an additionally connected mouse. The alternative procedure using the hardkeys on the device or the on-screen keyboard is only described if it deviates from the standard operating procedures as described in Chapter 4 "Basic Operations". The terms "select", "enter" and "press" may refer to any of the described methods, i.e. using a finger on the touchscreen, a mouse pointer in the display, a hardkey on the device, or a key on a keyboard.

Softkey descriptions

The description of a softkey (Operating Manual and Online Help) always starts with the softkey name, and is followed by explaining text and one or more remote control commands. Each remote command is placed in a single line.

Descriptions of remote control commands

The description of remote control commands always starts with the command itself, and is followed by descriptive text including an example, the characteristics and the mode (standard or only with certain options) framed by a line. 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 small letters is for information only.

How to Use the Help System

For every softkey, context-sensitive help is available. In addition, the help system provides a table of contents to access more general information.

Note: For basic information on available keys on the front panel and other means of user interaction, see the Quick Start Guide, chapter 4 "Basic Operation".

Calling context-sensitive and general help

- ◆ To display the general help dialog box, press the "HELP" key on the front panel. The help dialog box "View" tab is displayed. A topic containing information about the current menu or the currently opened dialog box and its function is displayed.

Note: For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

- ◆ If the help is already displayed, press the softkey for which you want to display help. A topic containing information about the softkey and its function is displayed.

Note: If a softkey opens a submenu and you press the softkey a second time, the submenu of the softkey is displayed.

Contents of the help dialog box

The help dialog box contains four tabs:

- ◆ "Contents" - contains a table of help contents
 - ◆ "View" - contains a specific help topic
 - ◆ "Index" - contains index entries to search for help topics
 - ◆ "Zoom" - contains zoom functions for the help display
- To change between these tabs, press the tab on the touchscreen.

Navigating in the table of contents

- ◆ To move through the displayed contents entries, use the "UPARROW" and "DNARROW" keys. Entries that contain further entries are marked with a plus sign.
- ◆ To display a help topic, press the "ENTER" key. The "View" tab with the corresponding help topic is displayed.
- ◆ To change to the next tab, press the tab on the screen.

Navigating in the help topics

- ◆ To scroll through a page, use the rotary knob or use the "UPARROW" and "DNARROW" keys.
- ◆ To jump to the linked topic, press the link text.

Searching for a topic

1. Change to the "Index" tab .
2. Enter the first characters of the topic you are interested in.
The entries starting with these characters are displayed.
3. Change the focus by pressing the "ENTER" key.
4. Select the suitable keyword by using the "UPARROW" or "DNARROW" keys or the rotary knob.
5. Press the "ENTER" key to display the help topic.
The "View" tab with the corresponding help topic is displayed.

Changing the zoom

6. Change to the "Zoom" tab.
7. Set the zoom using the rotary knob. Four settings are available: 1-4. The smallest size is selected by number 1, the largest size is selected by number 4.

Closing the help window

- ◆ Press the "ESC" key or a function key on the front panel.

1 Putting into Operation

For details refer to the Quick Start Guide chapters 1, "Front and Rear Panel", and 2, "Preparing for Use".

2 Advanced Measurement Examples

This chapter explains how to operate the R&S FSV using typical measurements as examples. Additional background information on the settings is given. For more detailed information on all available softkeys and the corresponding instrument functions, see [Chapter 4: Instrument functions](#).

Examples of more basic character are provided in the Quick Start Guide, chapter 5, as an introduction. The following topics are included in the Quick Start Guide:

1. Measuring a Sinusoidal Signal
 - Measuring the Level and Frequency Using Markers
 - Measuring the Signal Frequency Using the Frequency Counter
2. Measuring Harmonics of Sinusoidal Signals
 - Measuring the Suppression of the First and Second Harmonic of an Input Signal
3. Measuring Signal Spectra with Multiple Signals
 - Separating Signals by Selecting the Resolution Bandwidth
 - Measuring the Modulation Depth of an AM-Modulated Carrier (Span > 0)
 - Measuring of AM-Modulated Signals
4. Measurements with Zero Span
 - Measuring the Power Characteristic of Burst Signals
 - Measuring the Signal-to-Noise Ratio of Burst Signals
 - Measurement of FM-Modulated Signals
5. Storing and Loading Instrument Settings
 - Storing an Instrument Configuration (without Traces)
 - Storing Traces
 - Loading an Instrument Configuration (with Traces)
 - Configuring Automatic Loading

2.1 Test Setup

All of the following examples are based on the standard settings of the R&S FSV. These are set with the "PRESET" key. A complete listing of the standard settings can be found in chapter "Instrument Functions", section "Initializing the Configuration - PRESET Key".

In the following examples, a signal generator is used as a signal source. The RF output of the signal generator is connected to the RF input of R&S FSV.

If a 64 MHz signal is required for the test setup, as an alternative to the signal generator, the internal 64 MHz reference generator can be used:

1. Switch on the internal reference generator.
 - a) Press the "SETUP" key.
 - b) Press the "More" key.
 - c) Press the "Service" softkey.

- d) Press the "Input RF/Cal" softkey, until "Cal" is highlighted.
The internal 64 MHz reference generator is now on. The R&S FSV's RF input is switched off.
2. Switch on the RF input again for normal operation of the R&S FSV. Two ways are possible:
 - e) Press the "PRESET" key.
 - or:
 - a) Press the "SETUP" key.
 - b) Press the "Service" softkey.
 - c) Press the "Input RF/Cal" softkey, until "RF" is highlighted.
The internal signal path of the R&S FSV is switched back to the RF input in order to resume normal operation.

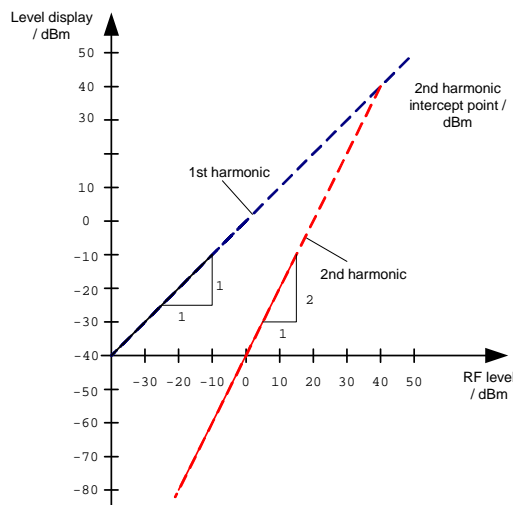
2.2 Measurement of Harmonics

Measuring the harmonics of a signal is a frequent problem which can be solved best by means of a signal analyzer. In general, every signal contains harmonics which are larger than others. Harmonics are particularly critical regarding high-power transmitters such as transceivers because large harmonics can interfere with other radio services. Harmonics are generated by nonlinear characteristics. They can often be reduced by low pass filters. Since the signal analyzer has a nonlinear characteristic, e.g. in its first mixer, measures must be taken to ensure that harmonics produced in the signal analyzer do not cause spurious results. If necessary, the fundamental wave must be selectively attenuated with respect to the other harmonics with a high pass filter.

When harmonics are being measured, the obtainable dynamic range depends on the second harmonic intercept of the signal analyzer. The second harmonic intercept is the virtual input level at the RF input mixer at which the level of the 2nd harmonic becomes equal to the level of the fundamental wave. In practice, however, applying a level of this magnitude would damage the mixer. Nevertheless the available dynamic range for measuring the harmonic distance of a DUT can be calculated relatively easily using the second harmonic intercept.

As shown in "[Figure 1](#)", the level of the 2nd harmonic drops by 20 dB if the level of the fundamental wave is reduced by 10 dB.

Figure 1: Extrapolation of the 1st and 2nd harmonics to the 2nd harmonic intercept at 40 dBm



The following formula for the obtainable harmonic distortion d_2 in dB is derived from the straight-line equations and the given intercept point:

$$d_2 = S.H.I. - P_1 \quad (1)$$

where:

d_2	=	harmonic distortion
P_1	=	mixer level/dBm
S.H.I.	=	second harmonic intercept

Note: The mixer level is the RF level applied to the RF input minus the set RF attenuation.

The formula for the internally generated level P_1 at the 2nd harmonic in dBm is:

$$P_1 = 2 \cdot P_1 - S.H.I. \quad (2)$$

The lower measurement limit for the harmonic is the noise floor of the signal analyzer. The harmonic of the measured DUT should - if sufficiently averaged by means of a video filter - be at least 4 dB above the noise floor so that the measurement error due to the input noise is less than 1 dB.

The following rules for measuring high harmonic ratios can be derived:

- ◆ Select the smallest possible IF bandwidth for a minimal noise floor.
- ◆ Select an RF attenuation which is high enough to just measure the harmonic ratio.

The maximum harmonic distortion is obtained if the level of the harmonic equals the intrinsic noise level of the receiver. The level applied to the mixer, according to (2), is:

$$P_1 = \frac{P_{noise} / dBm + IP2}{2} \quad (3)$$

At a resolution bandwidth of 10 Hz (noise level -143 dBm, S.H.I. = 40 dBm), the optimum mixer level is - 51.5 dBm. According to (1) a maximum measurable harmonic distortion of 91.5 dB minus a minimum S/N ratio of 4 dB is obtained.

Note: *If the harmonic emerges from noise sufficiently (approx. >15 dB), it is easy to check (by changing the RF attenuation) whether the harmonics originate from the DUT or are generated internally by the signal analyzer. If a harmonic originates from the DUT, its level remains constant if the RF attenuation is increased by 10 dB. Only the displayed noise is increased by 10 dB due to the additional attenuation. If the harmonic is exclusively generated by the signal analyzer, the level of the harmonic is reduced by 20 dB or is lost in noise. If both - the DUT and the signal analyzer - contribute to the harmonic, the reduction in the harmonic level is correspondingly smaller.*

High-Sensitivity Harmonics Measurements

If harmonics have very small levels, the resolution bandwidth required to measure them must be reduced considerably. The sweep time is, therefore, also increased considerably. In this case, the measurement of individual harmonics is carried out with the R&S FSV set to a small span. Only the frequency range around the harmonics will then be measured with a small resolution bandwidth.

Signal generator settings (e.g. R&S FSV SMU):

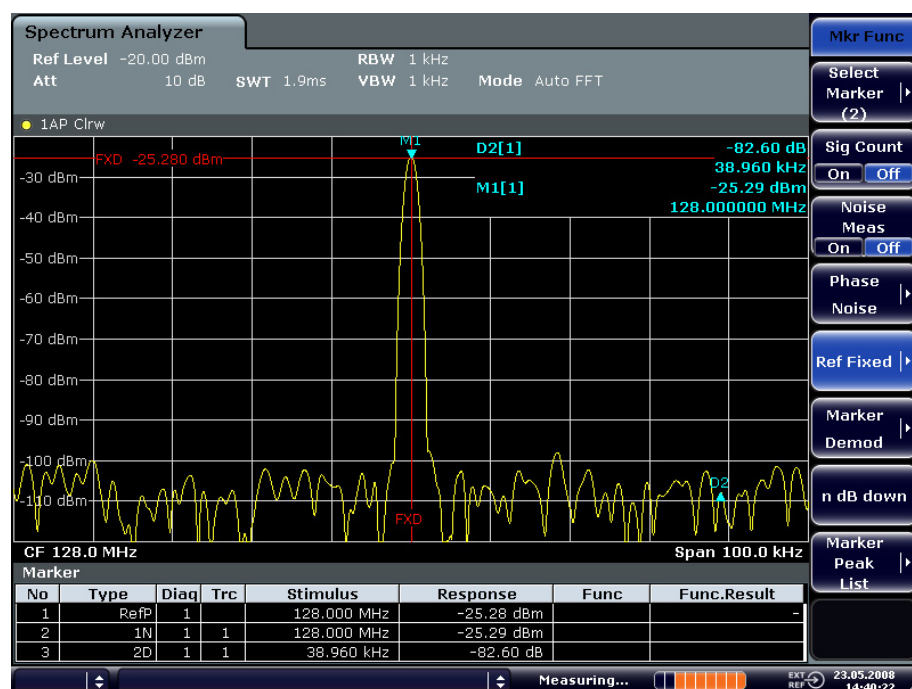
Frequency: 128 MHz
Level: - 25 dBm

Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is set to its default state.
2. Set the center frequency to 128 MHz and the span to 100 kHz:
 - a) Press the "FREQ" key.
The frequency menu is displayed.
 - b) In the dialog box, enter 128 using the numeric keypad and confirm with the "MHz" key.
 - c) Press the "SPAN" key.
 - d) In the dialog box, enter 100 using the numeric keypad and confirm with the "kHz" key.The R&S FSV displays the reference signal with a span of 100 kHz and resolution bandwidth of 1 kHz.
3. Switching on the marker by pressing the "MKR" key.
The marker is positioned on the trace maximum.

4. Set the measured signal frequency and the measured level as reference values
 - a) Press the "MKR FUNC" key
 - b) Press the "Phase Noise" softkey.
The position of the marker becomes the reference point. The reference point level is indicated by a horizontal line, the reference point frequency with a vertical line. At the same time, the delta marker 2 is switched on.
 - c) Press the "Ref Fixed" softkey.
The mode changes from phase noise measurement to reference fixed, the marker readout changes from dB/Hz to dB.

Figure 2: Fundamental wave and the frequency and level reference point

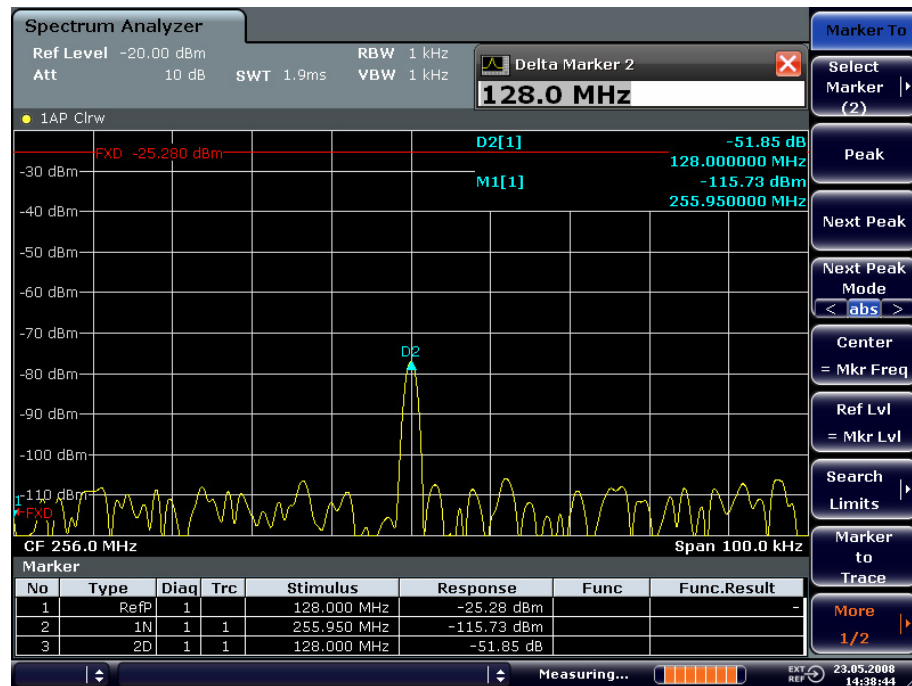


5. Make the step size for the center frequency equal to the signal frequency
 - a) Press the "FREQ" key.
The frequency menu is displayed.
 - b) Press the "CF-Stepsize" softkey and press the "= Marker" softkey in the submenu.
The step size for the center frequency is now equal to the marker frequency.
6. Set the center frequency to the 2nd harmonic of the signal
 - a) Press the "FREQ" key.
The frequency menu is displayed.
 - b) Press the "UPARROW" key once.
The center frequency is set to the 2nd harmonic.

7. Place the delta marker on the 2nd harmonic.
 - a) Press the "MKR"-> key.
 - b) Press the "Peak" softkey.

The delta marker moves to the maximum of the 2nd harmonic. The displayed level result is relative to the reference point level (= fundamental wave level).

Figure 3: Measuring the level difference between the fundamental wave (= reference point level) and the 2nd harmonic



The other harmonics are measured with steps 5 and 6, the center frequency being incremented or decremented in steps of 128 MHz using the "UPARROW" or "DNARROW" key.

2.3 Measuring the Spectra of Complex Signals

2.3.1 Separating Signals by Selecting an Appropriate Resolution Bandwidth

A basic feature of a signal analyzer is being able to separate the spectral components of a mixture of signals. The resolution at which the individual components can be separated is determined by the resolution bandwidth. Selecting a resolution bandwidth that is too large may make it impossible to distinguish between spectral components, i.e. they are displayed as a single component.

An RF sinusoidal signal is displayed by means of the passband characteristic of the resolution filter (RBW) that has been set. Its specified bandwidth is the 3 dB bandwidth of the filter.

Two signals with the same amplitude can be resolved if the resolution bandwidth is smaller than or equal to the frequency spacing of the signal. If the resolution bandwidth is equal to the frequency spacing, the spectrum display screen shows a level drop of 3 dB precisely in the center of the two signals. Decreasing the resolution bandwidth makes the level drop larger, which thus makes the individual signals clearer.

If there are large level differences between signals, the resolution is determined by selectivity as well as by the resolution bandwidth that has been selected. The measure of selectivity used for signal analyzers is the ratio of the 60 dB bandwidth to the 3 dB bandwidth (= shape factor).

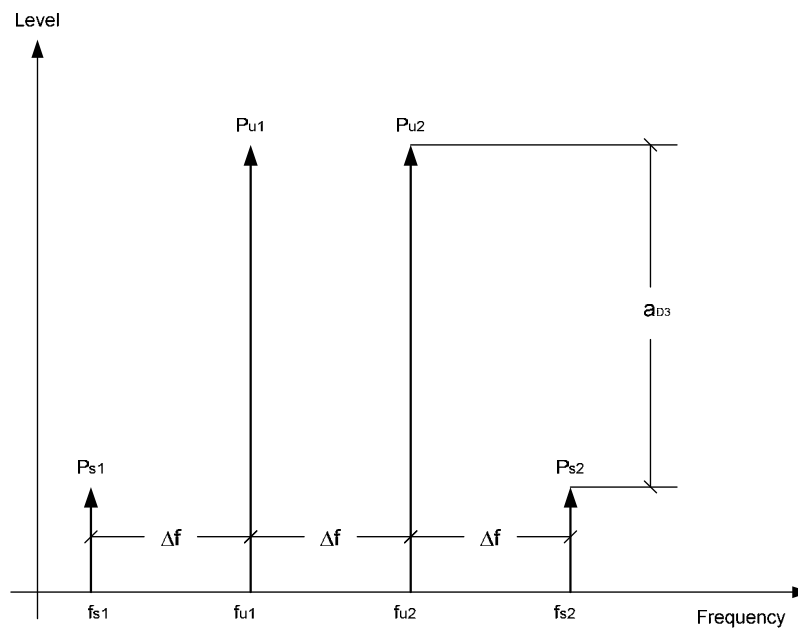
For the R&S FSV, the shape factor for bandwidths is < 5 , i.e. the 60 dB bandwidth of the 30 kHz filter is < 150 kHz.

The higher spectral resolution with smaller bandwidths is won by longer sweep times for the same span. The sweep time has to allow the resolution filters to settle during a sweep at all signal levels and frequencies to be displayed.

2.3.2 Intermodulation Measurements

If several signals are applied to a transmission two-port device with nonlinear characteristic, intermodulation products appear at its output by the sums and differences of the signals. The nonlinear characteristic produces harmonics of the useful signals which intermodulate at the characteristic. The intermodulation products of lower order have a special effect since their level is largest and they are near the useful signals. The intermodulation product of third order causes the highest interference. It is the intermodulation product generated from one of the useful signals and the 2nd harmonic of the second useful signal in case of two-tone modulation.

The frequencies of the intermodulation products are above and below the useful signals. "Figure 4" shows intermodulation products P_{11} and P^{12} generated by the two useful signals P_{U1} and P_{U2} .

Figure 4: Intermodulation products P_{U1} and P_{U2} 

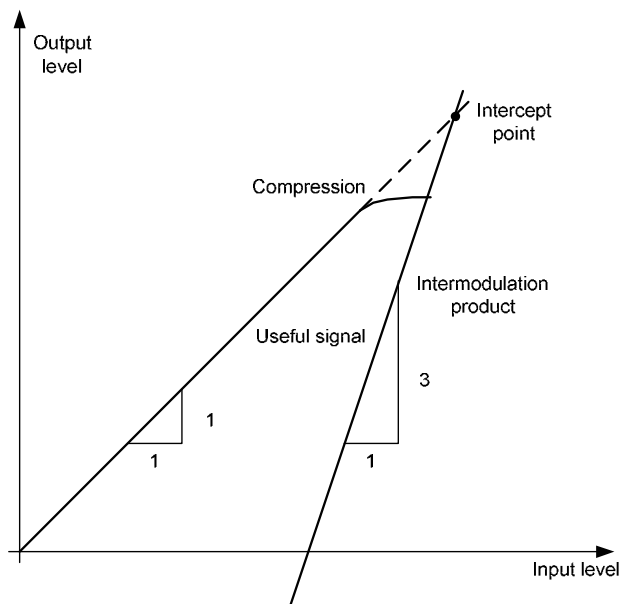
The intermodulation product at f_{i2} is generated by mixing the 2nd harmonic of useful signal P_{U2} and signal P_{U1} , the intermodulation product at f_{i1} by mixing the 2nd harmonic of useful signal P_{U1} and signal P_{U2} .

$$f_{i1} = 2 \times f_{u1} - f_{u2} \quad (6)$$

$$f_{i2} = 2 \times f_{u2} - f_{u1} \quad (7)$$

The level of the intermodulation products depends on the level of the useful signals. If the two useful signals are increased by 1 dB, the level of the intermodulation products increases by 3 dB, which means that spacing a_{D3} between intermodulation signals and useful signals are reduced by 2 dB. This is illustrated in "Figure 5".

Figure 5: Dependence of intermodulation level on useful signal level



The useful signals at the two-port output increase proportionally with the input level as long as the two-port is in the linear range. A level change of 1 dB at the input causes a level change of 1 dB at the output. Beyond a certain input level, the two-port goes into compression and the output level stops increasing. The intermodulation products of the third order increase three times as much as the useful signals. The intercept point is the fictitious level where the two lines intersect. It cannot be measured directly since the useful level is previously limited by the maximum two-port output power. It can be calculated from the known line slopes and the measured spacing a_{D3} at a given level according to the following formula.

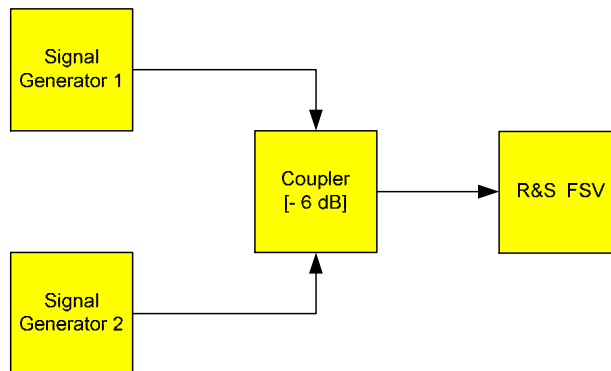
$$IP3 = \frac{a_{D3}}{2} + P_N \quad (8)$$

The 3rd order intercept point (TOI), for example, is calculated for an intermodulation of 60 dB and an input level P_U of -20 dBm according to the following formula:

$$IP3 = \frac{60}{2} + (-20dBm) = 10dBm \quad (9)$$

2.3.2.1 Measurement Example - Measuring the R&S FSV's Intrinsic Intermodulation

Test setup:



Signal generator settings (e.g. R&S FSV SMU):

	Level	Frequency
Signal generator 1	-4 dBm	999.7 MHz
Signal generator 2	-4 dBm	1000.3 MHz

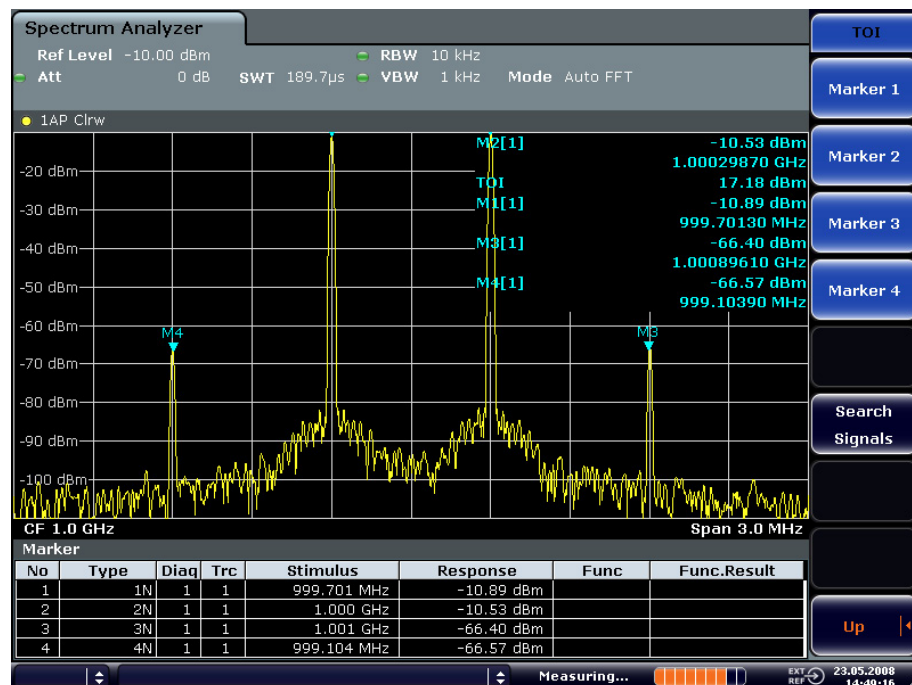
Procedure:

1. Set the R&S FSV to its default settings by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set center frequency to 1 GHz and the frequency span to 3 MHz.
 - a) Press the "FREQ" key and enter *1 GHz*.
 - b) Press the "SPAN" key and enter *3 MHz*.
3. Set the reference level to -10 dBm and RF attenuation to 0 dB.
 - a) Press the "AMPT" key and enter *-10 dBm*.
 - b) Press the "RF Atten Manual" softkey and enter *0 dB*.
4. Set the resolution bandwidth to 10 kHz.
 - a) Press the "BW" key.
 - b) Press the "Res BW Manual" softkey and enter *10 kHz*.
The noise is reduced, the trace is smoothed further and the intermodulation products can be clearly seen.

- c) Press the "Video BW Manual" softkey and enter 1 kHz.
5. Measuring intermodulation by means of the 3rd order intercept measurement function
 - a) Press the "MEAS" key.
 - b) Press the "TOI" softkey.

The R&S FSV activates four markers for measuring the intermodulation distance. Two markers are positioned on the useful signals and two on the intermodulation products. The 3rd order intercept is calculated from the level difference between the useful signals and the intermodulation products. It is then displayed on the screen:

Figure 6: Result of intrinsic intermodulation measurement on the R&S FSV. The 3rd order intercept (TOI) is displayed at the top right corner of the grid.

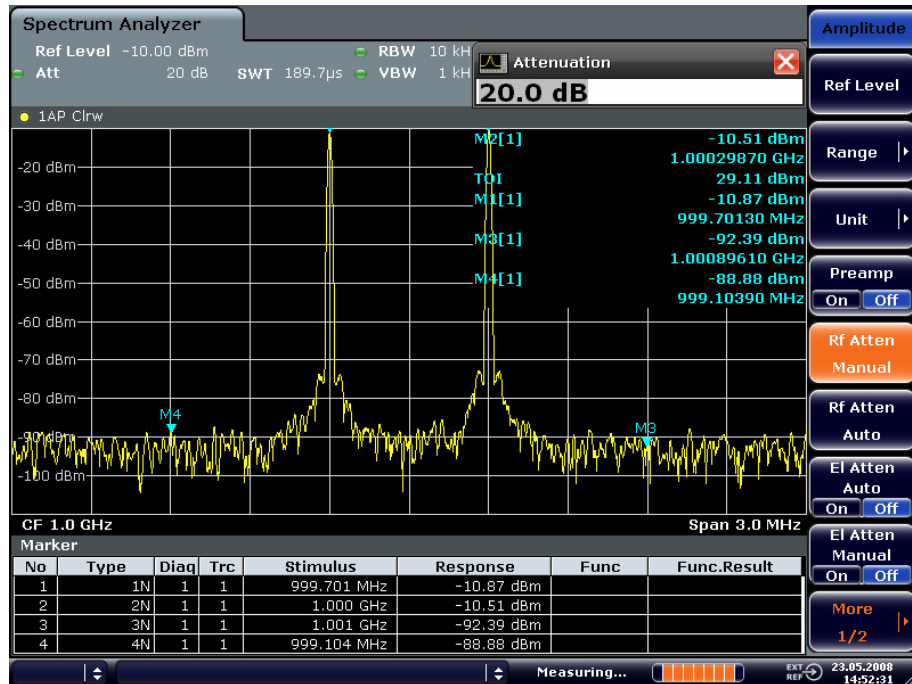


The level of a signal analyzer's intrinsic intermodulation products depends on the RF level of the useful signals at the input mixer. When the RF attenuation is added, the mixer level is reduced and the intermodulation distance is increased. With an additional RF attenuation of 10 dB, the levels of the intermodulation products are reduced by 20 dB. The noise level is, however, increased by 10 dB.

6. Increasing RF attenuation to 20 dB to reduce intermodulation products.
 - a) Press the "AMPT" key.
 - b) Press the "RF Atten Manual" softkey and enter 20 dB.

The R&S FSV's intrinsic intermodulation products disappear below the noise floor.

Figure 7: If the RF attenuation is increased, the R&S FSV's intrinsic intermodulation products disappear below the noise floor.



Calculation method:

The method used by the R&S FSV to calculate the intercept point takes the average useful signal level P_u in dBm and calculates the intermodulation d_3 in dB as a function of the average value of the levels of the two intermodulation products. The third order intercept (TOI) is then calculated as follows:

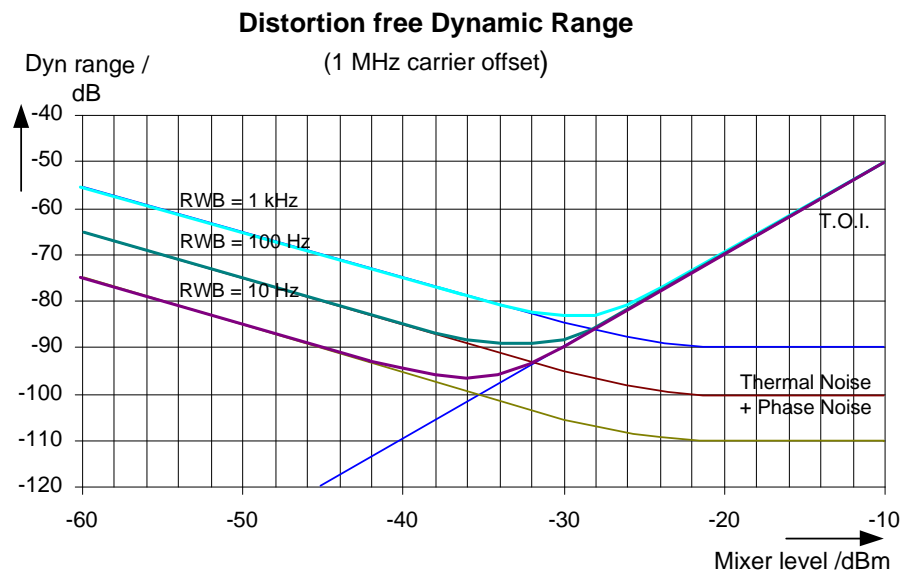
$$TOI/dBm = \frac{1}{2} d_3 + P_u$$

Intermodulation- free dynamic range

The "Intermodulation-free dynamic range", i.e. the level range in which no internal intermodulation products are generated if two-tone signals are measured, is determined by the 3rd order intercept point, the phase noise and the thermal noise of the signal analyzer. At high signal levels, the range is determined by intermodulation products. At low signal levels, intermodulation products disappear below the noise floor, i.e. the noise floor and the phase noise of the signal analyzer determine the range. The noise floor and the phase noise depend on the resolution bandwidth that has been selected. At the smallest resolution bandwidth, the noise floor and phase noise are at a minimum and so the maximum range is obtained. However, a large increase in sweep time is required for small resolution bandwidths. It is, therefore, best to select the largest resolution bandwidth possible to obtain the range that is required. Since phase noise decreases as the carrier-offset increases, its influence decreases with increasing frequency offset from the useful signals.

The following diagrams illustrate the intermodulation-free dynamic range as a function of the selected bandwidth and of the level at the input mixer (= signal level - set RF attenuation) at different useful signal offsets.

Figure 8: Intermodulation-free range of the R&S FSV as a function of level at the input mixer and the set resolution bandwidth

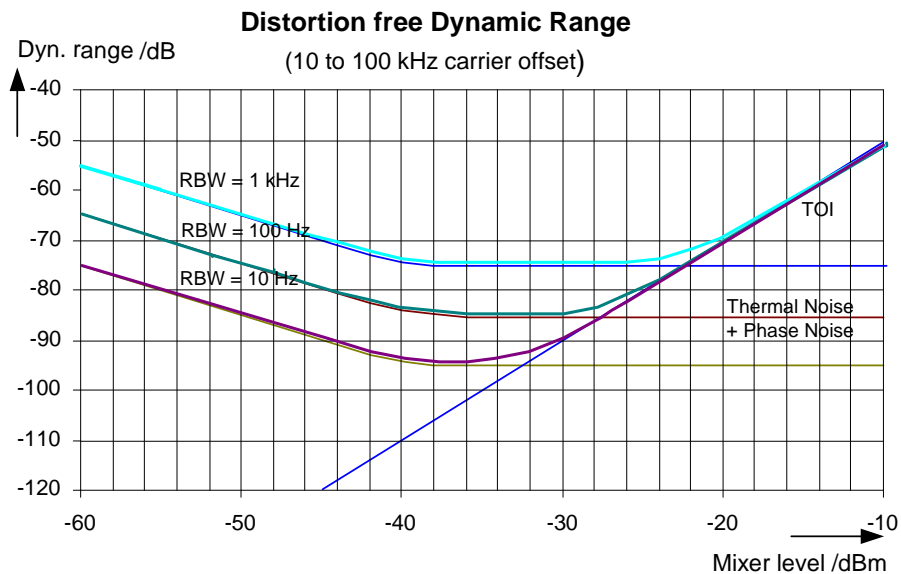


(Useful signal offset = 1 MHz, DANL = -145 dBm /Hz, TOI = 15 dBm; typical values at 2 GHz)

The optimum mixer level, i.e. the level at which the intermodulation distance is at its maximum, depends on the bandwidth. At a resolution bandwidth of 10 Hz, it is approx. -35 dBm and at 1 kHz increases to approx. -30 dBm.

Phase noise has a considerable influence on the intermodulation-free range at carrier offsets between 10 and 100 kHz ("Figure 9"). At greater bandwidths, the influence of the phase noise is greater than it would be with small bandwidths. The optimum mixer level at the bandwidths under consideration becomes almost independent of bandwidth and is approx. -40 dBm.

Figure 9: Intermodulation-free dynamic range of the R&S FSV as a function of level at the input mixer and of the selected resolution bandwidth



(Useful signal offset = 10 to 100 kHz, DANL = -145 dBm /Hz, TOI = 15 dBm; typical values at 2 GHz).

Note: If the intermodulation products of a DUT with a very high dynamic range are to be measured and the resolution bandwidth to be used is therefore very small, it is best to measure the levels of the useful signals and those of the intermodulation products separately using a small span. The measurement time will be reduced- in particular if the offset of the useful signals is large. To find signals reliably when frequency span is small, it is best to synchronize the signal sources and the R&S FSV.

2.4 Measuring Signals in the Vicinity of Noise

The minimum signal level a signal analyzer can measure is limited by its intrinsic noise. Small signals can be swamped by noise and therefore cannot be measured. For signals that are just above the intrinsic noise, the accuracy of the level measurement is influenced by the intrinsic noise of the signal analyzer.

The displayed noise level of a signal analyzer depends on its noise figure, the selected RF attenuation, the selected reference level, the selected resolution and video bandwidth and the detector. The effect of the different parameters is explained in the following.

Impact of the RF attenuation setting

The sensitivity of a signal analyzer is directly influenced by the selected RF attenuation. The highest sensitivity is obtained at a RF attenuation of 0 dB. The attenuation can be set in 10 dB steps up to 70 dB. Each additional 10 dB step reduces the sensitivity by 10 dB, i.e. the displayed noise is increased by 10 dB.

Impact of the resolution bandwidth

The sensitivity of a signal analyzer also directly depends on the selected bandwidth. The highest sensitivity is obtained at the smallest bandwidth (1 Hz). If the bandwidth is increased, the reduction in sensitivity is proportional to the change in bandwidth. The R&S FSV has bandwidth settings in 1, 2, 3, 5 sequence. Increasing the bandwidth by a factor of 3 increases the displayed noise by approx. 5 dB (4.77 dB precisely). If the bandwidth is increased by a factor of 10, the displayed noise increases by a factor of 10, i.e. 10 dB.

Impact of the video bandwidth

The displayed noise of a signal analyzer is also influenced by the selected video bandwidth. If the video bandwidth is considerably smaller than the resolution bandwidth, noise spikes are suppressed, i.e. the trace becomes much smoother. The level of a sine wave signal is not influenced by the video bandwidth. A sine wave signal can therefore be freed from noise by using a video bandwidth that is small compared with the resolution bandwidth, and thus be measured more accurately.

Impact of the detector

Noise is evaluated differently by the different detectors. The noise display is therefore influenced by the choice of detector. Sine wave signals are weighted in the same way by all detectors, i.e. the level display for a sine wave RF signal does not depend on the selected detector, provided that the signal-to-noise ratio is high enough. The measurement accuracy for signals in the vicinity of intrinsic signal analyzer noise is also influenced by the detector which has been selected. For details on the detectors of the R&S FSV refer to chapter "Instrument Functions", section "Detector overview" or the Online Help.

2.4.1.1 Measurement Example - Measuring Level at Low S/N Ratios

The example shows the different factors influencing the S/N ratio.

Signal generator settings (e.g. R&S FSV SMU):

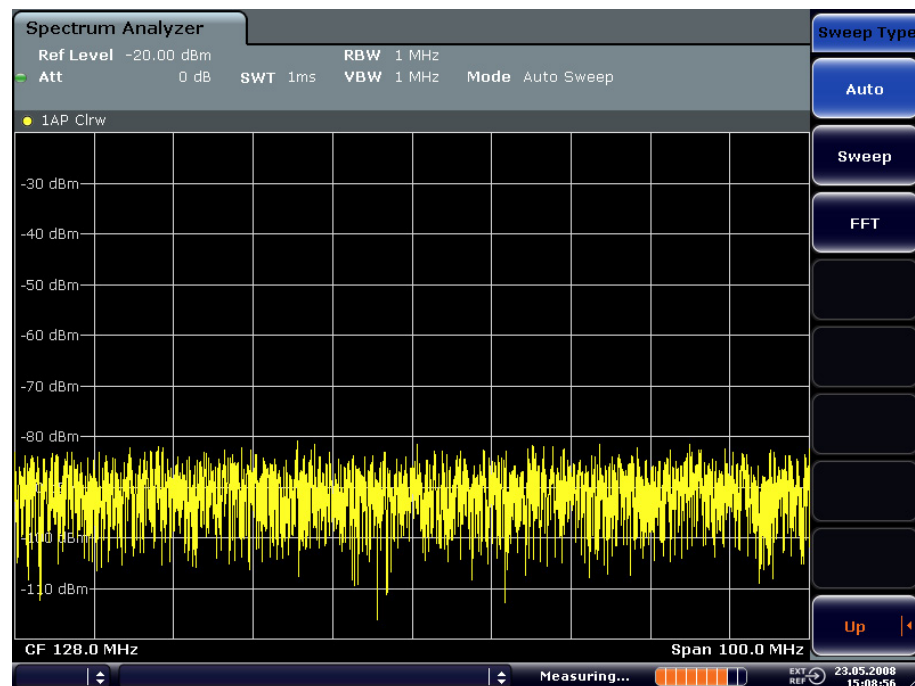
Frequency: 128 MHz

Level: -90 dBm

Procedure:

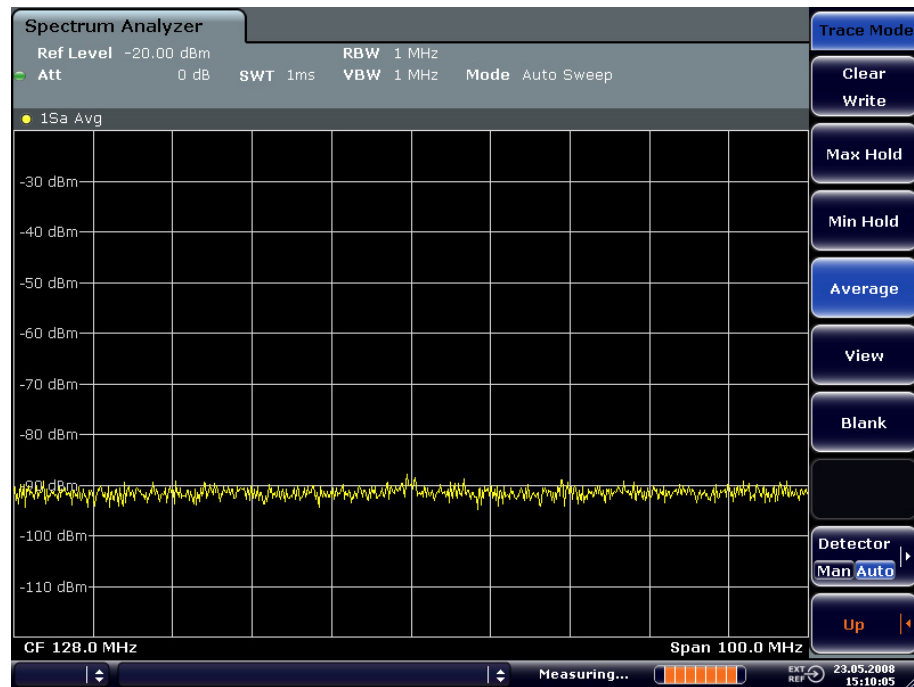
1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set the center frequency to 128 MHz and the frequency span to 100 MHz:
 - a) Press the "FREQ" key and enter 128 MHz.
 - b) Press the "SPAN" key and enter 100 MHz.

Figure10: Sine wave signal with low S/N ratio. The signal is measured with the auto peak detector and is completely hidden in the intrinsic noise of the R&S FSV.



3. To suppress noise spikes the trace can be averaged.
 - a) Press the "TRACE" key.
 - b) Press the "Trace Wizard" softkey.
The Trace Wizard dialog box opens.
 - c) Select "Average" in the "Trace Mode" pull down menu of the selected trace.
The traces of consecutive sweeps are averaged. To perform averaging, the R&S FSV automatically switches on the sample detector. The RF signal, therefore, can be more clearly distinguished from noise.

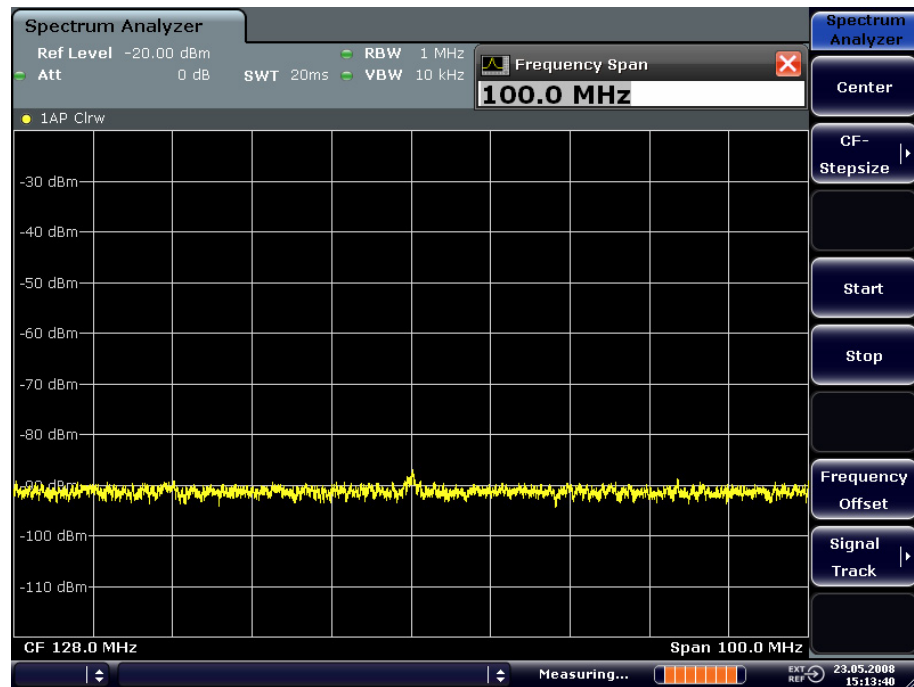
Figure 11: RF sine wave signal with low S/N ratio if the trace is averaged.



Instead of trace averaging, a video filter that is narrower than the resolution bandwidth can be selected:

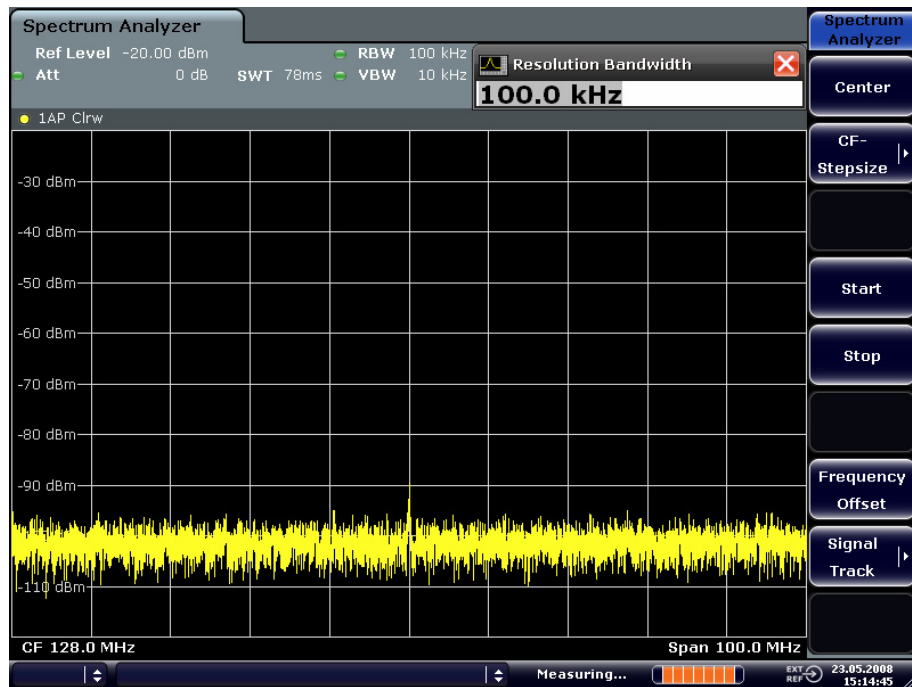
- a) Press the "TRACE" key.
- b) Press the "Trace Wizard" softkey.
The Trace Wizard dialog box opens.
- c) Select "Clear Write" in the "Trace Mode" pull down menu of the selected trace.
- d) Press the "BW" key.
- e) Press the "Video BW Manual" softkey and enter *10 kHz*.
The RF signal can be more clearly distinguished from noise.

Figure 12: RF sine wave signal with low S/N ratio if a smaller video bandwidth is selected.



4. By reducing the resolution bandwidth by a factor of 10, the noise is reduced by 10 dB:
 - ◆ In the "Bandwidth" menu press the "Res BW Manual" softkey and enter 100 kHz. The displayed noise is reduced by approx. 10 dB. The signal, therefore, emerges from noise by about 10 dB. Compared to the previous setting, the video bandwidth has remained the same, i.e. it has increased relative to the smaller resolution bandwidth. The averaging effect of the video bandwidth is therefore reduced. The trace will be noisier.

Figure 13: Reference signal at a smaller resolution bandwidth



2.5 Noise Measurements

Noise measurements play an important role in signal analysis. Noise e.g. affects the sensitivity of radio communication systems and their components.

Noise power is specified either as the total power in the transmission channel or as the power referred to a bandwidth of 1 Hz. The sources of noise are, for example, amplifier noise or noise generated by oscillators used for the frequency conversion of useful signals in receivers or transmitters. The noise at the output of an amplifier is determined by its noise figure and gain.

The noise of an oscillator is determined by phase noise near the oscillator frequency and by thermal noise of the active elements far from the oscillator frequency. Phase noise can mask weak signals near the oscillator frequency and make them impossible to detect.

2.5.1 Measuring Noise Power Density

To measure noise power referred to a bandwidth of 1 Hz at a certain frequency, the R&S FSV provides marker function. This marker function calculates the noise power density from the measured marker level.

2.5.1.1 Measurement Example - Measuring the Intrinsic Noise Power Density of the R&S FSV at 1 GHz and Calculating the R&S FSV's Noise Figure

Test setup:

- ◆ Connect no signal to the RF input; terminate RF input with 50 Ω.

Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set the center frequency to 1.234 GHz and the span to 1 MHz.
 - a) Press the "FREQ" key and enter *1.234 GHz*.
 - b) Press the "SPAN" key and enter *1 MHz*.
3. Switch on the marker and set the marker frequency to 1.234 GHz by pressing the "MKR" key and entering *1.234 GHz*.
4. Switch on the noise marker function by switching on the "Noise Meas" softkey.
 - a) Press the "MKR FUNC" key.
 - b) Switch the "Noise Meas" softkey to "On"
The R&S FSV displays the noise power at 1 GHz in dBm (1Hz).

Note: *Since noise is random, a sufficiently long measurement time has to be selected to obtain stable measurement results. This can be achieved by averaging the trace or by selecting a very small video bandwidth relative to the resolution bandwidth.*

5. The measurement result is stabilized by averaging the trace.
 - a) Press the "TRACE" key.
 - b) Press the "Trace Wizard" softkey.
The Trace Wizard dialog box opens.
 - c) Select "Average" in the "Trace Mode" pull down menu of the selected trace.
The R&S FSV performs sliding averaging over 10 traces from consecutive sweeps. The measurement result becomes more stable.

Conversion to other reference bandwidths

The result of the noise measurement can be referred to other bandwidths by simple conversion. This is done by adding $10 \cdot \log(BW)$ to the measurement result, BW being the new reference bandwidth.

Example:

A noise power of -150 dBm (1 Hz) is to be referred to a bandwidth of 1 kHz.

$$P_{[1\text{kHz}]} = -150 + 10 \cdot \log(1000) = -150 + 30 = -120 \text{ dBm (1 kHz)}$$

Calculation method for noise power

If the noise marker is switched on, the R&S FSV automatically activates the sample detector. The video bandwidth is set to 1/10 of the selected resolution bandwidth (RBW).

To calculate the noise, the R&S FSV takes an average over 17 adjacent pixels (the pixel on which the marker is positioned and 8 pixels to the left, 8 pixels to the right of the marker). The measurement result is stabilized by video filtering and averaging over 17 pixels.

Since both video filtering and averaging over 17 trace points is performed in the log display mode, the result would be 2.51 dB too low (difference between logarithmic noise average and noise power). The R&S FSV, therefore, corrects the noise figure by 2.51 dB.

To standardize the measurement result to a bandwidth of 1 Hz, the result is also corrected by $-10 \cdot \log(\text{RBW}_{\text{noise}})$, with $\text{RBW}_{\text{noise}}$ being the power bandwidth of the selected resolution filter (RBW).

Detector selection

The noise power density is measured in the default setting with the sample detector and using averaging. Other detectors that can be used to perform a measurement giving true results are the average detector or the RMS detector. If the average detector is used, the linear video voltage is averaged and displayed as a pixel. If the RMS detector is used, the squared video voltage is averaged and displayed as a pixel. The averaging time depends on the selected sweep time ($=\text{SWT}/501$). An increase in the sweep time gives a longer averaging time per pixel and thus stabilizes the measurement result. The R&S FSV automatically corrects the measurement result of the noise marker display depending on the selected detector (+1.05 dB for the average detector, 0 dB for the RMS detector). It is assumed that the video bandwidth is set to at least three times the resolution bandwidth. While the average or RMS detector is being switched on, the R&S FSV sets the video bandwidth to a suitable value.

The Pos Peak, Neg Peak, Auto Peak and Quasi Peak detectors are not suitable for measuring noise power density.

Determining the noise figure

The noise figure of amplifiers or of the R&S FSV alone can be obtained from the noise power display. Based on the known thermal noise power of a 50 Ω resistor at room temperature (-174 dBm (1Hz)) and the measured noise power P_{noise} the noise figure (NF) is obtained as follows:

$$NF = P_{\text{noise}} + 174 - g,$$

where g = gain of DUT in dB

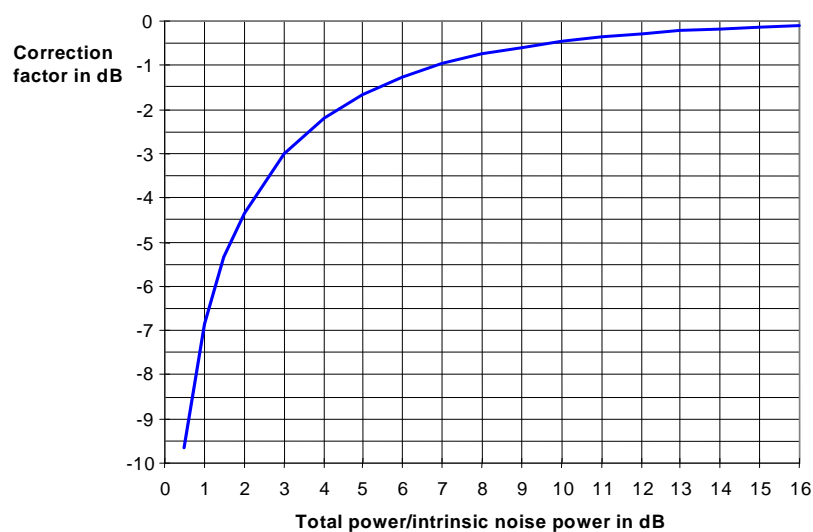
Example:

The measured internal noise power of the R&S FSV at an attenuation of 0 dB is found to be -143 dBm/1 Hz. The noise figure of the R&S FSV is obtained as follows

$$NF = -143 + 174 = 31 \text{ dB}$$

Note: If noise power is measured at the output of an amplifier, for example, the sum of the internal noise power and the noise power at the output of the DUT is measured. The noise power of the DUT can be obtained by subtracting the internal noise power from the total power (subtraction of linear noise powers). By means of the following diagram, the noise level of the DUT can be estimated from the level difference between the total and the internal noise level.

Figure 14: Correction factor for measured noise power as a function of the ratio of total power to the intrinsic noise power of the signal analyzer



2.5.2 Measurement of Noise Power within a Transmission Channel

Noise in any bandwidth can be measured with the channel power measurement functions. Thus the noise power in a communication channel can be determined, for example. If the noise spectrum within the channel bandwidth is flat, the noise marker from the previous example can be used to determine the noise power in the channel by considering the channel bandwidth. If, however, phase noise and noise that normally increases towards the carrier is dominant in the channel to be measured, or if there are discrete spurious signals in the channel, the channel power measurement method must be used to obtain correct measurement results.

2.5.2.1 Measurement Example - Measuring the Intrinsic Noise of the R&S FSV at 1 GHz in a 1.23 MHz Channel Bandwidth with the Channel Power Function

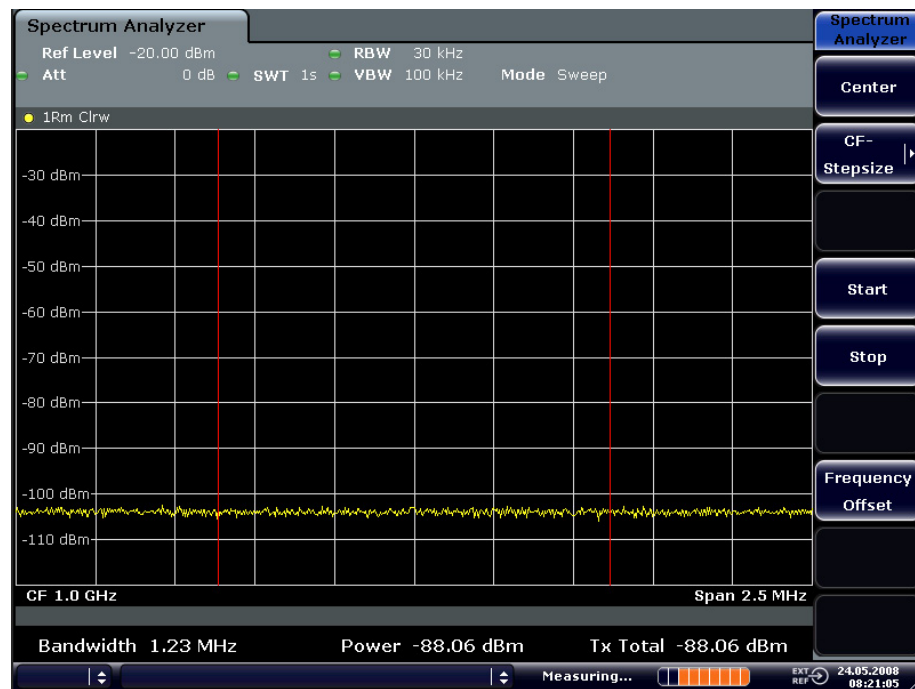
Test setup:

- ◆ Leave the RF input of the R&S FSV open-circuited or terminate it with 50 Ω .

Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set the center frequency to 1 GHz and the span to 1 MHz.
 - a) Press the "FREQ" key and enter *1 GHz*.
 - b) Press the "SPAN" key and enter *2 MHz*.
3. To obtain maximum sensitivity, set RF attenuation on the R&S FSV to 0 dB.
 - a) Press the "AMPT" key.
 - b) Press the "RF Atten Manual" softkey and enter *0 dB*.
4. Set the "Sweep Type" to sweep.
 - a) Press the "AUTO SET" key.
 - b) Press the "Sweep Type" softkey.
 - c) Press the "Sweep" softkey.
5. Switch on and configure the channel power measurement.
 - a) Press the "MEAS" key.
 - b) Press the "Ch Power / ACLR" softkey.
The R&S FSV activates the channel or adjacent channel power measurement according to the currently set configuration.
 - c) Press the "CP / ACLR Settings" softkey.
The submenu for configuring the channel is displayed.
 - d) Press the "Channel Settings" softkey.
The submenu for channel settings is displayed.
 - e) Press the "Channel Bandwidth" softkey and enter *1.23 MHz*.
The R&S FSV displays the 1.23 MHz channel as two vertical lines which are symmetrical to the center frequency.
 - f) Press the "Adjust Settings" softkey.
The settings for the frequency span, the bandwidth (RBW and VBW) and the detector are automatically set to the optimum values required for the measurement.

Figure 15: Measurement of the R&S FSV's intrinsic noise power in a 1.23 MHz channel bandwidth.

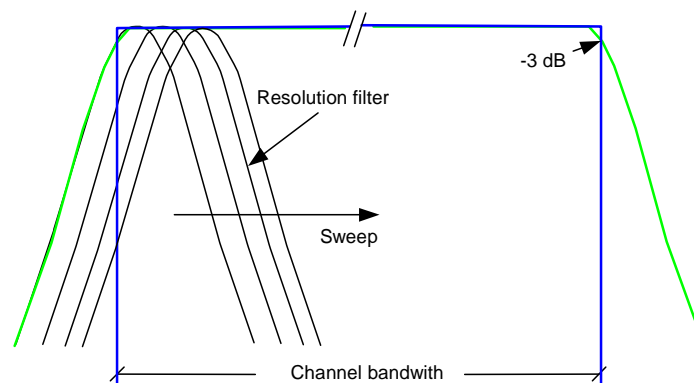


6. Stabilizing the measurement result by increasing the sweep time
 - a) Press the "UP" key twice.
The main menu for channel and adjacent channel power measurement is displayed.
 - b) Press the "Sweep Time" softkey and enter 1 s.
The trace becomes much smoother because of the RMS detector and the channel power measurement display is much more stable.

Method of calculating the channel power

When measuring the channel power, the R&S FSV integrates the linear power which corresponds to the levels of the pixels within the selected channel. The signal analyzer uses a resolution bandwidth which is far smaller than the channel bandwidth. When sweeping over the channel, the channel filter is formed by the passband characteristics of the resolution bandwidth (see "Figure 16").

Figure 16: Approximating the channel filter by sweeping with a small resolution bandwidth



The following steps are performed:

1. The linear power of all the trace pixels within the channel is calculated.

$$P_i = 10^{(L_i/10)}$$

where P_i = power of the trace pixel i

L_i = displayed level of trace point i

2. The powers of all trace pixels within the channel are summed up and the sum is divided by the number of trace pixels in the channel.
3. The result is multiplied by the quotient of the selected channel bandwidth and the noise bandwidth of the resolution filter (RBW).

Since the power calculation is performed by integrating the trace within the channel bandwidth, this method is also called the IBW method (**I**ntegration **B**and**w**idth method).

Parameter settings

For selection of the sweep time, see next section. For details on the parameter settings refer to chapter "Instrument Functions", section "Settings of the CP / ACLR test parameters" or the Online Help.

Sweep time selection

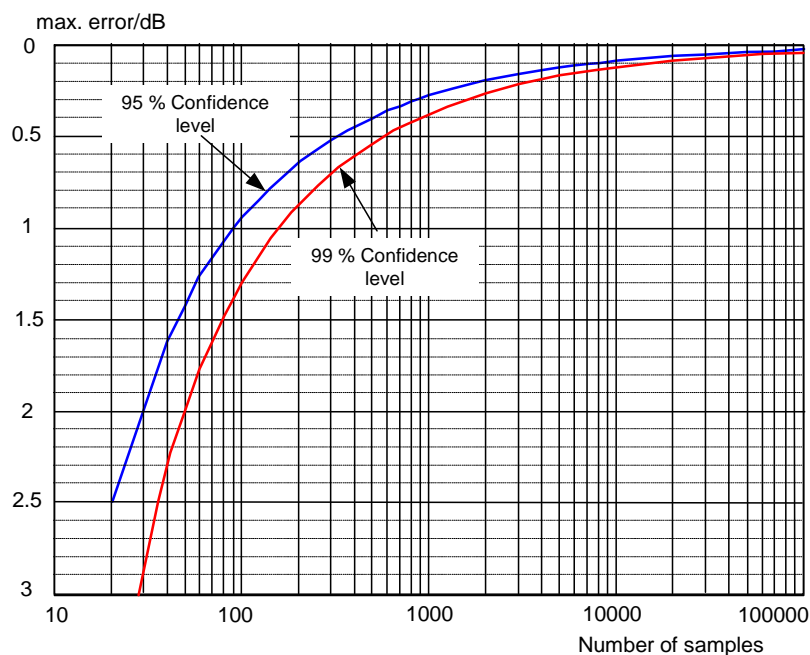
The number of A/D converter values, N , used to calculate the power, is defined by the sweep time. The time per trace pixel for power measurements is directly proportional to the selected sweep time.

If the sample detector is used, it is best to select the smallest sweep time possible for a given span and resolution bandwidth. The minimum time is obtained if the setting is coupled. This means that the time per measurement is minimal. Extending the measurement time does not have any advantages as the number of samples for calculating the power is defined by the number of trace pixels in the channel.

If the RMS detector is used, the repeatability of the measurement results can be influenced by the selection of sweep times. Repeatability is increased at longer sweep times.

Repeatability can be estimated from the following diagram:

Figure 17: Repeatability of channel power measurements as a function of the number of samples used for power calculation



The curves in "Figure 17" indicate the repeatability obtained with a probability of 95% and 99% depending on the number of samples used.

The repeatability with 600 samples is ± 0.5 dB. This means that - if the sample detector and a channel bandwidth over the whole diagram (channel bandwidth = span) is used - the measured value lies within ± 0.5 dB of the true value with a confidence level of 99%.

If the RMS detector is used, the number of samples can be estimated as follows:

Since only uncorrelated samples contribute to the RMS value, the number of samples can be calculated from the sweep time and the resolution bandwidth.

Samples can be assumed to be uncorrelated if sampling is performed at intervals of $1/\text{RBW}$. The number of uncorrelated samples is calculated as follows:

$$N_{\text{decorr}} = \text{SWT} \cdot \text{RBW} \quad (N_{\text{decorr}} \text{ means uncorrelated samples})$$

The number of uncorrelated samples per trace pixel is obtained by dividing N_{decorr} by 691 (= pixels per trace).

Example

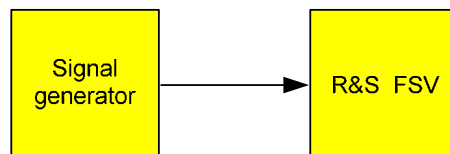
At a resolution bandwidth of 30 kHz and a sweep time of 100 ms, 3000 uncorrelated samples are obtained. If the channel bandwidth is equal to the frequency display range, i.e. all trace pixels are used for the channel power measurement, a repeatability of 0.2 dB with a probability of 99% is the estimate that can be derived from "Figure 17".

2.5.3 Measuring Phase Noise

The R&S FSV has an easy-to-use marker function for phase noise measurements. This marker function indicates the phase noise of an RF oscillator at any carrier in dBc in a bandwidth of 1 Hz.

2.5.3.1 Measurement Example - Measuring the Phase Noise of a Signal Generator at a Carrier Offset of 10 kHz

Test setup:



Signal generator settings (e.g. R&S FSV SMU):

Frequency:	100 MHz
Level:	0 dBm

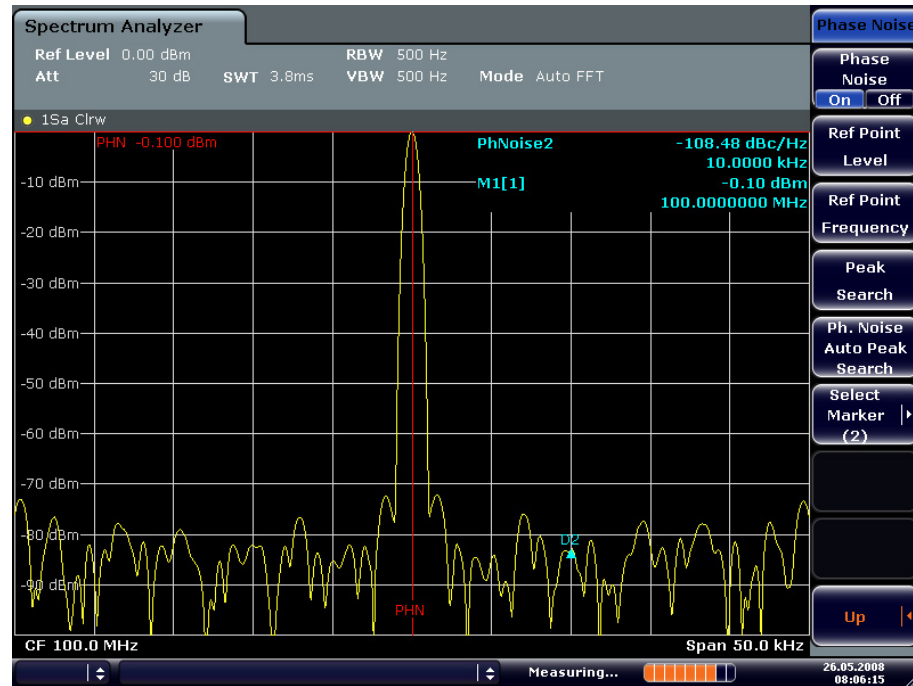
Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key. R&S FSV is in its default state.
2. Set the center frequency to 100 MHz and the span to 50 kHz.
 - a) Press the "FREQ" key and enter *100 MHz*.
 - b) Press the "SPAN" key and enter *50 kHz*.
3. Set the R&S FSV's reference level to 0 dBm (=signal generator level) by pressing the "AMPT" key and enter *0 dBm*.
4. Enable phase noise measurement.
 - a) Press the "MKR FUNC" key.
 - b) Press the "Phase Noise" softkey.

The R&S FSV activates phase noise measurement. Marker 1 (=main marker) and marker 2 (= delta marker) are positioned on the signal maximum. The position of the marker is the reference (level and frequency) for the phase noise measurement. A horizontal line represents the level of the reference point and a vertical line the frequency of the reference point. The dialog box for the delta marker is displayed so that the frequency offset at which the phase noise is to be measured can be entered directly.

5. Set the frequency offset to 10 kHz for determining phase noise by entering 10 kHz. The R&S FSV displays the phase noise at a frequency offset of 10 kHz. The magnitude of the phase noise in dBc/Hz is displayed in the delta marker output field at the top right of the screen (Phn2).
6. Stabilize the measurement result by activating trace averaging.

Figure 18: Measuring phase noise with the phase-noise marker function



The frequency offset can be varied by moving the marker with the rotary knob or by entering a new frequency offset as a number.

2.6 Measurements on Modulated Signals

For measurements on AM and FM signals refer to the Quick Start Guide, chapter 5, "Basic Measurements Examples".

2.6.1 Measuring Channel Power and Adjacent Channel Power

Measuring channel power and adjacent channel power is one of the most important tasks in the field of digital transmission for a signal analyzer with the necessary test routines. While, theoretically, channel power could be measured at highest accuracy with a power meter, its low selectivity means that it is not suitable for measuring adjacent channel power as an absolute value or relative to the transmit channel power. The power in the adjacent channels can only be measured with a selective power meter.

A signal analyzer cannot be classified as a true power meter, because it displays the IF envelope voltage. However, it is calibrated such as to correctly display the power of a pure sine wave signal irrespective of the selected detector. This calibration cannot be applied for non-sinusoidal signals. Assuming that the digitally modulated signal has a Gaussian amplitude distribution, the signal power within the selected resolution bandwidth can be obtained using correction factors. These correction factors are normally used by the signal analyzer's internal power measurement routines in order to determine the signal power from IF envelope measurements. These factors apply if and only if the assumption of a Gaussian amplitude distribution is correct.

Apart from this common method, the R&S FSV also has a true power detector, i.e. an RMS detector. It correctly displays the power of the test signal within the selected resolution bandwidth irrespective of the amplitude distribution, without additional correction factors being required. The absolute measurement uncertainty of the FSV is < 1.5 dB and a relative measurement uncertainty of < 0.5 dB (each with a confidence level of 95%).

There are two possible methods for measuring channel and adjacent channel power with a signal analyzer:

- ◆ **IBW method (Integration Bandwidth Method)**
The signal analyzer measures with a resolution bandwidth that is less than the channel bandwidth and integrates the level values of the trace versus the channel bandwidth. This method is described in section "[Method of calculating the channel power](#)".
- ◆ **Using a channel filter**
For a detailed description, refer to the following section.

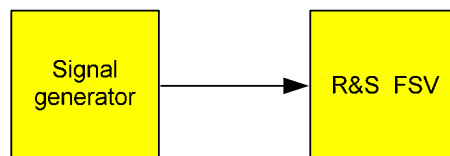
Measurements using a channel filter

In this case, the signal analyzer makes zero span measurements using an IF filter that corresponds to the channel bandwidth. The power is measured at the output of the IF filter. Until now, this method has not been used for signal analyzers, because channel filters were not available and the resolution bandwidths, optimized for the sweep, did not have a sufficient selectivity. The method was reserved for special receivers optimized for a particular transmission method.

The R&S FSV has test routines for simple channel and adjacent channel power measurements. These routines give quick results without any complex or tedious setting procedures.

2.6.1.1 Measurement Example 1 - ACPR Measurement on an CDMA 2000 Signal

Test setup:



Signal generator settings (e.g. R&S FSV SMU):

Frequency:	850 MHz
Level:	0 dBm
Modulation:	CDMA 2000

Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set the center frequency to 850 MHz and span to 4 MHz.
 - a) Press the "FREQ" key and enter *850 MHz*.
 - b) Press the "SPAN" key and enter *4 MHz*.
3. Set the reference level to +10 dBm by pressing the "AMPT" key and enter *10 dBm*.
4. Configuring the adjacent channel power for the CDMA 2000.
 - a) Press the "MEAS" key.
 - b) Press the "Ch Power ACLR" softkey.
 - c) Press the "CP / ACLR Standard" softkey.
 - d) In the standards list, mark "CDMA 2000".

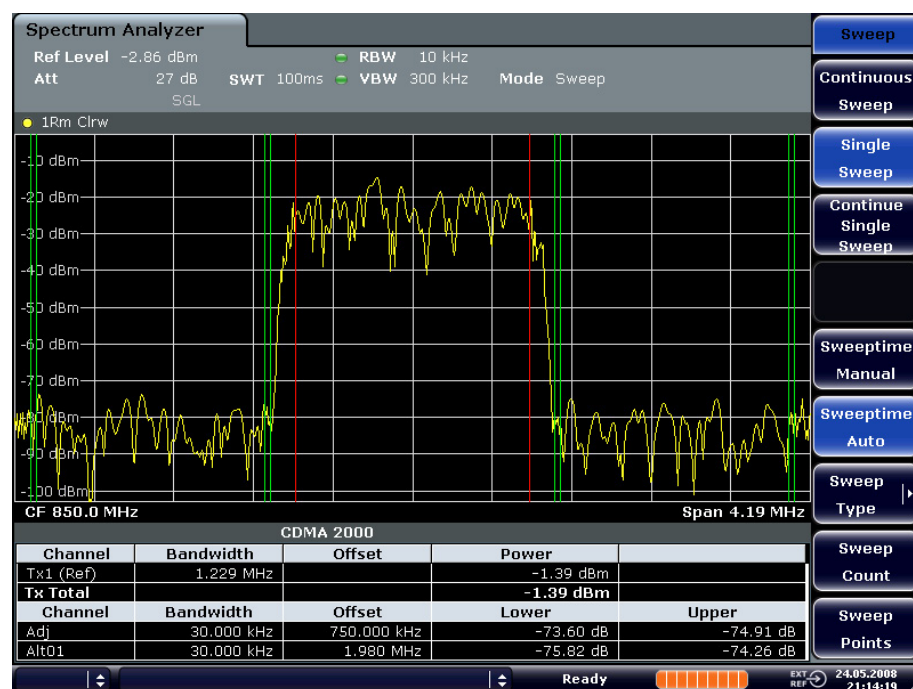
The R&S FSV sets the channel configuration according to the 2000 standard for mobile stations with 2 adjacent channels above and below the transmit channel. The spectrum is displayed in the upper part of the screen, the numeric values of the results and the channel configuration in the lower part of the screen. The various channels are represented by vertical lines on the graph.

The frequency span, resolution bandwidth, video bandwidth and detector are selected automatically to give correct results. To obtain stable results - especially in the adjacent channels (30 kHz bandwidth) which are narrow in comparison with the transmission channel bandwidth (1.23 MHz) - the RMS detector is used.

- Set the optimal reference level and RF attenuation for the applied signal level by pressing the "Adjust Ref Level" softkey.

The R&S FSV sets the optimal RF attenuation and the reference level based on the transmission channel power to obtain the maximum dynamic range. "Figure 19" shows the result of the measurement.

Figure 19: Adjacent channel power measurement on a CDMA 2000 MC1 signal



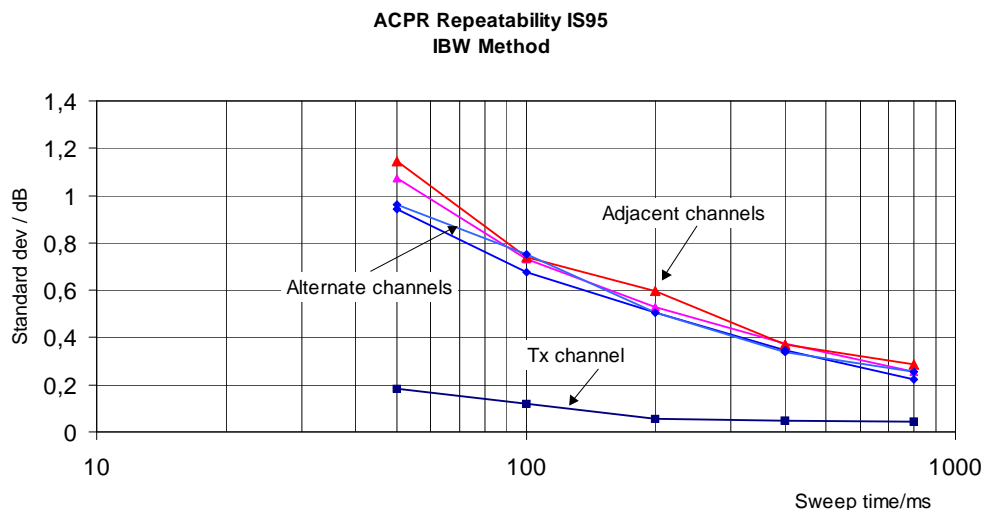
The repeatability of the results, especially in the narrow adjacent channels, strongly depends on the measurement time since the dwell time within the 30 kHz channels is only a fraction of the complete sweep time. A longer sweep time may increase the probability that the measured value converges to the true value of the adjacent channel power, but this increases measurement time.

To avoid long measurement times, the R&S FSV measures the adjacent channel power with zero span (fast ACLR mode). In the fast ACLR mode, the R&S FSV measures the power of each channel at the defined channel bandwidth, while being tuned to the center frequency of the channel in question. The digital implementation of the resolution bandwidths makes it possible to select filter characteristics that is precisely tailored to the signal. In case of CDMA 2000 MC1, the power in the useful channel is measured with a bandwidth of 1.23 MHz and that of the adjacent channels with a bandwidth of 30 kHz. Therefore the R&S FSV changes from one channel to the other and measures the power at a bandwidth of 1.23 MHz or 30 kHz using the RMS detector. The measurement time per channel is set with the sweep time. It is equal to the selected measurement time divided by the selected number of channels. The five channels from the above example and the sweep time of 100 ms give a measurement time per channel of 20 ms.

Compared to the measurement time per channel given by the span (= 5 MHz) and sweep time (= 100 ms, equal to 0.600 ms per 30 kHz channel) used in the example, this is a far longer dwell time on the adjacent channels (factor of 12). In terms of the number of uncorrelated samples this means $20000/33 \mu\text{s} = 606$ samples per channel measurement compared to $600/33 \mu\text{s} = 12.5$ samples per channel measurement.

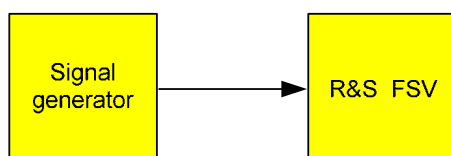
Repeatability with a confidence level of 95% is increased from ± 1.4 dB to ± 0.38 dB as shown in "Figure 17". For the same repeatability, the sweep time would have to be set to 1.2 s with the integration method. shows the standard deviation of the results as a function of the sweep time.

Figure 20: Repeatability of adjacent channel power measurement on CDMA 2000 standard signals if the integration bandwidth method is used



2.6.1.2 Measurement Example 2 - Measuring Adjacent Channel Power of a W-CDMA Uplink Signal

Test setup:



Signal generator settings (e.g. R&S FSV SMU):

Frequency:	1950 MHz
Level:	4 dBm
Modulation:	3 GPP W-CDMA Reverse Link

Procedure:

1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Set the center frequency to 1950 MHz by pressing the "FREQ" key and entering *1950 MHz*.

3. Switch on the ACLR measurement for W-CDMA.
 - a) Press the "MEAS" key.
 - b) Press the "Ch Power ACLR" softkey.
 - c) Press the "CP / ACLR Standard" softkey.
 - d) In the standards list, select "W-CDMA 3GPP REV".

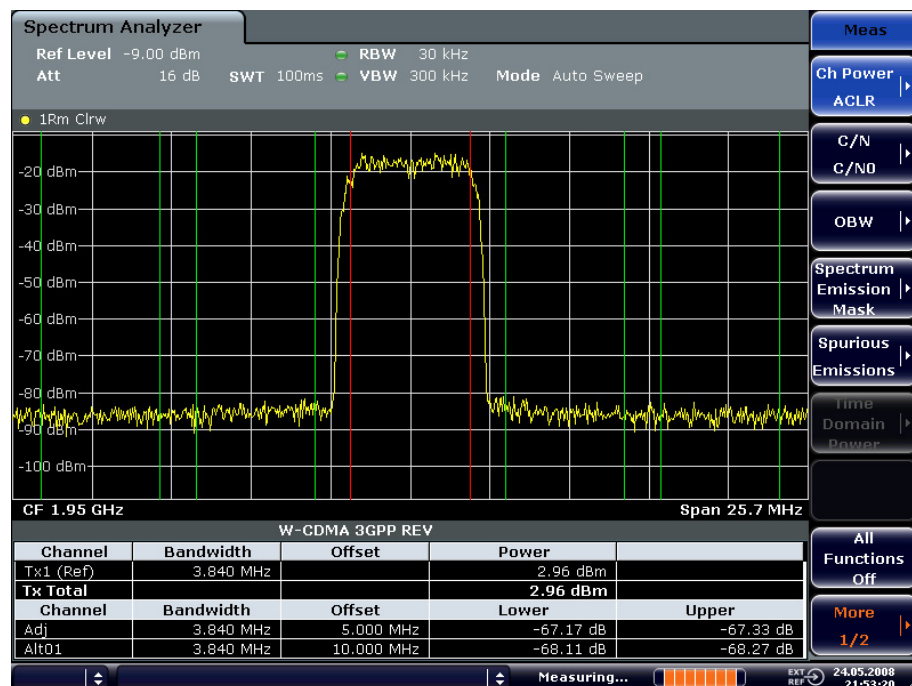
The R&S FSV sets the channel configuration to the 3GPP W-CDMA standard for mobiles with two adjacent channels above and below the transmit channel. The frequency span, the resolution and video bandwidth and the detector are automatically set to the correct values. The spectrum is displayed in the upper part of the screen and the channel power, the level ratios of the adjacent channel powers and the channel configuration in the lower part of the screen. The individual channels are displayed as vertical lines on the graph.

4. Set the optimum reference level and the RF attenuation for the applied signal level.

- a) Press the "Adjust Ref Level" softkey.

The R&S FSV sets the optimum RF attenuation and the reference level for the power in the transmission channel to obtain the maximum dynamic range. The following figure shows the result of the measurement.

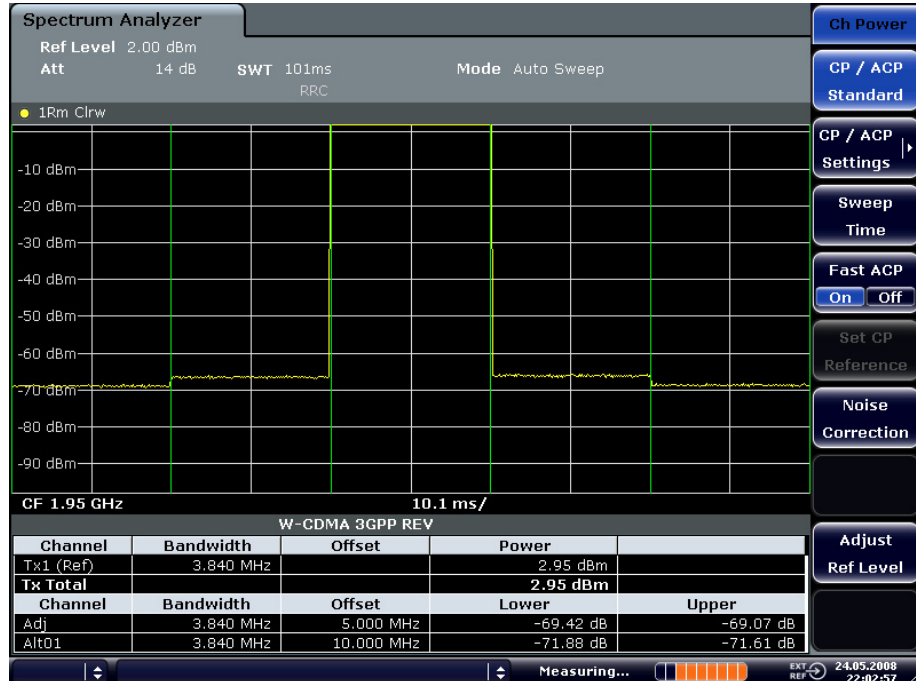
Figure 21: Measuring the relative adjacent channel power on a W-CDMA uplink signal



5. Measuring adjacent channel power with the fast ACLR mode.
 - a) Set "Fast ACLR" softkey to "On".
 - b) Press the "Adjust Ref Level" softkey.

The R&S FSV measures the power of the individual channels with zero span. A root raised cosine filter with the parameters $\alpha = 0.22$ and chip rate 3.84 Mcps (= receive filter for 3GPP W-CDMA) is used as channel filter.

Figure 22: Measuring the adjacent channel power of a W-CDMA signal with the fast ACLR mode



2.6.2 Amplitude Distribution Measurements

If modulation types are used that do not have a constant zero span envelope, the transmitter has to handle peak amplitudes that are greater than the average power. This includes all modulation types that involve amplitude modulation -QPSK for example. CDMA transmission modes in particular may have power peaks that are large compared to the average power.

For signals of this kind, the transmitter must provide large reserves for the peak power to prevent signal compression and thus an increase of the bit error rate at the receiver. The peak power or the crest factor of a signal is therefore an important transmitter design criterion. The crest factor is defined as the peak power / mean power ratio or, logarithmically, as the peak level minus the average level of the signal.

To reduce power consumption and cut costs, transmitters are not designed for the largest power that could ever occur, but for a power that has a specified probability of being exceeded (e.g. 0.01%).

To measure the amplitude distribution, the R&S FSV has simple measurement functions to determine both the APD = Amplitude Probability Distribution and CCDF = Complementary Cumulative Distribution Function.

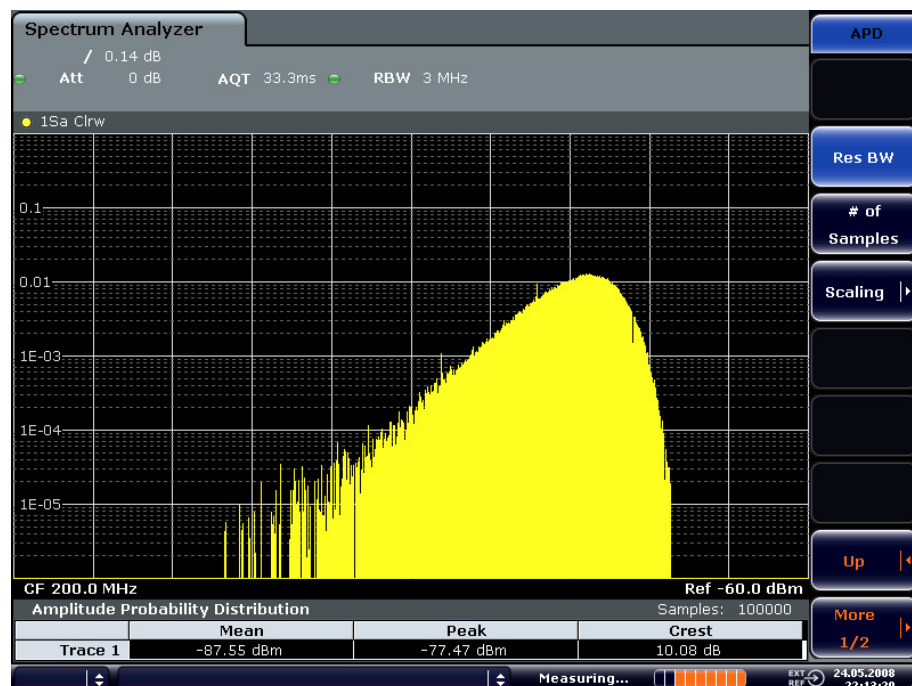
In the APD display mode, the probability of occurrence of a certain level is plotted against the level.

In the CCDF display mode, the probability that the mean signal power will be exceeded is shown in percent.

2.6.2.1 Measurement Example - Measuring the APD and CCDF of White Noise Generated by the R&S FSV

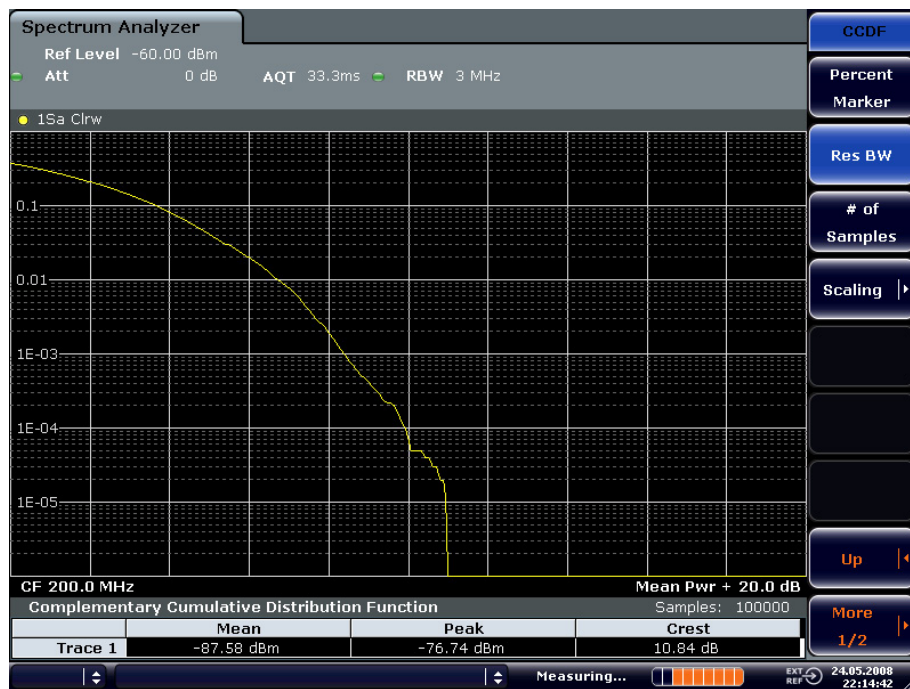
1. Set the R&S FSV to its default state by pressing the "PRESET" key.
The R&S FSV is in its default state.
2. Configure the R&S FSV for APD measurement
 - a) Press the "AMPT" key and enter -60 dBm.
The R&S FSV's intrinsic noise is displayed at the top of the screen.
 - b) Press the "MEAS" key.
 - c) Press the "More" softkey.
 - d) Press the "APD" softkey.
The R&S FSV sets the frequency span to 0 Hz and measures the amplitude probability distribution (APD). The number of uncorrelated level measurements used for the measurement is 100000. The mean power and the peak power are displayed in dBm. The crest factor (peak power - mean power) is output as well.

Figure 23: Amplitude probability distribution of white noise



3. Switch to the CCDF display mode.
 - a) Press the "UP" key.
 - b) Press the "CCDF" softkey.
The CCDF display mode is switched on.

Figure 24: CCDF of white noise



The CCDF trace indicates the probability that a level will exceed the mean power. The level above the mean power is plotted along the x-axis of the graph. The origin of the axis corresponds to the mean power level. The probability that a level will be exceeded is plotted along the y-axis.

Bandwidth selection

When the amplitude distribution is measured, the resolution bandwidth must be set so that the complete spectrum of the signal to be measured falls within the bandwidth. This is the only way of ensuring that all the amplitudes will pass through the IF filter without being distorted. If the resolution bandwidth which is selected is too small for a digitally modulated signal, the amplitude distribution at the output of the IF filter becomes a Gaussian distribution according to the central limit theorem and so corresponds to a white noise signal. The true amplitude distribution of the signal therefore cannot be determined.

Selecting the number of samples

For statistics measurements with the R&S FSV, the number of samples N_{Samples} is entered for statistical evaluation instead of the sweep time. Since only statistically independent samples contribute to statistics, the measurement or sweep time is calculated automatically and displayed. The samples are statistically independent if the time difference is at least $1/\text{RBW}$. The sweep time SWT is, therefore, expressed as follows:

$$\text{SWT} = N_{\text{Samples}} / \text{RBW}$$

3 Manual Operation

For details refer to the Quick Start Guide chapter 4, "Basic Operations".

4 Instrument Functions

This chapter describes the analyzer functions and all basic settings functions of the R&S FSV in detail.

4.1 Instrument Functions - Analyzer

In this section, all analyzer functions of the R&S FSV and their application are explained in detail. The basic settings functions are described in section "[Instrument Functions - Basic Settings](#)".

For every key a table is provided in which all submenus and corresponding commands are listed. The description of the submenus and commands follows the order of the table. The commands for the optional remote control (if any) are indicated for each softkey. The description is divided into the following topics:

- ◆ "[Measurement Parameters](#)" on page "94"
This section describes how to reset the instrument, to set up specific measurements and to set the measurement parameters. Examples of basic operations are provided in the Quick Start Guide, chapter 5 "Basic Measurement Examples". Advanced examples are described in chapter "Advanced Measurement Examples".
- ◆ "[Measurement Functions](#)" on page "145"
This section informs about how to select and configure the measurement functions. Examples of basic operations are provided in the Quick Start Guide, chapter 5 "Basic Measurement Examples". Advanced examples are described in chapter "Advanced Measurement Examples".
- ◆ "[Measurement Modes](#)" on page "237"
This section describes the provided measurement modes, the change of measurement modes and the access to the menus of all active measurement modes.

More basic information on operation is given in the Quick Start Guide. The front and the rear view of the instrument together with a table of all available keys and a short description are provided in chapter "Front and Rear Panel". Chapter "Preparing for Use" informs how to start working with the instrument for the first time. A brief introduction on handling the instrument is given in chapter "Basic Operations". This also includes the description of the keys for basic operations like switching the instrument on and off or starting a measurement.

4.2 Measurement Parameters

In this section all menus necessary for setting measurement parameters are described. This includes the following topics and keys. For details on changing the mode refer to "[Measurement Mode Selection - MODE Key](#)" on page "237".

- ◆ "[Initializing the Configuration - PRESET Key](#)" on page "94"
- ◆ "[Selecting the Frequency and Span - FREQ Key](#)" on page "96"
- ◆ "[Setting the Frequency Span - SPAN Key](#)" on page "102"
- ◆ "[Setting the Level Display and Configuring the RF Input - AMPT Key](#)" on page "104"
- ◆ "[Defining Automatic Settings - AUTO SET Key](#)" on page "111"
- ◆ "[Setting the Bandwidths and Sweep Time - BW Key](#)" on page "113"
- ◆ "[Configuring the Sweep Mode - SWEEP Key](#)" on page "121"
- ◆ "[Setting Traces - TRACE Key](#)" on page "124"
- ◆ "[Triggering the Sweep - TRIG Key](#)" on page "138"

Table 1: Sweep range variables

Abbreviation	Definition	R&S FSV3 value	R&S FSV7 value
f_{\max}	max. frequency	3.6 GHz	7 GHz
f_{\min}	min. frequency available	1 MHz	1 MHz
span_{\min}	smallest selectable span > 0 Hz	1 MHz	1 MHz

4.2.1 Initializing the Configuration - PRESET Key

The "PRESET" key resets the instrument to the default setting and therefore provides a defined initial state as a known starting point for measurements.

Note: If the "LOCAL LOCKOUT" function is active in the remote control mode, the "PRESET" key is disabled.

Further information

- ◆ "[Initial Configuration](#)" on page "95"

Task

- ◆ "[Presetting the Instrument](#)"

4.2.1.1 Presetting the Instrument

1. Define the data set for the presetting:
 - To retrieve the originally provided settings file (see "[Initial Configuration](#)"), in the "[SAVE/RCL](#)" menu, deactivate the "[Startup Recall](#)" softkey.
 - To retrieve a customized settings file, in the file menu, activate the "Startup Recall" softkey, press the "Startup Recall Setup" softkey, and select the corresponding file.
For details refer to section "[Saving and Recalling Settings Files – SAVE/RCL Key](#)".
2. Press the "PRESET" key to trigger a preset.
 - Remote: *RST or SYSTem:PRESet (for details refer to chapter "Remote Control - Commands", section "[Common Commands](#)" or section "[SYSTem Subsystem](#)").

4.2.1.2 Initial Configuration

The initial configuration is selected in a way that the RF input is always protected against overload, provided that the applied signal levels are in the allowed range for the instrument.

The parameter set of the initial configuration can be customized by using the "Startup Recall" softkey in the file menu. For further information refer to section "[Instrument Functions - Basic Settings](#)", "[Saving and Recalling Settings Files - FILE Key](#)".

Table 2 : Initial configuration

Parameter	Setting
mode	Spectrum analyzer
sweep mode	auto
center frequency	$f_{\max} / 2$
center frequency step size	$0.1 * \text{span}$
span	R&S FSV3: 3.6 GHz R&S FSV7: 7 GHz
RF attenuation	0 dB
reference level	-10 dBm
level range	100 dB log
level unit	dBm
sweep time	auto
resolution bandwidth	auto (3 MHz)
video bandwidth	auto (3 MHz)
FFT filters	off
span / RBW	100
RBW / VBW	1
sweep	cont
trigger	free run
trace 1	clr write
trace 2/3/4/5/6	blank
detector	auto peak
frequency offset	0 Hz
reference level offset	0 dB
reference level position	100 %
grid	abs
cal correction	on
noise source	off
input	RF

4.2.2 Selecting the Frequency and Span - FREQ Key

The "FREQ" key is used to specify the frequency axis, and to set the frequency offset and the signal track function. The frequency axis can be specified either by the start and stop frequency or by the center frequency and the span.

To open the frequency menu

- ◆ Press the "FREQ" key.
The frequency menu is displayed. The "Frequency Center" edit dialog box is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Frequency Menu](#)" on page "97"

Tasks

- ◆ "[Specifying the Frequency Axis by the Start and Stop Frequency](#)"
- ◆ "[Specifying the Frequency Axis by the Center Frequency and the Span](#)"
- ◆ "[Specifying the Step Size for the Arrow Keys and the Rotary Knob](#)"
- ◆ "[Modifying the Frequency Axis by an Offset](#)"
- ◆ "[Tracking Signals \(Span > 0\)](#)"

4.2.2.1 Softkeys of the Frequency Menu

The following table shows all softkeys available in the Frequency menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Center	
CF Stepsize >	0.1*Span/0.1*RBW
	0.5*Span/0.5*RBW
	x*Span/x*RBW
	=Center
	=Marker
	Manual
Start	
Stop	
Frequency Offset	
Signal Track >	Track On/Off
	Track BW
	Track Threshold
	Select Trace

Center

Opens an edit dialog box to enter the center frequency. The allowed range of values for the center frequency depends on the frequency span.

$$\text{span} > 0: \text{span}_{\min} / 2 \leq f_{\text{center}} \leq f_{\text{max}} - \text{span}_{\min} / 2$$

$$\text{span} = 0: 0 \text{ Hz} \leq f_{\text{center}} \leq f_{\text{max}}$$

f_{max} and span_{\min} are specified in the data sheet. To help analyze signals located at the end of the frequency range, for R&S FSV models with an upper frequency limit of 6 GHz or less, the f_{max} value is extended by 0.05 GHz for direct entry via the key pad. The preset and full span values remain unchanged.

→ Remote: [FREQ:CENT 100MHz](#)

Start

Opens an edit dialog box to define the start frequency. The following range of values is allowed:

$$f_{min} \leq f_{start} \leq f_{max} - span_{min}$$

f_{min} , f_{max} and $span_{min}$ are specified in the data sheet. To help analyze signals located at the end of the frequency range, for R&S FSV models with an upper frequency limit of 6 GHz or less, the f_{max} value is extended by 0.05 GHz for direct entry via the key pad.

The preset and full span values remain unchanged.

→ Remote: [FREQ:STAR 20MHZ](#)

Stop

Opens an edit dialog box to define the stop frequency. The following range of values for the stop frequency is allowed:

$$f_{min} + span_{min} \leq f_{stop} \leq f_{max}$$

f_{min} , f_{max} and $span_{min}$ are specified in the data sheet. To help analyze signals located at the end of the frequency range, for R&S FSV models with an upper frequency limit of 6 GHz or less, the f_{max} value is extended by 0.05 GHz for direct entry via the key pad.

The preset and full span values remain unchanged.

→ Remote: [FREQ:STOP 2000MHZ](#)

CF Stepsize

Opens a submenu to set the step size of the center frequency. In addition to the "[=Center](#)", "[=Marker](#)" and "[Manual](#)" softkeys, the other softkeys are displayed depending on the selected frequency span.

The step size can be coupled to the span ($span > 0$) or the resolution bandwidth ($span = 0$) or it can be manually set to a fixed value.

The submenu contains the following commands:

0.1*Span/0.1*RBW
0.5*Span/0.5*RBW
x*Span/x*RBW
=Center
=Marker
Manual

0.1*Span (span > 0)

Sets the step size for the center frequency to 10% of the span.

→ Remote: [FREQ:CENT:STEP:LINK SPAN](#)

→ Remote: [FREQ:CENT:STEP:LINK:FACT 10PCT](#)

0.1*RBW (zero span)

Sets the step size for the center frequency to 10% of the resolution bandwidth. This is the default setting.

→ Remote: [FREQ:CENT:STEP:LINK RBW](#)

→ Remote: [FREQ:CENT:STEP:LINK:FACT 10PCT](#)

0.5*Span (span > 0)

Sets the step size for the center frequency to 50% of the span.

- Remote: [FREQ:CENT:STEP:LINK SPAN](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 50PCT](#)

0.5*RBW (zero span)

Sets the step size for the center frequency to 50% of the resolution bandwidth.

- Remote: [FREQ:CENT:STEP:LINK RBW](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 50PCT](#)

x*Span (span > 0)

Opens an edit dialog box to set the step size for the center frequency as % of the span.

- Remote: [FREQ:CENT:STEP:LINK SPAN](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 20PCT](#)

x*RBW (zero span)

Opens an edit dialog box to set the step size for the center frequency as % of the resolution bandwidth. Values between 1 and 100% in steps of 1% are allowed. The default setting is 10%.

- Remote: [FREQ:CENT:STEP:LINK RBW](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 20PCT](#)

=Center

Sets the step size to the value of the center frequency and removes the coupling of the step size to span or resolution bandwidth. This function is especially useful during measurements of the signal harmonic content because by entering the center frequency each stroke of the arrow key selects the center frequency of another harmonic.

=Marker

Sets the step size to the value of the current marker and removes the coupling of the step size to span or resolution bandwidth. This function is especially useful during measurements of the signal harmonic content at the marker position because by entering the center frequency each stroke of the arrow key selects the center frequency of another harmonic.

Manual

Opens an edit dialog box to enter a fixed step size for the center frequency.

- Remote: [FREQ:CENT:STEP 120MHz](#)

Frequency Offset

Opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset. The allowed values range from -100 GHz to 100 GHz.

The default setting is 0 Hz.

→ Remote: [FREQ:OFFS 10 MHz](#)

Signal Track (span > 0)

Opens a submenu to modify the parameters for signal tracking:

- ◆ search bandwidth
- ◆ threshold value
- ◆ trace

The search bandwidth and the threshold value are shown in the diagram by two vertical lines and one horizontal line, which are labeled as "TRK". After each sweep the center frequency is set to the maximum signal found within the searched bandwidth. If no maximum signal above the set threshold value is found in the searched bandwidth, the track mechanism stops.

The submenu contains the following commands:

Track On/Off
Track BW
Track Threshold
Select Trace

Track On/Off (span > 0)

Switches the signal tracking on or off.

→ Remote: [CALC:MARK:FUNC:STR OFF](#)

Track BW (span > 0)

Opens an edit dialog box to set the search bandwidth for signal tracking. The frequency range is calculated as a function of the center frequency.

→ Remote: [CALC:MARK:FUNC:STR:BAND 1MHZ](#)

Track Threshold (span > 0)

Opens an edit dialog box to set the threshold value for signal tracking.

→ Remote: [CALC:MARK:FUNC:STR:THR -70DBM](#)

Select Trace (span > 0)

Opens an edit dialog box to select the trace on which the signal is tracked.

→ Remote: [CALC:MARK:FUNC:STR:TRAC 1](#)

4.2.2.2 Specifying the Frequency Axis by the Start and Stop Frequency

1. Press the ["Start"](#) softkey and enter a start frequency.
2. Press the ["Stop"](#) softkey and enter a stop frequency.

4.2.2.3 Specifying the Frequency Axis by the Center Frequency and the Span

1. Press the "FREQ" key and enter a center frequency in the "Frequency Center" edit dialog box.
2. Press the "SPAN" key and enter the bandwidth you want to analyze.

Note: Entering a value of 0 Hz will cause a change to the zero span analysis mode.

4.2.2.4 Specifying the Step Size for the Arrow Keys and the Rotary Knob

1. Press the ["CF Stepsize"](#) softkey.
The" softkeys are displayed according to the selected frequency span (zero span or span > 0).
2. To define the step size of the center frequency:
 - Only if span > 0: Press ["0.1*Span"](#), ["0.5*Span"](#) or ["x*Span"](#) to define the step size for the center frequency as percentage of the span.
 - Only if span = 0: Press ["0.1*RBW"](#), ["0.5*RBW"](#), or ["x*RBW"](#) to define the step size for the center frequency as percentage of the resolution bandwidth.
 - Press the ["=Center"](#) softkey to set the step size to the value of the center frequency and to remove the dependency of the step size to span or resolution bandwidth.
 - Press the ["=Marker"](#) softkey to set the step size to the value of the marker and to remove the dependency of the step size to span or resolution bandwidth.
 - Press the ["Manual"](#) softkey and enter a fixed step size for the center frequency.

Note: The step size assigned to arrow keys corresponds to the selected value; the step size of the rotary knob is $\frac{1}{10}$ of it.

4.2.2.5 Modifying the Frequency Axis by an Offset

- ◆ Press the "[Frequency Offset](#)" softkey and enter the offset to shift the displayed frequency span.

4.2.2.6 Tracking Signals (Span > 0)

- ◆ Press the "[Signal Track](#)" softkey to display the submenu and start and stop signal tracking with specified parameters.
- ◆ Press the "[Track On/Off](#)" softkey to switch signal tracking on or off.
- ◆ Press the "[Track BW](#)" softkey and enter a bandwidth for signal tracking.
- ◆ Press the "[Track Threshold](#)" softkey and enter the threshold for signal tracking.
- ◆ Press the "[Select Trace](#)" softkey and select the trace for signal tracking.

4.2.3 Setting the Frequency Span - SPAN Key

The "SPAN" key is used to set the frequency span to be analyzed.

To open the span menu

- ◆ Press the "SPAN" key.
The span menu is displayed. For span > 0 an edit dialog box to enter the frequency is displayed. For zero span, an edit dialog box to enter the sweep time is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Span Menu](#)" on page "102"

Task

- ◆ "[Specifying the Span \(Alternatives\)](#)"

4.2.3.1 Softkeys of the Span Menu

The following table shows all softkeys available in the span menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Command
Span Manual
SweepTime Manual
Full Span
Zero Span
Last Span
Freq Axis (Lin/Log)

Span Manual

Opens an edit dialog box to enter the frequency span. The center frequency is kept constant. The following range is allowed:

span = 0: 0 Hz

span >0: $\text{span}_{\min} \leq f_{\text{span}} \leq f_{\max}$

f_{\max} and span_{\min} are specified in the data sheet. To help analyze signals located at the end of the frequency range, for R&S FSV models with an upper frequency limit of 6 GHz or less, the f_{\max} value is extended by 0.05 GHz for direct entry via the key pad.

The preset and full span values remain unchanged.

→ Remote: [FREQ:SPAN 2GHz](#)

Full Span

Sets the span to the full frequency range of the R&S FSV specified in the data sheet. This setting is useful for overview measurements.

→ Remote: [FREQ:SPAN:FULL](#)

Zero Span

Sets the span to 0 Hz (zero span). The x-axis becomes the time axis with the grid lines corresponding to 1/10 of the current sweep time ("SWT").

→ Remote: [FREQ:SPAN 0Hz](#)

Last Span

Sets the span to the previous value. With this function e.g. a fast change between overview measurement and detailed measurement is possible.

Freq Axis (Lin/Log)

Switches the frequency axis to linear or logarithmic scaling.

→ Remote: [DISP:TRAC:X:SPAC LIN](#)

4.2.3.2 Specifying the Span (Alternatives)

1. To set the span, use the "[Span Manual](#)", "[Full Span](#)", "[Zero Span](#)" and "[Last Span](#)" softkeys.
2. To define a frequency range, use the "[Start](#)" and "[Stop](#)" softkeys of the "Frequency" menu.
3. For zero span, press the "[Sweptime Manual](#)" softkey and enter a sweep time.

4.2.4 Setting the Level Display and Configuring the RF Input - AMPT Key

The "AMPT" key is used to set the reference level, the level range and unit, the scaling and the RF attenuation.

To open the amplitude menu

- ◆ Press the "AMPT" key.
The amplitude menu is displayed. The "Reference Level" dialog box is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Amplitude Menu](#)" on page "104"

Tasks

- ◆ "[Specifying the Amplitude](#)" on page "110"
- ◆ "[Using Electronic Attenuation \(Option Electronic Attenuator, B25\)](#)" on page "110"

4.2.4.1 Softkeys of the Amplitude Menu

The following table shows all softkeys available in the amplitude menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Ref Level	
Range >	Range Log 100 dB
	Range Log 50 dB
	Range Log 10 dB
	Range Log 5 dB
	Range Log 1 dB
	Range Log Manual
	Range Linear %
	Range Lin. Unit
Unit >	dBm
	dBmV
	dBμV
	dBμA
	dBpW
	Volt
	Ampere
	Watt
Preamp On/Off	
RF Atten Auto / Mech Att Auto	
RF Atten Manual / Mech Att Manual	
EI Atten State	
EI Atten Mode (Auto/ Man)	

Menu / Command	Command
More >	
Ref Level Offset	
Ref Level Position	
Grid Abs / Rel	
Input (AC/DC)	
Input 50 Ω / 75 Ω	

Ref Level

Opens an edit dialog box to enter the reference level in the currently active unit (dBm, dBμV, etc).

The reference level value is the maximum value the AD converter can handle without distortion of the measured value. Signal levels above this value will not be measured correctly, which is indicated by the "IFOVL" status display.

→ Remote: [DISP:TRAC:Y:RLEV -60dBm](#)

Range

Opens a submenu to define the level display range using one of the following settings:

- ◆ ["Range Log 100 dB"](#)
- ◆ ["Range Log 50 dB"](#)
- ◆ ["Range Log 10 dB"](#)
- ◆ ["Range Log 5 dB"](#)
- ◆ ["Range Log 1 dB"](#)
- ◆ ["Range Log Manual"](#)
- ◆ ["Range Linear %"](#)
- ◆ ["Range Lin. Unit"](#)

Range Log 100 dB

Sets the level display range to 100 dB.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 100DB](#)

Range Log 50 dB

Sets the level display range to 50 dB.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 50DB](#)

Range Log 10 dB

Sets the level display range to 10 dB.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 10DB](#)

Range Log 5 dB

Sets the level display range to 5 dB.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 5DB](#)

Range Log 1 dB

Sets the level display range to 1 dB.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 1DB](#)

Range Log Manual

Opens an edit dialog box to enter a value for logarithmic scaling for the level display range.

→ Remote: [DISP:WIND:TRAC:Y:SPAC LOG](#)

(To define logarithmic scaling.)

→ Remote: [DISP:WIND:TRAC:Y 1DB](#)

Range Linear %

Selects linear scaling in % for the level display range, i.e. the horizontal grid lines are labeled in %. The grid is divided in decadal steps.

Markers are displayed in the selected unit ("[Unit](#)" softkey). Delta markers are displayed in % referenced to the voltage value at the position of marker 1. This is the default setting for linear scaling.

→ Remote: [DISP:TRAC:Y:SPAC LIN](#)

Range Lin. Unit

Selects linear scaling in dB for the level display range, i.e. the horizontal lines are labeled in dB.

Markers are displayed in the selected unit ("[Unit](#)" softkey). Delta markers are displayed in dB referenced to the power value at the position of marker 1.

→ Remote: [DISP:TRAC:Y:SPAC LDB](#)

Unit

Opens the "Unit" submenu to select the unit for the level axis. The default setting is dBm. If a transducer is switched on, the softkey is not available.

In general, the signal analyzer measures the signal voltage at the RF input. The level display is calibrated in RMS values of an unmodulated sine wave signal. In the default state, the level is displayed at a power of 1 mW (= dBm). Via the known input impedance (50 Ω or 75 Ω), conversion to other units is possible. The following units are available and directly convertible:

- ◆ dBm
 - ◆ dBmV
 - ◆ dB μ V
 - ◆ dB μ A
 - ◆ dBpW
 - ◆ Volt
 - ◆ Ampere
 - ◆ Watt
- Remote: [CALC:UNIT:POW DBM](#)

Preamp On/Off (option RF Preamplifier, B22)

Switches the preamplifier on or off.

The preamplifier has only an effect below 7 GHz.

- Remote: [INP:GAIN:STAT ON](#)

RF Atten Manual / Mech Att Manual

Opens an edit dialog box to enter the attenuation, irrespective of the reference level. If electronic attenuation is activated (option R&S FSV-B25 only; "EI Atten Mode Auto"), this setting defines the mechanical attenuation.

The mechanical attenuation can be set in 10 dB steps.

The RF attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). The range is specified in the data sheet. If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

Note: Values under 10 dB can only be entered via the numeric keypad or via remote control command in order to protect the input mixer against overload.

The RF attenuation defines the level at the input mixer according to the formula:

$$level_{mixer} = level_{input} - RF \text{ attenuation}$$

The maximum mixer level allowed is -10 dBm. Mixer levels above this value may lead to incorrect measurement results, which are indicated by the "OVL" status display.

→ Remote: [INP:ATT 30 DB](#)

RF Atten Auto / Mech Att Auto

Sets the RF attenuation automatically as a function of the selected reference level. This ensures that the optimum RF attenuation is always used. It is the default setting.

→ Remote: [INP:ATT:AUTO ON](#)

EI Atten State

This softkey switches the electronic attenuator on or off. This softkey is only available with option R&S FSV-B25.

When the electronic attenuator is activated, the mechanical and electronic attenuation can be defined separately. Note however, that both parts must be defined in the same mode, i.e. either both manually, or both automatically.

- ◆ To define the mechanical attenuation, use the "[RF Atten Manual / Mech Att Manual](#)" or "[RF Atten Auto / Mech Att Auto](#)" softkeys.
- ◆ To define the electronic attenuation, use the "[EI Atten Mode \(Auto/ Man\)](#)" softkey.

Note: When the electronic attenuator is switched off, the corresponding RF attenuation mode (auto/manual) is automatically activated.

→ Remote: [INP:EATT:AUTO ON](#)

EI Atten Mode (Auto/ Man)

This softkey defines whether the electronic attenuator value is to be set automatically or manually. If manual mode is selected, an edit dialog box is opened to enter the value. This softkey is only available with option R&S FSV-B25, and only if the electronic attenuator has been activated via the "[EI Atten State](#)" softkey.

The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

Tip: To re-open the edit dialog box for manual value definition, select the "Man" mode again.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

- Remote: [INP:EATT:AUTO OFF](#)
- Remote: [INP:EATT 10 DB](#)

Ref Level Offset

Opens an edit dialog box to enter the arithmetic level offset. This offset is added to the measured level irrespective of the selected unit. The scaling of the y-axis is changed accordingly. The setting range is ± 200 dB in 0.1 dB steps.

- Remote: [DISP:WIND:TRAC:Y:RLEV:OFFS -10dB](#)

Ref Level Position

Opens an edit dialog box to enter the reference level position, i.e. the position of the maximum AD converter value on the level axis. The setting range is from -200 to +200%, 0% corresponding to the lower and 100% to the upper limit of the diagram.

Grid Abs / Rel (not available with Range Linear)

Switches between absolute and relative scaling of the level axis.

Absolute scaling	The labeling of the level lines refers to the absolute value of the reference level. Absolute scaling is the default setting.
Relative scaling	The upper line of the grid is always at 0 dB. The scaling is in dB whereas the reference level is always in the set unit (for details on unit settings see " Unit " softkey).

- Remote: [DISP:WIND:TRAC:Y:MODE ABS](#)

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

- Remote: [INP:COUP AC](#)

Input 50 Ω / 75 Ω

Uses 50 Ω or 75 Ω as reference impedance for the measured levels. Default setting is 50 Ω .

The setting 75 Ω should be selected if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = 10 log (75 Ω / 50 Ω).

All levels specified in this Operating Manual refer to the default setting of the instrument (50 Ω).

→ Remote: [INP:IMP 50OHM](#)

4.2.4.2 Specifying the Amplitude

1. Set the reference level, offset and position using the "[Ref Level](#)", "[Ref Level Offset](#)" and "[Ref Level Position](#)" softkeys.
2. Select the level range and the unit for the level axis using the "[Range](#)" and "[Unit](#)" softkeys.
3. Set the scaling using the "[Ref Level Position](#)" and/or "[Grid Abs / Rel](#)" softkeys.
4. Set the attenuation using the "[RF Atten Manual](#)" or "[RF Atten Auto](#)", or (for option B25 only) "[EI Atten State](#)" / "[EI Atten Mode \(Auto/ Man\)](#)" softkeys.
5. Define the RF input coupling using the "[Input \(AC/DC\)](#)" softkey, or a reference impedance using the "[Input 50 Ω / 75 Ω](#)" softkey.
6. If available, activate or deactivate the RF Preamplifier (option B22) using the "[Preamp On/Off](#)" softkey.

4.2.4.3 Using Electronic Attenuation (Option Electronic Attenuator, B25)

Besides the mechanical attenuator at the RF input, the R&S FSV also offers an electronic attenuation setting (option Electronic Attenuator B25). The electronic attenuator can be set manually or automatically. The default attenuation is preset by the mechanical attenuator. The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

In automatic mode, the electronic attenuator is set to 0 dB. If a reference level outside the allowed 30 dB range is set, the mechanical attenuator performs the setting. From this new reference level to over 30dB, the electronic attenuator performs the setting again.

Setting electronic attenuation

1. Activate the electronic attenuation by pressing the "[EI Atten State](#)" softkey.
2. Select the required attenuator mode by pressing the "[EI Atten Mode \(Auto/ Man\)](#)" softkey until the required mode is highlighted.
Two new softkeys are displayed to set the mechanical attenuation. The same mode is activated for mechanical attenuation as was selected for electronic attenuation.
3. To define the attenuation manually:
 - a) Press the "[EI Atten Mode \(Auto/ Man\)](#)" softkey again, if necessary, to display the edit dialog box.
 - b) Enter the value for the electronic attenuator in the edit dialog box.
 - c) If necessary, press the "[Mech Att Manual](#)" softkey to open the edit dialog box for mechanical attenuation and enter the required value.

4.2.5 Defining Automatic Settings - AUTO SET Key

The "AUTO SET" menu allows you define automatic settings for measurements quickly.

To open the AUTO SET menu

- ◆ Press the "AUTO SET" key.
The Auto Set menu is displayed.

Menu and softkey description

- ◆ "[Softkeys of the AUTO SET Menu](#)" on page "111"

4.2.5.1 Softkeys of the AUTO SET Menu

The following table shows all softkeys available in the AUTO SET menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Auto All	
Auto Freq	
Auto Level	
Settings >	Meas Time Manual
	Meas Time Auto
Sweep Type >	Auto
	Sweep
	FFT

Auto All

Performs all automatic settings:

1. [Auto Freq](#)
 2. [Auto Level](#)
- Remote: [ADJ:ALL](#)

Auto Freq

Defines the center frequency automatically by determining the highest frequency level in the frequency span. This function uses the signal counter; thus it is intended for use with sinusoidal signals.

→ Remote: [ADJ:FREQ](#)

Auto Level

Defines the optimal reference level for the current measurement automatically. The measurement time for automatic leveling can be defined using the "[Settings](#)" softkey.

→ Remote: [ADJ:LEV](#)

Settings

Opens a submenu to define settings for automatic leveling.

Possible settings are:

- ◆ [Meas Time Manual](#)
- ◆ [Meas Time Auto](#)

Meas Time Manual

Opens an edit dialog box to enter the duration of the level measurement in seconds. The level measurement is used to determine the optimal reference level automatically (see the "[Auto Level](#)" softkey). The default value is 100 ms.

→ Remote: [ADJ:CONF:LEV:DUR 5](#)

Meas Time Auto

The level measurement is used to determine the optimal reference level automatically (see the "[Auto Level](#)" softkey). This softkey resets the level measurement duration for automatic leveling to the default value of 100 ms.

Sweep Type

Opens a submenu to define the sweep type.

In frequency sweep mode, the analyzer provides several possible methods of sweeping:

- ◆ [Sweep](#)
- ◆ [FFT](#)
- ◆ [Auto](#)

Sweep

Sets the "[Sweep Type](#)" to standard analog frequency sweep.

In the standard sweep mode, the local oscillator is set to provide the spectrum quasi analog from the start to the stop frequency.

→ Remote: [SWE:TYPE SWE](#)

FFT

Sets the "[Sweep Type](#)" to FFT mode.

The FFT sweep mode samples on a defined frequency value and transforms it to the spectrum by fast Fourier transformation (FFT).

Note: *Not all measurement configurations allow for FFT mode. For instance, the Quasi peak detector does not support FFT. In this case, sweep mode is used.*

FFT mode is also available for:

- ◆ sweep time
 - ◆ video bandwidth
 - ◆ all detectors except Quasi peak
 - ◆ gated trigger measurements
 - ◆ signal count
-

→ Remote: [SWE:TYPE FFT](#)

Auto

Automatically sets the fastest available "[Sweep Type](#)" for the current measurement. Auto mode is set by default.

→ Remote: [SWE:TYPE AUTO](#)

4.2.6 Setting the Bandwidths and Sweep Time - BW Key

The "BW" key is used to set the resolution bandwidth, video bandwidth (VBW) and sweep time (SWT). The values available for resolution bandwidth and video bandwidth depend on the selected filter type. For details on channel filters see also "[List of Available RRC and Channel Filters](#)" on page "120".

To open the bandwidth menu

- ◆ Press the "BW" key.
The bandwidth menu is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Bandwidth Menu](#)" on page "120"

Further information

- ◆ "[List of Available RRC and Channel Filters](#)" on page "120"
- ◆ "[Table 3 : Filter types](#)" on page "120"

Tasks

- ◆ "[Specifying the Bandwidth](#)" on page "119"
- ◆ "[Selecting the Appropriate Filter Type](#)" on page "119"

4.2.6.1 Softkeys of the Bandwidth Menu

The following table shows all softkeys available in the bandwidth menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu/Command	Command
Res BW Manual	
Res BW Auto	
Video BW Manual	
Video BW Auto	
SweepTime Manual	
SweepTime Auto	
Sweep Type >	Sweep
	Auto
	FFT
Coupling Ratio >	RBW / VBW Sine [1/1]
	RBW / VBW Pulse [.1]
	RBW / VBW Noise [10]
	RBW / VBW Manual
	Span / RBW Auto [100]
	Span / RBW Manual
	Default Coupling
Filter Type	Normal (3dB)
	EMI (6dB)
	Channel
	FFT
	RRC

Sweep Type

See the "[Sweep Type](#)" softkey for the "AUTO SET" menu.

Res BW Manual

Opens an edit dialog box to enter a value for the resolution bandwidth. The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to "[Selecting the Appropriate Filter Type](#)" on page "119".

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or "UP"/"DNARROW" key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the resolution bandwidth is indicated by a green bullet next to the "RBW" display in the channel bar.

→ Remote: [BAND:AUTO OFF](#)

→ Remote: [BAND 1MHz](#)

Res BW Auto (span > 0)

Couples the resolution bandwidth to the selected span. If the span is changed, the resolution bandwidth is automatically adjusted.

This setting is recommended, if a favorable setting of the resolution bandwidth in relation to the selected span is desired.

→ Remote: [BAND:AUTO ON](#)

Video BW Manual

Opens an edit dialog box to enter the video bandwidth. The available video bandwidths are specified in the data sheet.

Numeric input is always rounded to the nearest possible bandwidth. For rotary knob or UP/DOWN key inputs, the bandwidth is adjusted in steps either upwards or downwards.

The manual input mode of the video bandwidth is indicated by a green bullet next to the "VBW" display in the channel bar.

→ Remote: [BAND:VID:AUTO OFF](#)

→ Remote: [BAND:VID 10 kHz](#)

Video BW Auto

Couples the video bandwidth to the resolution bandwidth. If the resolution bandwidth is changed, the video bandwidth is automatically adjusted.

This setting is recommended, if a minimum sweep time is required for a selected resolution bandwidth. Narrow video bandwidths require longer sweep times due to the longer settling time. Wide bandwidths reduce the signal/noise ratio.

→ Remote: [BAND:VID:AUTO ON](#)

Sweeptime Manual

Opens an edit dialog box to enter the sweep time.

Sweep time

absolute max. sweep time value: 16000 s

absolute min. sweep time value: 1 μ s (zero span)

2.5 ms (span > 0)

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Numeric input is always rounded to the nearest possible sweep time. For rotary knob or "UPARROW"/"DNARROW" key inputs, the sweep time is adjusted in steps either downwards or upwards.

The manual input mode of the sweep time is indicated by a green bullet next to the "SWT" display in the channel bar. If the selected sweep time is too short for the selected bandwidth and span, level measurement errors will occur due to a too short settling time for the resolution or video filters. In this case, the R&S FSV displays the error message "UNCAL" and marks the indicated sweep time with a red bullet.

- Remote: [SWE:TIME:AUTO OFF](#)
- Remote: [SWE:TIME 10s](#)

Sweeptime Auto (not available for zero span)

Couples the sweep time to the span, video bandwidth (VBW) and resolution bandwidth (RBW). If the span, resolution bandwidth or video bandwidth is changed, the sweep time is automatically adjusted.

The R&S FSV always selects the shortest sweep time that is possible without falsifying the signal. The maximum level error is < 0.1 dB, compared to using a longer sweep time.

- Remote: [SWE:TIME:AUTO ON](#)

Coupling Ratio

Opens a submenu to select the coupling ratios for functions coupled to the bandwidth.

The submenu contains the following commands:

RBW / VBW Sine [1/1]
RBW / VBW Pulse [.1]
RBW / VBW Noise [10]
RBW / VBW Manual
Span / RBW Auto [100]
Span / RBW Manual
Default Coupling

RBW / VBW Sine [1/1]

Sets the following coupling ratio:

$$\text{video bandwidth} = \text{resolution bandwidth}$$

This is the default setting for the coupling ratio resolution bandwidth/video bandwidth.

This is the coupling ratio recommended if sinusoidal signals are to be measured.

This setting is only effective for the "[Video BW Auto](#)" selection in the bandwidth menu.

- Remote: [BAND:VID:RAT 1](#)

RBW / VBW Pulse [.1]

Sets the following coupling ratio:

$$\text{video bandwidth} = 10 \times \text{resolution bandwidth or}$$

$$\text{video bandwidth} = 10 \text{ MHz (= max. VBW).}$$

This coupling ratio is recommended whenever the amplitudes of pulsed signals are to be measured correctly. The IF filter is exclusively responsible for pulse shaping. No additional evaluation is performed by the video filter.

This setting is only effective for the "[Video BW Auto](#)" selection in the main bandwidth menu.

→ Remote: [BAND:VID:RAT 10](#)

RBW / VBW Noise [10]

Sets the following coupling ratio:

$$\text{video bandwidth} = \text{resolution bandwidth}/10$$

At this coupling ratio, noise and pulsed signals are suppressed in the video domain.

For noise signals, the average value is displayed.

This setting is only effective for the "[Video BW Auto](#)" selection in the main menu.

→ Remote: [BAND:VID:RAT 0.1](#)

RBW / VBW Manual

Activates the manual input of the coupling ratio.

The resolution bandwidth/video bandwidth ratio can be set in the range 0.001 to 1000.

This setting is only effective for the "[Video BW Auto](#)" selection in the main menu.

→ Remote: [BAND:VID:RAT 10](#)

Span / RBW Auto [100]

Sets the following coupling ratio:

$$\text{resolution bandwidth} = \text{span}/100$$

This coupling ratio is the default setting of the R&S FSP

This setting is only effective for the "[Res BW Auto](#)" selection in the main menu.

→ Remote: [BAND:RAT 0.001](#)

Span / RBW Manual

Activates the manual input of the coupling ratio.

This setting is only effective for the "[Res BW Auto](#)" selection in the main menu.

The span / resolution bandwidth ratio can be set in the range 1 to 10000.

→ Remote: [BAND:RAT 0.1](#)

Default Coupling

Sets all coupled functions to the default state ("AUTO"). In addition, the ratio "RBW/VBW" is set to "SINE [1/3]" and the ratio "SPAN/RBW" to 50.

- Remote: [BAND:AUTO ON](#)
- Remote: [BAND:VID:AUTO ON](#)
- Remote: [SWE:TIME:AUTO ON](#)

Filter Type

Opens the "Filter Type" submenu to select the filter type.

The submenu contains the following softkeys:

- ◆ [Normal \(3dB\)](#)
- ◆ [EMI \(6dB\)](#)
- ◆ [Channel](#)
- ◆ [FFT](#)
- ◆ [RRC](#)

For detailed information on filters see "[Selecting the Appropriate Filter](#)" on page "119" and "[List of Available RRC and Channel Filters](#)" on page "120".

- Remote: [BAND:TYPE NORM](#)

4.2.6.2 Specifying the Bandwidth

1. Set the resolution bandwidth using the "[Res BW Manual](#)" or "[Res BW Auto](#)" softkey.
2. Set the video bandwidth using the "[Video BW Manual](#)" or "[Video BW Auto](#)" softkey.
3. Set the sweep time using the "[Sweeptime Manual](#)" or "[Sweeptime Auto](#)" softkey.
4. Press the "[Coupling Ratio](#)" softkey and select the appropriate filters.

4.2.6.3 Selecting the Appropriate Filter Type

All resolution bandwidths are realized with digital filters.

The video filters are responsible for smoothing the displayed trace. Using video bandwidths that are small compared to the resolution bandwidth, only the signal average is displayed and noise peaks and pulsed signals are repressed. If pulsed signals are to be measured, it is advisable to use a video bandwidth that is large compared to the resolution bandwidth ($VBW * 10 \times RBW$) for the amplitudes of pulses to be measured correctly.

The following filter types are available using the "[Filter Type](#)" softkey:

- ◆ Normal (3dB) (Gaussian) filters
The Gaussian filters are set by default. The available bandwidths are specified in the data sheet.
- ◆ EMI (6dB) filters
The available bandwidths are specified in the data sheet.
- ◆ FFT filters
The available bandwidths are specified in the data sheet.
For details on FFT see the "[Sweep Type](#)".
- ◆ Channel filters
For details see "[List of Available RRC and Channel Filters](#)".
Channel filters do not support FFT mode.
- ◆ RRC filters
For details see "[List of Available RRC and Channel Filters](#)".
RRC filters do not support FFT mode.

4.2.6.4 List of Available RRC and Channel Filters

For power measurement a number of especially steep-edged channel filters are available (see the following table).

For filters of type RRC (Root Raised Cosine), the filter bandwidth indicated describes the sampling rate of the filter. For all other filters (CFILter) the filter bandwidth is the 3 dB bandwidth.

Table 3 : Filter types

Filter Bandwidth	Filter Type	Application
100 Hz	CFILter	A0
200 Hz	CFILter	
300 Hz	CFILter	
500 Hz	CFILter	
1 kHz	CFILter	SSB
1.5 kHz	CFILter	
2 kHz	CFILter	
2.4 kHz	CFILter	
2.7 kHz	CFILter	
3 kHz	CFILter	
3.4 kHz	CFILter	
4 kHz	CFILter	DAB, Satellite
4.5 kHz	CFILter	
5 kHz	CFILter	
6 kHz	CFILter	ETTS300 113 (12.5 kHz channels)
8.5 kHz	CFILter	
9 kHz	CFILter	AM Radio

Filter Bandwidth	Filter Type	Application
10 kHz	CFILter	CDMAone ETTS300 113 (20 kHz channels) ETTS300 113 (25 kHz channels) TETRA PDC IS 136 CDPD, CDMAone
12.5 kHz	CFILter	
14 kHz	CFILter	
15 kHz	CFILter	
16 kHz	CFILter	
18 kHz, $\alpha=0.35$	RRC	
20 kHz	CFILter	
21 kHz	CFILter	
24.3 kHz, $\alpha=0.35$	RRC	
25 kHz	CFILter	
30 kHz	CFILter	FM Radio PHS J.83 (8-VSB DVB, USA)
50 kHz	CFILter	
100 kHz	CFILter	
150 kHz	CFILter	
192 kHz	CFILter	
200 kHz	CFILter	
300 kHz	CFILter	CDMAone CDMAone DAB W-CDMA 3GPP W-CDMA NTT DOCoMo
500 kHz	CFILter	
1 MHz	CFILter	
1.228 MHz	CFILter	
1.28 MHz	RRC	
1.5 MHz	CFILter	
2 MHz	CFILter	
3 MHz	CFILter	
3.84 MHz, $\alpha=0.22$	RRC	
4.096 MHz, $\alpha=0.22$	RRC	
5 MHz	CFILter	

4.2.7 Configuring the Sweep Mode - SWEEP Key

The "SWEEP" key is used to configure the sweep mode. Continuous sweep or single sweep is possible. The sweep time and the number of measured values are set.

To open the sweep menu

- ◆ Press the "SWEEP" key.
The sweep menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the Sweep Menu"](#) on page "122"

Task

- ◆ ["Specifying the Sweep Settings"](#) on page "124"

4.2.7.1 Softkeys of the Sweep Menu

The following table shows all softkeys available in the sweep menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu/ Command	Command
Continuous Sweep	
Single Sweep	
Continue Single Sweep	
Sweeptime Manual	
Sweeptime Auto	
Sweep Type >	Auto
	Sweep
	FFT
Sweep Count	
Sweep Points	

Continuous Sweep

Sets the continuous sweep mode: the sweep takes place continuously according to the trigger settings. This is the default setting. The trace averaging is determined by the sweep count value (see "[Sweep Count](#)" softkey).

→ Remote: [INIT:CONT ON](#)

Single Sweep

Sets the single sweep mode: after triggering, starts the number of sweeps that are defined by using the "[Sweep Count](#)" softkey. The measurement stops after the defined number of sweeps has been performed.

→ Remote: [INIT:CONT OFF](#)

Continue Single Sweep

Repeats the number of sweeps set by using the "[Sweep Count](#)" softkey, without deleting the trace of the last measurement.

This is particularly of interest when using the trace configurations "Average" or "Max Hold" to take previously recorded measurements into account for averaging / maximum search. For details on trace configuration refer to "[Setting Traces - TRACE Key](#)" on page "124".

→ Remote: [INIT:CONM](#)

Sweeptime Manual

Opens an edit dialog box to enter the sweep time. For details see "[Sweeptime Manual](#)" softkey in the bandwidth menu.

→ Remote: [SWE:TIME 10s](#)

Sweeptime Auto

Sets the automatic sweep time mode. For details see "[Sweeptime Auto](#)" softkey in the bandwidth menu.

→ Remote: [SWE:TIME:AUTO ON](#)

Sweep Type

See the "[Sweep Type](#)" softkey for the "AUTO SET" menu.

Sweep Count

Opens an edit dialog box to enter the number of sweeps to be performed in the single sweep mode. Values from 0 to 32767 are allowed. If the values 0 or 1 are set, one sweep is performed. The sweep count is applied to all the traces in a diagram.

The sweep count set in the sweep menu is the same as that in the trace menu (for further details see "[Sweep Count](#)" softkey). If the trace configurations "Average", "Max Hold" or "Min Hold" are set, the sweep count value also determines the number of averaging or maximum search procedures (for details on trace configuration see "[Setting Traces - TRACE Key](#)" on page "124").

Example:

1. Press the "TRACE" key > "Trace Mode" softkey > "Mode Max Hold" softkey.
2. Press the "SWEEP" key > "Sweep Count" softkey.
3. In the "Average Sweep Count" dialog box, enter 10.
4. Press the "Single Sweep" softkey:
R&S FSV performs the "Max Hold" function over 10 sweeps.

→ Remote: [SWE:COUN 64](#)

Sweep Points

Opens an edit dialog box to enter the number of measured values to be collected during one sweep.

- ◆ Entry via rotary knob:
 - In the range from 101 to 1001, the sweep points are increased or decreased in steps of 100 points.
 - In the range from 1001 to 32001, the sweep points are increased or decreased in steps of 1000 points.
- ◆ Entry via keypad:
All values in the defined range can be set.

The default value is 691 sweep points. If a value \neq 691 is set, the auto peak detector is turned off automatically.

→ Remote: [SWE:POIN 691](#)

4.2.7.2 Specifying the Sweep Settings

1. Press the "[Sweep Count](#)" softkey and enter the sweep count.
2. Press the "[Sweptime Manual](#)" or "[Sweptime Auto](#)" softkey to set the sweep time.
3. Press the "[Sweep Type](#)" softkey to select the sweep type.
4. Press the "[Sweep Points](#)" softkey and enter the number of sweep points.
5. Press the "[Continuous Sweep](#)" or "[Single Sweep](#)" softkey to select the sweep mode.
6. Press the "[Continue Single Sweep](#)" softkey to repeat the single sweep.

4.2.8 Setting Traces - TRACE Key

The "TRACE" key is used to configure the data acquisition for measurement and the analysis of the measurement data.

The R&S FSV is capable of displaying up to six different traces at a time in a diagram. A trace consists of a maximum of 691 measurement points on the horizontal axis (frequency or time). If more measured values than measurement points are available, several measured values are combined in one measurement point.

The trace functions include the following:

- ◆ Display mode of the trace ("[Clear Write](#)", "[View](#)" and "[Blank](#)"). For details on trace modes see "[Trace Mode Overview](#)" on page "133".
- ◆ Evaluation of the trace as a whole ("[Average](#)", "[Max Hold](#)", "[Min Hold](#)" and "[Trace Math](#)"). For details on averaging see "[Description of the Averaging Method](#)" on page "134".
- ◆ Evaluation of individual measurement points of a trace. For details on detectors see "[Detector Overview](#)" on page "135".

To open the trace menu

- ◆ Press the "TRACE" key.
The trace menu is displayed. The "Trace Configuration" dialog box is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Trace Menu](#)" on page "125"

Further information

- ◆ "[Trace Mode Overview](#)" on page "133"
- ◆ "[Detector Overview](#)" on page "135"
- ◆ "[Table 4 : Trace mode types](#)" on page "134"
- ◆ "[ASCII File Export Format](#)" on page "137"

Task

- ◆ "[Configuring Traces](#)" on page "131"
- ◆ "[Specifying the Trace Settings](#)" on page "133"

4.2.8.1 Softkeys of the Trace Menu

The following table shows all softkeys available in the trace menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Submenu / Command	Command
Trace 1/ Trace 2/ Trace 3/ Trace 4/ Trace 5/Trace 6 >	Clear Write	
	Max Hold	
	Min Hold	
	Average	
	View	
	Blank	
	Detector (Man/Auto)>	Auto Select
		Auto Peak
		Positive Peak
		Negative Peak
		Sample
		RMS
		Average
		Quasi Peak
Copy Trace		
Trace Wizard		
More >		
Hold/Cont		
Average Mode >	Lin	
	Log	
	Power	
ASCII Trace Export		
Decim Sep		
Trace Math >	T1-T2 -> T1	
	T1-T3 -> T1	
	T1-T4 -> T1	
	T1-T5 -> T1	
	T1-T6 -> T1	
	Trace Math Position	
	Trace Math Off	

Trace 1/ Trace 2/ Trace 3/ Trace 4/ Trace 5/Trace 6

Selects the active trace (1, 2, 3, 4, 5, 6) and opens the "Trace Mode" submenu for the selected trace. The default setting is trace 1 in the overwrite mode (see "[Clear Write](#)" mode), the other traces are switched off (see "[Blank](#)").

For details see "[Trace Mode Overview](#)" on page "133".

The submenu contains the following commands:

Clear Write
Max Hold
Min Hold
Average
View
Blank
Detector (Man/Auto)>

→ Remote: (selected via numeric suffix of :TRACe<1...6>)

Tip: To configure several traces in one step, press the "[Trace Wizard](#)" softkey to open a trace configuration dialog. See also "[Configuring Traces](#)" on page "131".

Trace Wizard

Opens the "Trace Wizard" dialog. See "[Configuring Traces](#)" on page "131".

Clear Write

Selects the "Clear Write" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC:MODE WRIT](#)

Max Hold

Selects the "Max Hold" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC:MODE MAXH](#)

Min Hold

Selects the "Min Hold" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC:MODE MINH](#)

Average

Selects the "Average" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC:MODE AVER](#)

View

Selects the "View" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC:MODE VIEW](#)

Blank

Selects the "Blank" mode. For details see "[Trace Mode Overview](#)" on page "133".

→ Remote: [DISP:TRAC OFF](#)

Detector (Man/Auto)

Opens a submenu to select the detector. For details see "[Detector Overview](#)" on page "135". If a detector was selected manually, the "MAN" indicator is highlighted.

The submenu contains the following commands:

Auto Select
Auto Peak
Positive Peak
Negative Peak
Sample
RMS
Average
Quasi Peak

Auto Select

Selects the optimum detector for the selected trace and filter mode. This is the default setting. For details see also "[Detector Overview](#)" on page "135".

Trace mode	Detector (band-pass filter)	Detector (FFT filter)
Clear/Write	Auto Peak	Max Peak
Average	Sample	Sample
Max Hold	Max Peak	Max Peak
Min Hold	Min Peak	Max Peak

→ Remote: [DET:AUTO ON](#)

Auto Peak

Selects the "Auto Peak" detector. For details see "[Detector Overview](#)" on page "135".

→ Remote: [DET APE](#)

Positive Peak

Selects the "Positive Peak" detector. For details see "[Detector Overview](#)" on page "135".

→ Remote: [DET POS](#)

Negative Peak

Selects the "Negative Peak" detector. For details see "[Detector Overview](#)" on page "135".

→ Remote: [DET NEG](#)

RMS

Selects the "RMS" detector. For details see "[Detector Overview](#)" on page "135".

Remote: [DET RMS](#)

Average

Selects the "Average" detector. For details see "[Detector Overview](#)" on page "135".

Remote: [DET AVER](#)

Sample

Selects the "Sample" detector. For details see "[Detector Overview](#)" on page "135".

Remote: [DET SAMP](#)

Quasi Peak

Selects the "Quasi Peak" detector. For details see "[Detector Overview](#)" on page "135".

Remote: [DET QPE](#)

Copy Trace

Opens an edit dialog box to enter the number of the trace memory in which the currently selected trace shall be copied.

→ Remote: [TRAC: COPY TRACE1, TRACE2](#)

Trace Math

Opens the "Trace Mathematics" dialog box to define which trace is subtracted from trace 1. The result is displayed in trace 1 and refers to the zero point defined with the "[Trace Math Position](#)" softkey. The following subtractions can be performed:

"T1"->"T1"- "T2"	Subtracts trace 2 from trace 1.
"T1"->"T1"- "T3"	Subtracts trace 3 from trace 1
"T1"->"T1"- "T4"	Subtracts trace 4 from trace 1
"T1"->"T1"- "T5"	Subtracts trace 5 from trace 1
"T1"->"T1"- "T6"	Subtracts trace 6 from trace 1

To switch off the trace math, use the "[Trace Math Off](#)"key.

→ Remote: [CALC1: MATH \(TRACE1 - TRACE2\)](#)

→ Remote: [CALC: MATH: STAT ON](#)

Trace Math Position

Opens an edit dialog box to define the zero point in % of the diagram height. The range of values extends from -100% to +200%.

→ Remote: [CALC: MATH: POS 50PCT](#)

Trace Math Off

Deactivates any previously selected trace math functions.

→ Remote: [CALC:MATH:STAT OFF](#)

Hold/Cont

Switches on or off the reset of the traces in Min Hold, Max Hold and Average mode after some specific parameter changes have been made. The default setting is off. Normally, the measurement is started anew after parameter changes, before the measurement results are evaluated (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

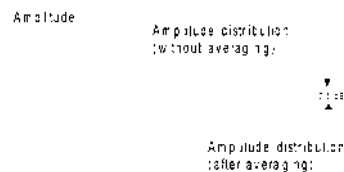
→ Remote: [DISP:TRAC:MODE:HCON ON](#)

Average Mode

Opens a submenu to select the averaging method for the average trace mode. The submenu contains the following softkeys:

Command
Lin
Log
Power

Logarithmic averaging is preferred to display signals with a low signal to noise ratio. While positive peak values are decreased in logarithmic averaging due to the characteristics involved, it is also true that negative peaks are increased relative to the average value. If the distorted amplitude distribution is averaged, a value is obtained that is smaller than the actual average value. The difference is -2.5 dB.



Probability distribution

This low average value is usually corrected in noise power measurements by a 2.5 dB factor. Therefore the R&S FSV offers the selection of linear averaging. The trace data is converted to linear values prior to averaging, then averaged and reconverted to logarithmic values. After these conversions the data is displayed on the screen. The average value is always correctly displayed irrespective of the signal characteristic. In case of stationary sinusoidal signals both logarithmic and linear averaging has the same results.

Lin

Activates linear averaging. This averaging method takes effect if the grid is set to a linear scale.

Linear averaging means that the power level values are converted into linear units prior to averaging. After the averaging, the data is converted back into its original unit.

This softkey takes effect if the grid is set to a linear scale (see "[Range](#)" softkey). In this case, the averaging is done in two ways (depending on the set unit – see "[Unit](#)" softkey):

- ◆ The unit is set to either W or dBm: the data is converted into W prior to averaging, i.e. averaging is done in W.
 - ◆ The unit is set to either V, A, dBmV, dB μ V, dB μ A or dBpW: the data is converted into V prior to averaging, i.e. averaging is done in V.
- Remote: [CALC:MATH:MODE LIN](#)

Log

Activates logarithmic averaging.

This averaging method only takes effect if the grid is set to a logarithmic scale (see "[Range](#)" softkey), i.e. the unit of the data is dBm. In this case the values are averaged in dBm. Otherwise (i.e. with linear scaling) the behavior is the same as with linear averaging (see "[Lin](#)" softkey). For further information on logarithmic scaling refer to the "Average Mode" softkey.

→ Remote: [CALC:MATH:MODE LOG](#)

Power

Activates linear power averaging.

The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

Unlike the linear mode, the averaging is always done in W.

→ Remote: [CALC:MATH:MODE POW](#)

ASCII Trace Export

Opens the "ASCII Trace Export Name" dialog box and saves the active trace in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the trace data. For details on an ASCII file see "[ASCII File Export Format](#)" on page "137".

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "[Decim Sep](#)" softkey.

→ Remote: [FORM ASC](#)

→ Remote: [MMEM:STOR:TRAC 1, 'TRACE.DAT'](#)

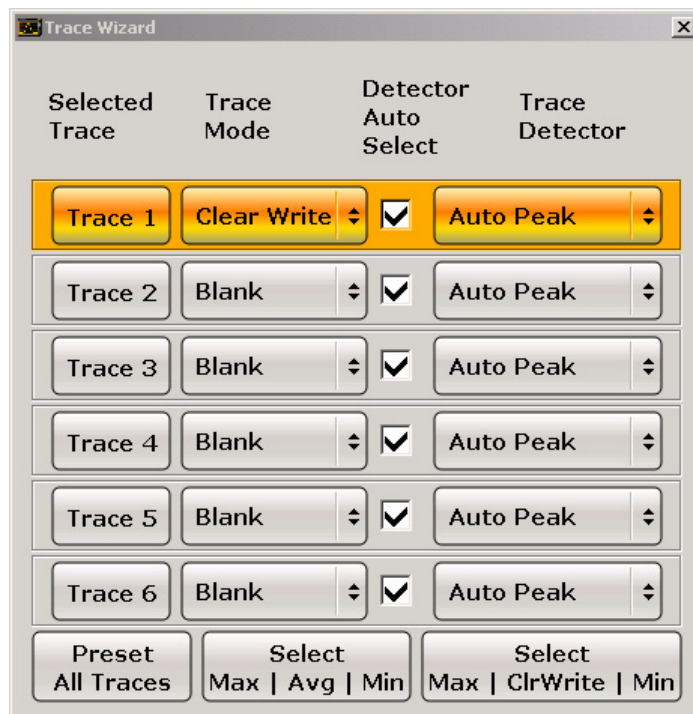
Decim Sep

Selects the decimal separator with floating-point numerals for the ASCII Trace export to support evaluation programs (e.g. MS-Excel) in different languages. The values '.' (decimal point) and ',' (comma) can be set. For details see also "[Average Mode](#)" softkey.

→ Remote: [FORM:DEXP:DSEP POIN](#)

4.2.8.2 Configuring Traces

1. To open the trace wizard, press the "TRACE" key and then the "[Trace Wizard](#)" softkey.



2. For each trace you can define the following settings:

"Display Mode"	<ul style="list-style-type: none"> ◆ Clear Write ◆ Max Hold ◆ Min Hold ◆ Average ◆ View ◆ Blank <p>For details see "Trace Mode Overview" on page "133".</p>
"Detector Auto Select"	Activates automatic detector selection (see " Auto Select " softkey). If activated, the "Trace Detector" setting is ignored.
"Trace Detector"	<p>Defines a specific trace detector. If one of the following settings is defined, the "Detector Auto Select" option is deactivated.</p> <ul style="list-style-type: none"> ◆ Auto Peak ◆ Positive Peak ◆ Negative Peak ◆ RMS ◆ Average ◆ Sample ◆ Quasi Peak

3. To configure several traces to predefined display modes in one step, press the button for the required function:

"Preset All Traces"	<p>Trace 1: Clear Write</p> <p>Trace 2-6: Blank</p>
"Select Max Avg Min"	<p>Trace 1: Max Hold</p> <p>Trace 2: Average</p> <p>Trace 3: Min Hold</p> <p>Trace 4-6: Blank</p>
"Select Max ClrWrite Min"	<p>Trace 1: Max Hold</p> <p>Trace 2: Clear Write</p> <p>Trace 3: Min Hold</p> <p>Trace 4-6: Blank</p>

For details see "[Trace Mode Overview](#)" on page "133").

4.2.8.3 Specifying the Trace Settings

1. To configure one or more traces, see "[Configuring Traces](#)" on page "125".
2. To select the trace mode for the selected trace, press the softkey for the corresponding trace (for details see "[Trace Mode Overview](#)" on page "133").
3. To select a detector, press the "[Auto Select](#)" softkey for automatic detector selection, or press the "[Detector](#)" softkey (for details see "[Detector Overview](#)" on page "135").
4. To change the sweep count setting, which also determines trace averaging, press the "[Sweep Count](#)" softkey.
5. To deactivate the reset of the traces in "Min Hold" and "Max Hold" mode after some specific parameter changes, press the "[Trace Math](#)" softkey.
6. To copy a trace into another trace memory, press the "[Copy Trace](#)" softkey. Upon copying, the contents of the selected memory are overwritten and the new contents are displayed in the "View" mode.
7. To export the active trace in ASCII format:
 - a) Press the "More" softkey.
 - b) If necessary, press the "[Decim Sep](#)" softkey to change the decimal separator with floating-point numerals.
 - c) Press the "[Average Mode](#)" softkey to enter the ASCII file export name. The active trace is saved in ASCII format on a floppy disk.

4.2.8.4 Trace Mode Overview

The traces can be activated individually for a measurement or frozen after completion of a measurement. Traces that are not activated are hidden. Each time the trace mode is changed, the selected trace memory is cleared.

The R&S FSV offers 6 different trace modes:

Table 4 : Trace mode types

Mode	Description
"Clear Write"	Overwrite mode: the trace is overwritten by each sweep. All available detectors can be selected. This is the default setting.
"Max Hold"	The maximum value is determined over several sweeps and displayed. The R&S FSV saves the sweep result in the trace memory only if the new value is greater than the previous one. The detector is automatically set to "Positive Peak". This mode is especially useful with modulated or pulsed signals. The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope. This mode is not available for statistics measurements.

Mode	Description
"Min Hold"	<p>The minimum value is determined from several measurements and displayed. The R&S FSV saves for each sweep the smallest of the previously stored/currently measured values in the trace memory. The detector is automatically set to "Negative Peak".</p> <p>This mode is useful e.g. for making an unmodulated carrier in a composite signal visible. Noise, interference signals or modulated signals are suppressed whereas a CW signal is recognized by its constant level.</p> <p>This mode is not available for statistics measurements.</p>
"Average"	<p>The average is formed over several sweeps. All available detectors can be selected. If the detector is automatically selected, the sample detector is used. For details see also "Table 4 : Trace mode types" on page "134".</p> <p>This mode is not available for statistics measurements.</p>
"View"	<p>The current contents of the trace memory is frozen and displayed.</p> <p>If a trace is frozen, the instrument settings, apart from level range and reference level (see below), can be changed without impact on the displayed trace. The fact that the trace and the current instrument setting do not correspond any more is indicated by the enhancement label "*" at the left edge of the grid.</p> <p>If level range or reference level is changed, the R&S FSV automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be made after the measurement in order to show details of the trace.</p>
"Blank"	Hides the selected trace.

4.2.8.5 Description of the Averaging Method

Averaging is carried out over the measurement points derived from the measurement samples. Several measured values may be combined in a measurement point. This means that with linear level display the average is formed over linear amplitude values. The sweep mode (continuous or single sweep, for details see "[Configuring the Sweep Mode - SWEEP Key](#)" on page "121") and running averaging apply to the average display analogously. In principle, two methods for calculating the average are used: continuous averaging and averaging over the selected number of sweeps.

◆ sweep count > 1

Depending on the relation of the following two parameters, two different situations exist:

n = number of sweeps performed since measurement start

c = sweep count (number of sweeps forming one statistics cycle)

– $n \leq c$

In single sweep or continuous sweep mode during the first statistics cycle, averaging over the selected number of sweeps is performed. The average trace n is calculated at each measurement point according to:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \quad \text{Equation 1}$$

with Avg = average trace; Curr = current trace

Until the first statistics cycle is completed ($n < c$), a preliminary average is displayed which represents the arithmetic mean value over all measured sweeps. With n increasing, the displayed trace is increasingly smoothed since there are more single sweeps for averaging.

When the first statistics cycle is completed ($n = c$), the average trace is saved in the trace memory.

– $n > c$

In continuous sweep mode after the first statistics cycle, continuous averaging is performed. The average trace n is calculated at each measurement point according to:

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \quad \text{Equation 2}$$

with Avg = average trace; Curr = current trace

In single sweep mode, the same formula is valid if the "[Continue Single Sweep](#)" softkey is pressed.

◆ sweep count = 0

In continuous sweep mode, a continuous average is calculated according to "[Equation 2](#)" with $c = 10$:

$$Avg(n) = \frac{9}{10} Avg(n-1) + \frac{1}{10} Curr(n) \quad \text{Equation 3}$$

with Avg = average trace; Curr = current trace

Due to the weighting between the current trace and the average trace, past values have practically no influence on the displayed trace after about ten sweeps. With this setting, signal noise is effectively reduced without need for restarting the averaging process after a change of the signal.

◆ sweep count = 1

The current trace is displayed. No averaging is performed. This is a special case of "[Equation 1](#)" with $n = 0$.

4.2.8.6 Detector Overview

The measurement detector for the individual display modes can be selected directly by the user or set automatically by R&S FSV. The detector activated for the specific trace is identified in the respective trace display field in form of an abbreviation (for details see "[Table 5 : Detector types](#)").

The detectors of the R&S FSV are implemented as pure digital devices. They collect signal power data within each measured point during a sweep. The default number of sweep points is 691. The following detectors are available:

Table 5 : Detector types

Detector	Indicator	Function
Auto Peak	Ap	determines the maximum and the minimum value within a measurement point
Positive Peak	Pk	determines the maximum value within a measurement point
Negative Peak (min peak)	Mi	determines the minimum value within a measurement point
RMS	Rm	determines the root mean square power within a measurement point
Average	Av	determines the linear average power within a measurement point
Sample	Sa	selects a random value within a measurement point
Quasi Peak	QP	determines the quasipeak power within a measurement point for EMI measurements

The result obtained from the selected detector within a measurement point is displayed as the power value at this measurement point.

All detectors work in parallel in the background, which means that the measurement speed is independent of the detector combination used for different traces.

Note: During a frequency sweep, R&S FSV increments the 1st local oscillator in steps that are smaller than approximately 1/10 of the bandwidth. This makes sure that the oscillator step speed is conforming to the hardware settling times and does not affect the precision of the measured power.

The number of measured values taken during a sweep is independent of the number of oscillator steps. It is always selected as a multiple or a fraction of 691 (= default number of trace points displayed on the screen). Choosing less than 691 measured values (e.g. 125 or 251) will lead to an interpolated measurement curve, choosing more than 691 points (e.g. 1001, 2001 ...) will result in several measured values being overlaid at the same frequency position.

4.2.8.7 ASCII File Export Format

The data of the file header consist of three columns, each separated by a semicolon: parameter name; numeric value; basic unit. The data section starts with the keyword "Trace <n>" (<n> = number of stored trace), followed by the measured data in one or several columns (depending on measurement) which are also separated by a semicolon.

File contents: header	Description
Type;R&S FSV;	Instrument model
Version;5.00;	Firmware version
Date;01.Oct 2006;	Date of data set storage
Mode;ANALYZER;	Instrument mode
Center Freq;55000;Hz	Center frequency
Freq Offset;0;Hz	Frequency offset
Span;90000;Hz	Frequency range (0 Hz in zero span and statistics measurements)
x-Axis;LIN;	Scaling of x-axis linear (LIN) or logarithmic (LOG)
Start;10000;Hz	Start/stop of the display range.
Stop;100000;Hz	Unit: Hz for span > 0, s for span = 0, dBm/dB for statistics measurements
Ref Level;-30;dBm	Reference level
Level Offset;0;dB	Level offset
Ref Position;75;%	Position of reference level referred to diagram limits (0% = lower edge)
y-Axis;LOG;	Scaling of y-axis linear (LIN) or logarithmic (LOG)
Level Range;100;dB	Display range in y direction. Unit: dB with x-axis LOG, % with x-axis LIN
Rf Att;20;dB	Input attenuation
RBW;100000;Hz	Resolution bandwidth
VBW;30000;Hz	Video bandwidth
SWT;0.005;s	Sweep time
Trace Mode;AVERAGE;	Display mode of trace: CLR/WRITE,AVERAGE,MAXHOLD,MINHOLD
Detector;AUTOPEAK;	Detector set: AUTOPEAK,MAXPEAK,MINPEAK,AVERAGE,RMS,SAMPLE,QUASISPEAK
Sweep Count;20;	Number of sweeps set
File contents: data section of the file	Description
Trace 1;;	Selected trace
x-Unit;Hz;	Unit of x values: Hz with span > 0; s with span = 0; dBm/dB with statistics measurements
y-Unit;dBm;	Unit of y values: dB*/V/A/W depending on the selected unit with y-axis LOG or % with y-axis LIN
Values; 691;	Number of measurement points
10000;-10.3;-15.7	Measured values: <x value>, <y1>, <y2>; <y2> being available only with detector AUTOPEAK and containing in this case the smallest of the two measured values for a measurement point.
10130;-11.5;-16.9	
10360;-12.0;-17.4	
.....;	

4.2.9 Triggering the Sweep - TRIG Key

The "TRIG" key is used to set trigger mode, trigger threshold, trigger delay, trigger polarity and for gated sweep the gate configuration.

To open the trigger menu

- ◆ Press the "TRIG" key.
The trigger menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the Trigger Menu"](#) on page "145"

Further information

- ◆ ["Trigger Mode Overview"](#) on page "145"

Tasks

- ◆ ["Specifying the Trigger Settings"](#) on page "142"
- ◆ ["Using Gated Sweep Operation"](#) on page "142"

4.2.9.1 Softkeys of the Trigger Menu

The following table shows all softkeys available in the trigger menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Submenu / Command	Command
Trg / Gate Source >	Free Run	
	External	
	Video	
	IF Power	
	Time	
Trg / Gate Level		
Trg / Gate Polarity (Pos/Neg)		
Trigger Offset		
Trigger Hysteresis		
Trigger Holdoff		
Gated Trigger		
Gate Settings >	Gate Mode (Lvl/Edge)	
	Gate Delay	
	Gate Length	
	Trg / Gate Source >	Free Run
		External
		Video
		IF Power
		Time
	Trg / Gate Level	
	Trg / Gate Polarity (Pos/Neg)	
	Sweep Time	

Trg / Gate Source

Opens the "Trigger" / "Gate Source" dialog box to select the trigger / gate mode. For detailed information on trigger modes see "[Trigger Mode Overview](#)" on page "145".

As gate modes, all modes are available. For details see also "[Using Gated Sweep Operation](#)" on page "142".

The default setting is "Free Run". If a trigger mode other than "Free Run" has been set, the enhancement label "TRG" is displayed.

The submenu contains the following commands:

Free Run
External
Video
IF Power
Time

- ➔ Remote: [TRIG:SOUR IMM | VID | IFP | EXT | TIME](#) (Free Run, Video, IF Power, Extern)
- ➔ Remote: [SWE:EGAT:SOUR EXT](#) (Extern)

Trg / Gate Level

Opens an edit dialog box to enter the trigger / gate level. For details see also "[Trigger Mode Overview](#)" on page "145" and "[Using Gated Sweep Operation](#)" on page "142".

In the "Time Trigger" mode, this softkey is not available.

- ➔ Remote: [TRIG:LEV:IFP -30DBM](#)

Trg / Gate Polarity (Pos/Neg)

Sets the polarity of the trigger / gate source.

The sweep starts after a positive or negative edge of the trigger signal. The default setting is "Pos". The setting applies to all modes with the exception of the "Free Run" mode.

- level triggering In the setting "Pos" the sweep is stopped by the logic "0" signal and restarted by the logical "1" signal after the gate delay time has elapsed.
- edge triggering The sweep is continued on a "0" to "1" transition for the gate length duration after the gate delay time has elapsed.

In the "Time Trigger" mode, this softkey is not available.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

- ➔ Remote: [TRIG:SLOP POS](#)
- ➔ Remote: [SWE:EGAT:POL POS](#)

Trigger Offset

Opens an edit dialog box to enter the time offset between the trigger signal and the start of the sweep. The time may be entered in multiples of 125 ns in the range -100 s to 100 s (default 0 s).

- offset > 0: start of the sweep is delayed
- offset < 0: sweep starts earlier (pre-trigger)
 - only possible for span = 0 and gated trigger switched off
 - not possible if RMS or average detector activated
 - maximum allowed range and the maximum resolution limited by the sweep time:
 - ◆ $\text{range}_{\text{max}} = -499/500 \times \text{sweep time}$
 - ◆ $\text{resolution}_{\text{max}} = \text{sweep time}/500$

In the "External" or "IF Power" trigger mode, a common input signal is used for both trigger and gate. Therefore changes to the gate delay will affect the trigger delay (trigger offset) as well.

In the "Time Trigger" mode, this softkey is not available.

→ Remote: [TRIG:HOLD 10US](#)

Trigger Hysteresis

Opens an edit dialog box to define the value for the trigger hysteresis. The hysteresis in dB is the value the input signal must stay below the IF power trigger level in order to allow a trigger to start the measurement. The range of the value is between 3 dB and 50 dB with a step width of 1 dB.

→ Remote: [TRIG:HYST 10DB](#)

Trigger Holdoff

Opens an edit dialog box to define the value for the trigger holdoff. The holdoff value in s is the time which must pass before triggering, in case another trigger event happens. The range of the value is between 150 ns and 10 s with a step width of 10 ns.

→ Remote: [TRIG:HOLD 500us](#)

→ Remote: `TRIG:HOLDOFF:ADJUST:AUTO`

Gated Trigger

Switches the sweep mode with gate on or off.

This softkey requires the following trigger mode:

- span > 0 "External" or "IF Power"
- span = 0 "External" or "IF Power" or "Video"

If a different mode is active, the "IF Power" trigger mode is automatically selected.

If the gate is switched on, a gate signal applied to the rear panel connector EXT TRIGGER/GATE or the internal IF power detector controls the sweep of the analyzer.

In the "Time Trigger" mode, this softkey is not available.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

→ Remote: [SWE:EGAT ON](#)

→ Remote: [SWE:EGAT:SOUR IFP | EXT](#)

Gate Settings

Opens a submenu to make all the settings required for gated sweep operation.

In the "Time Trigger" mode, this softkey is not available.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

The submenu contains the following commands:

Gate Mode (Lvl/Edge)
Gate Delay
Gate Length
Trg / Gate Source >
Trg / Gate Level
Trg / Gate Polarity (Pos/Neg)
Sweep Time

Gate Mode (Lvl/Edge)

Sets the gate mode. As settings level-triggered or edge-triggered gate mode can be selected.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

→ Remote: [SWE:EGAT:TYPE EDGE](#)

Gate Delay

Opens an edit dialog box to enter the gate delay time between the gate signal and the continuation of the sweep. Values between 125 ns and 100 s are allowed. The delay position on the time axis in relation to the sweep is indicated by a line labeled "GD". This is useful for e.g. taking into account a delay between the gate signal and the stabilization of an RF carrier.

As a common input signal is used for both trigger and gate when selecting the "External" or "IF Power" trigger mode, changes to the gate delay will affect the trigger delay (trigger offset) as well.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

→ Remote: [SWE:EGAT:HOLD 1US](#)

Gate Length (Gate Mode Edge)

Opens an edit dialog box to enter the gate length. Values between 125 ns and 100 s are allowed. The gate length in relation to the sweep is indicated by a line labeled "GL".

The length of the gate signal defines if the sweep is to be interrupted. Only in the edge-triggered mode the gate length can be set, while in the level-triggered the gate length depends on the length of the gate signal.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

→ Remote: [SWE:EGAT:LENG 100US](#)

Sweep Time

Opens an edit dialog box to change the sweep time in order to obtain a higher resolution for positioning gate delay and gate length. When quitting the "Gate Settings" submenu, the original sweep time is retrieved.

For details also see "[Using Gated Sweep Operation](#)" on page "142".

4.2.9.2 Specifying the Trigger Settings

1. Press the "[Trg / Gate Source](#)" softkey to select the trigger mode (for details see "[Trigger Mode Overview](#)" on page "145").
2. Press the "[Trg / Gate Level](#)" softkey to set the trigger level.
3. Press the "[Trigger Offset](#)" softkey to set the trigger offset. In addition, a "[Trigger Hysteresis](#)" and "[Trigger Holdoff](#)" can be defined via the corresponding softkeys. For details on gated sweep operation, see "[Using Gated Sweep Operation](#)" on page "142".

4.2.9.3 Using Gated Sweep Operation

By using a gate in sweep mode and stopping the measurement while the gate signal is inactive, the spectrum for pulsed RF carriers can be displayed without the superposition of frequency components generated during switching. Similarly, the spectrum can also be examined for an inactive carrier. The sweep can be controlled by an external gate or by the internal power trigger.

Gated sweep operation is also possible for span = 0. This enables - e.g. in burst signals - level variations of individual slots to be displayed versus time.

1. Press the "[Gate Settings](#)" submenu" softkey to define the settings of the gate mode.
At the center frequency a transition to zero span is made and the time parameters gate delay and gate length are displayed as vertical lines to adjust them easily. When quitting the "[Gate Settings](#)" submenu, the original span is retrieved so the desired measurement can be performed with the accurately set gate.
2. Setting the parameters gate delay and gate length highly accurate, press the "[Sweep Time](#)" softkey to alter the x-axis in a way that the signal range concerned (e.g. one full burst) is displayed.
3. Press the "[Gate Delay](#)" softkey to set the sampling time in a way that the desired portion of the signal is shown.
4. Press the "[Gate Mode \(Lvl/Edge\)](#)" softkey to set the gate mode.
5. If the "Edge" gate mode has been selected, press the "[Gate Length](#)" softkey to set the sampling duration in a way that the desired portion of the signal is shown.
6. Press the "[Trg / Gate Polarity \(Pos/Neg\)](#)" softkey to set the polarity of the trigger source.

- Press the "[Gated Trigger](#)" softkey to activate the gated sweep mode. To indicate that a gate is used for the sweep, the enhancement label "GAT" is displayed on the screen. This label appears to the right of the window for which the gate is configured.

Figure 25: TDMA signal with GATE OFF

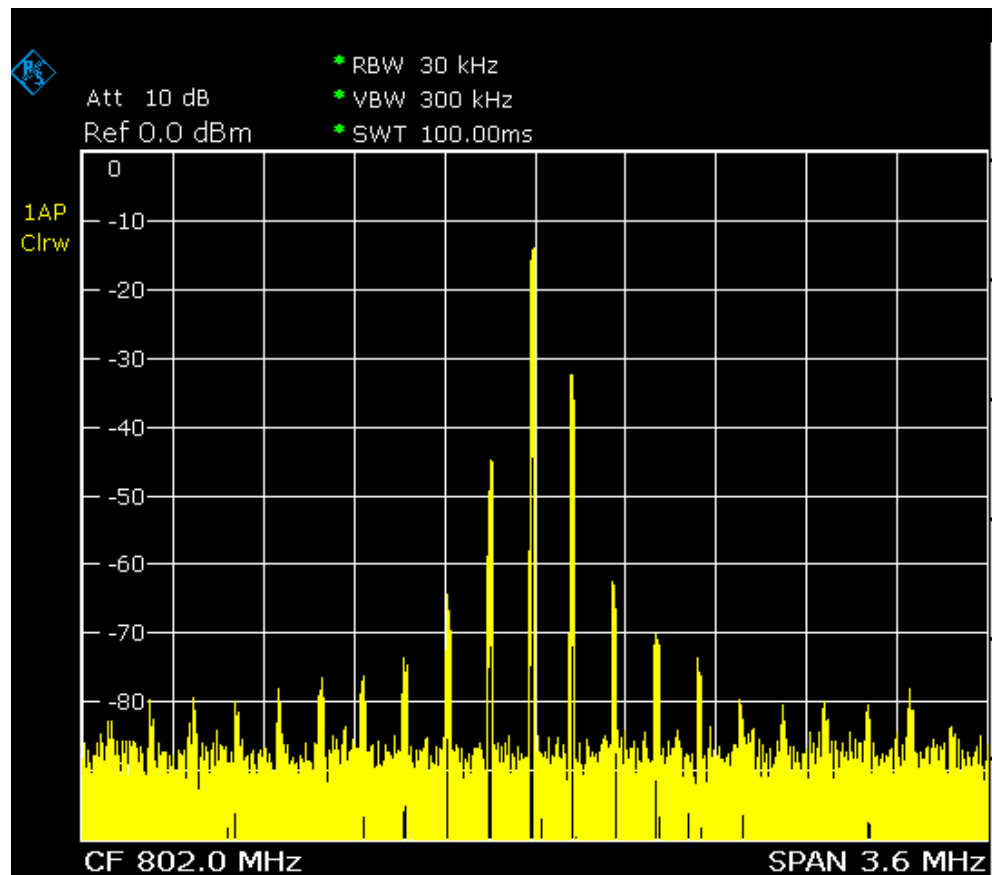


Figure 26: Pulsed signal with GATE ON

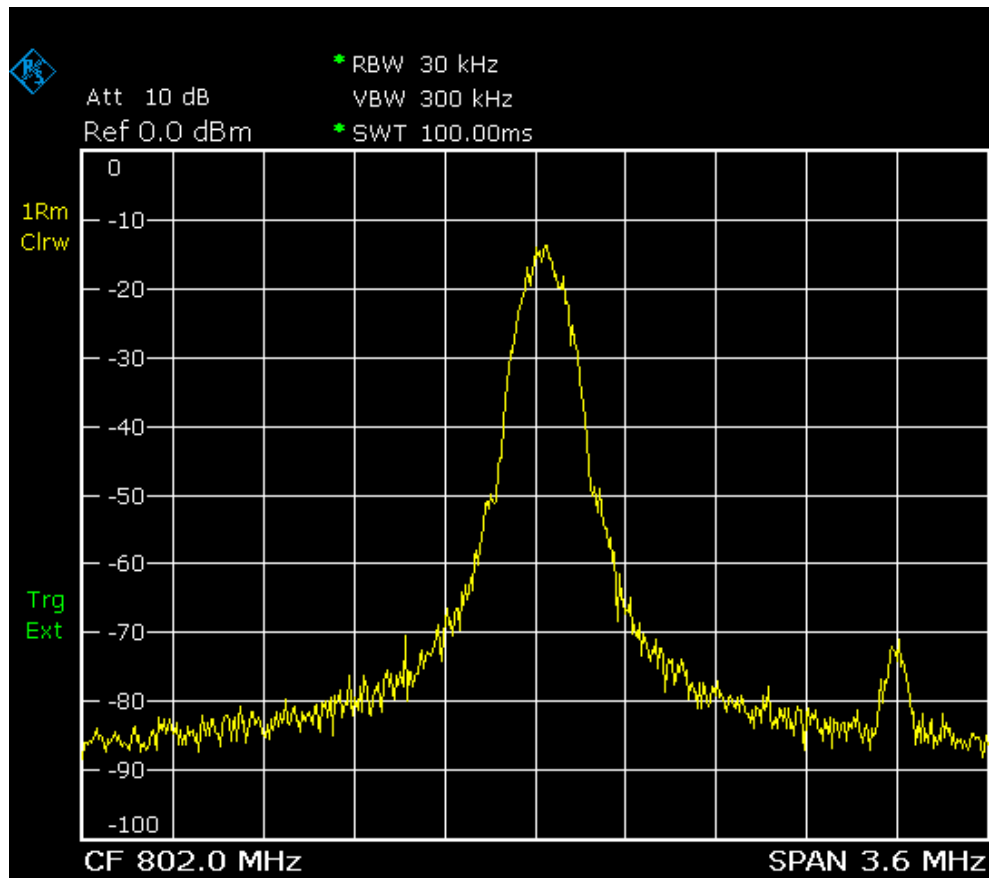
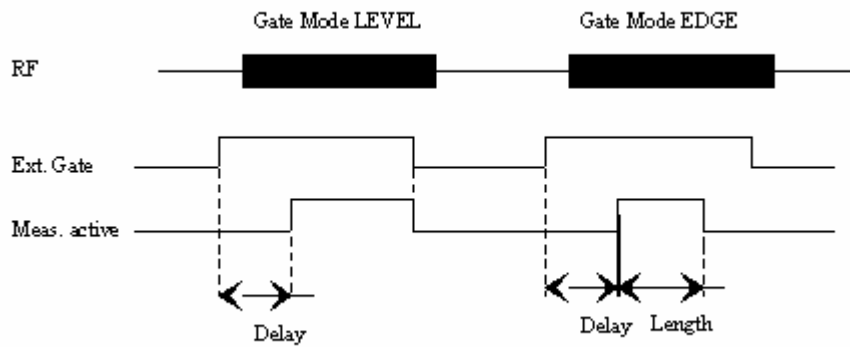


Figure 27: Timing diagram for GATE, GATE DELAY and GATE LENGTH



4.2.9.4 Trigger Mode Overview

The R&S FSV offers the following trigger modes:

- ◆ Free Run
The start of a sweep is not triggered. Once a measurement is completed, another is started immediately.
- ◆ External
Triggering via a TTL signal at the input connector "EXT TRIG / GATE IN" on the rear panel.
- ◆ Video
Triggering by the displayed voltage.
A horizontal trigger line is shown in the diagram. It is used to set the trigger threshold from 0% to 100% of the diagram height.
- ◆ IF Power
Triggering of the measurement via signals which are outside the measurement channel.
For this purpose, the R&S FSV uses a level detector at the second intermediate frequency. Its threshold can be set in a range between -50 dBm and -10 dBm at the input mixer. The resulting trigger level at the RF input is calculated via the following formula:

$$\text{Mixerlevel}_{\min} + \text{RFAtt} - \text{PreampGain} \leq \text{Input Signal} \leq \text{Mixerlevel}_{\max} + \text{RFAtt} - \text{PreampGain}$$

The bandwidth at the intermediate frequency is 20 MHz. The R&S FSV is triggered as soon as the trigger threshold is exceeded within a 10 MHz range around the selected frequency (= start frequency in the frequency sweep).
Thus, the measurement of spurious emissions, e.g. for pulsed carriers, is possible even if the carrier lies outside the selected frequency span.
- ◆ Time
Triggering of the measurement by a time interval, set via the "[Trigger Holdoff](#)" softkey.

4.3 Measurement Functions

In this section all menus necessary for setting measurement functions are described.

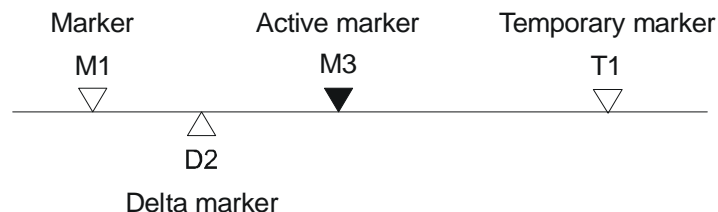
This includes the following topics and keys:

- ◆ "[Using Markers and Delta Markers - MKR Key](#)" on page "146"
- ◆ "[Changing Settings via Markers - MKR-> Key](#)" on page "163"
- ◆ "[Power Measurements - MEAS Key](#)" on page "171"
- ◆ "[Using Limit Lines and Display Lines - LINES Key](#)" on page "225"

4.3.1 Using Markers and Delta Markers - MKR Key

The markers are used for marking points on traces, reading out measurement results and for selecting a display section quickly. The R&S FSV provides 16 markers per trace.

Figure 28: Marker types



All markers can be used either as markers or delta markers. The marker that can be moved by the user is defined in the following as the active marker. Temporary markers are used in addition to the markers and delta markers to evaluate the measurement results. They disappear when the associated function is deactivated.

The measurement results of the active marker (also called marker values) are displayed in the marker field, which is located at the upper right corner of the diagram, or in a separate table beneath the diagram. The marker information includes the following:

- ◆ marker type (M1 in the example)
- ◆ trace in square brackets ([1] in the example)
- ◆ level (-33.09 dBm in the example)
- ◆ marker location (3 GHz in the example)

Figure 29: Marker values

```
M1[1]          -33.09 dBm
              3.000000000 GHz
```

The "MKR" key is used to select and position the absolute and relative measurement markers (markers and delta markers). In addition, the functions for the frequency counter, a fixed reference point for relative measurement markers, and for enlargement of the measurement area are assigned to this key.

To open the marker menu

- ◆ Press the "MKR" key.
The marker menu is displayed. If no marker is active, marker 1 is activated and a peak search on the trace is carried out. Otherwise, the edit dialog box for the last activated marker is opened and the current frequency / time value is displayed.

Further information

- ◆ ["Displayed Marker Information"](#) on page "150"
- ◆ ["Changing Settings via Markers - MKR-> Key"](#) on page "163".

Menu and softkey description

- ◆ "[Softkeys of the Marker Menu](#)" on page "147"

Tasks

- ◆ "[Basic Marker](#)" on page "150"

4.3.1.1 Softkeys of the Marker Menu

The following table shows all softkeys available in the marker menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Marker 1	
Marker 2	
Marker 3	
More Markers >	Marker 1
	Marker 2
	Marker 3
	Marker 4
	Marker 5
	Marker 6
	Marker Norm/Delta
	More >
	Marker 7
	Marker 8
	Marker 9
	Marker 10
	Marker 11
	Marker 12
	Marker Norm/Delta
	More >
	Marker 13
	Marker 14
	Marker 15
	Marker 16
	Marker Norm/Delta
Marker Norm/Delta	
Marker to Trace	
All Marker Off	
More >	
Marker Table (Off/On/Aut)	
Marker Stepsize >	Stepsize Standard
	Stepsize Sweep Points
Marker Zoom	
Link Mrk1 and Delta1	

Marker 1/Marker 2/Marker 3/Marker 4, / Marker Norm/Delta

The "Marker <no>" softkey activates the corresponding marker and opens an edit dialog box to enter a value for the marker to be set to. Pressing the softkey again deactivates the selected marker.

If a marker value is changed using the rotary knob, the step size is defined via the "[Stepsize Standard](#)" or "[Stepsize Sweep Points](#)" softkeys.

Marker 1 is always the reference marker for relative measurements. If activated, markers 2 to 4 are delta markers that refer to marker 1. These markers can be converted into markers with absolute value display by means of the "Marker Norm"/"Delta" softkey. If marker 1 is the active marker, pressing the "Marker Norm"/"Delta" softkey switches on an additional delta marker.

- Remote: [CALC:MARK ON](#)
- Remote: [CALC:MARK:X <value>](#)
- Remote: [CALC:MARK:Y?](#)
- Remote: [CALC:DELT ON](#)
- Remote: [CALC:DELT:X <value>](#)
- Remote: [CALC:DELT:X:REL?](#)
- Remote: [CALC:DELT:Y?](#)

More Markers

Opens a sub-menu to select one of up to 16 available markers and define whether the marker is a normal or a delta marker ("[Marker Norm/Delta](#)" softkey).

Marker 1 / Marker 2 / ... / Marker 16

The selected marker becomes active.

All Marker Off

Switches all markers off.

- Remote: [CALC:MARK:AOFF](#)

Marker Table (Off/On/Aut)

Displays the marker information in a table in a separate area beneath the diagram, or within the diagram area. By default, the marker table is displayed automatically if more than 2 markers are active, and removed if only 1 or 2 markers are active. This helps keep the information in the display clear.

For more information, see "[Displayed Marker Information](#)" on page 150.

- Remote: [DISP:FORM SPLIT](#)

Marker Stepsize

Opens a submenu to set the step size of all markers and delta markers ("[Stepsize Standard](#)" or "[Stepsize Sweep Points](#)").

Default value for the marker step size is "[Stepsize Sweep Points](#)".

Marker Zoom (span > 0)

Opens an edit dialog box to enter a display range for the zoom. The area around marker 1 is expanded accordingly and more details of the spectrum can be seen. If no marker is activated, marker 1 is switched on and set on the largest signal..

The following sweep is stopped at the position of the reference marker. The frequency of the signal is counted and the measured frequency becomes the new center frequency. The zoomed display range is then configured and the new settings are used by the R&S FSV for further measurements.

If the display has not yet been switched to the new frequency display range and you press the softkey, the procedure is aborted. If an instrument setting is changed during this operation, the procedure is also aborted.

→ Remote: [CALC:MARK1:FUNC:ZOOM 1kHz](#)

Link Mrk1 and Delta1

The delta marker 1 is linked to marker 1, so if the x-axis value of the marker 1 is changed, the delta marker 1 will follow on the same x-position. The link is off by default.

→ Remote: [CALC:DELT3:LINK ON](#)

Stepsize Standard

Moves the marker or delta marker from one measurement point to the next, if the marker or delta marker value is changed via the rotary knob ("[Marker 1](#)" / "[Marker 2](#)" / "[Marker 3](#)" softkeys). If more measured values than measurement points exist, it is not possible to read out all measured values. In this case, use the "[Stepsize Sweep Points](#)" softkey.

→ Remote: [CALC:MARK:X:SSIZ STAN](#)

Stepsize Sweep Points

Moves the marker or delta marker from one measured value to the next, if the marker or delta marker value is changed via the rotary knob ("[Marker 1](#)" / "[Marker 2](#)" / "[Marker 3](#)" / "[Marker 4](#)" /... softkeys). If more measured values than measurement points exist, every single measured value is accessible and its value is displayed in the marker field.

The number of measured values is defined in the sweep menu via the "[Sweep Points](#)" softkey.

This functionality is available for all base unit measurements with the exception of statistics ("[APD](#)" and "[CCDF](#)" softkeys in the measurement menu).

→ Remote: [CALC:MARK:X:SSIZ POIN](#)

4.3.1.2 Basic Marker Functions

- ◆ To open the marker menu, press the "MKR" key.
Marker 1 is activated and positioned on the maximum value of the trace as normal marker. If several traces are being displayed, the marker is set to the maximum value (peak) of the trace which has the lowest number (1 to 3) and is not frozen (View mode). In case a marker is already located there, it will be set to the frequency of the next lowest level (next peak).
- ◆ To change to another trace, press the "[Marker to Trace](#)" softkey and enter the number of the trace on which the marker is to be placed.
The marker changes to selected trace, but remains on the previous frequency or time. If a trace is turned off, the corresponding markers and marker functions are also deactivated.
- ◆ To switch to another marker, select the corresponding softkey. If necessary, select the "[More Markers](#)" softkey first to open a submenu that contains all marker numbers.
- ◆ To switch on a delta marker, select the softkey for the corresponding marker, then press the "[Marker Norm/Delta](#)" softkey until "Delta" is highlighted.
The selected marker is switched on as a delta marker. The frequency and level of the marker are displayed in relation to marker 1 in the marker field.
- ◆ To change the marker type of a marker, select the softkey for the corresponding marker, then press the "[Marker Norm/Delta](#)" softkey.
For a normal marker, the frequency and level are displayed as absolute values in the marker field. For a delta marker, the frequency and level of the marker are displayed in relation to marker 1 in the marker field.
- ◆ To switch off a marker, press the corresponding softkey again.
The marker is deactivated. Marker 1 becomes the active marker for entry. The frequency and level of marker 1 are displayed in the marker field.
- ◆ To switch off all markers, press the "[All Marker Off](#)" softkey.
- ◆ To change the stepsize between one measured value and the next when the marker or delta marker value is changed via the rotary knob, press either the "[Stepsize Standard](#)" or the "[Stepsize Sweep Points](#)" softkey.
- ◆ To zoom into the display around a marker, press the "[Marker Zoom](#)" softkey and enter a span.
- ◆ To link the delta marker1 to marker1, so if the x-axis value of the marker 1 is changed, the delta marker 1 follows on the same x-position, press the "[Link Mrk1 and Delta1](#)" softkey.

4.3.1.3 Displayed Marker Information

The following additional information is displayed within the diagram grid or in a marker table beneath the diagram. The marker table is displayed automatically if more than 2 markers are active. You can hide or show the table using the "[Marker Table \(Off/On/Aut\)](#)" softkey.

Marker information in Diagram Grid

The x and y axis positions of the last 2 markers or delta markers that were set, as well as their index, are displayed within the diagram grid, if available. The value in the square brackets after the index indicates the trace to which the marker is assigned. (Example: M1[1] defines marker 1 on trace 1.) For more than 2 markers, a separate marker table is displayed beneath the diagram.

If applicable, the active measurement function for the marker and its main results are indicated, as well. The functions are indicated with the following abbreviations:

FXD	Reference fixed marker active
PHNoise	Phase noise measurement active
CNT	Frequency counter active
TRK	Signal track active
NOise	Noise measurement active
MDepth	Measurement of the AM modulation depth active
TOI	TOI measurement active

Marker Information in Marker Table

In addition to the marker information displayed within the diagram grid, a separate marker table may be displayed beneath the diagram. This table provides the following information for all active markers:

No.	Serial number
Type	Marker type: N (normal), D (delta), T (temporary, internal)
Dgr	Diagram number
Trc	Trace to which the marker is assigned
Stimulus	x-value of the marker
Response	y-value of the marker
Func	Activated marker or measurement function
Func .Result	Result of the active marker or measurement function

4.3.2 Performing Peak Searches with Markers – PEAK SEARCH Key

The "PEAK SEARCH" key is used to perform a peak search with the currently active marker. If no marker is active, marker 1 is activated in normal mode and set as the peak.

If the selected diagram does not support markers, this key is ignored.

4.3.3 Performing Marker Functions – MKR FUNC Key

The "MKR FUNC" key provides various functions for markers, e.g.

- ◆ Phase Noise processing
- ◆ Setting reference points
- ◆ Marker demodulation
- ◆ Defining Marker peak lists
- ◆ Setting signal counts

To open the marker function menu

- ◆ Press the "MKR FUNC" key.
The "MKR FUNC" (marker function) menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the MKR FUNC Menu"](#)

Further information

- ◆ ["AF Demodulation"](#) on page "161"
- ◆ ["Frequency Measurement with the Frequency Counter"](#) on page "161"
- ◆ ["Measurement of Noise Density"](#) on page "162"

Tasks

- ◆ ["Setting a Fixed Reference Point \(Phase Noise Measurement\)"](#) on page "160"
- ◆ ["Setting the Demodulation Mode and Duration"](#) on page "161"

4.3.3.1 Softkeys of the MKR FUNC Menu

The following table shows all softkeys available in the marker functions menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu/Command	Command	Command
Select Marker (No) >	Marker 1	
	Marker 2	
	Marker 3	
	Marker 4	
	Marker 5	
	Marker 6	
	Marker Norm/Delta	
	More >	
	Marker 7	
	Marker 8	
	Marker 9	
	Marker 10	
	Marker 11	
	Marker 12	
	Marker Norm/Delta	
	More >	
	Marker 13	

	Marker 14	
	Marker 15	
	Marker 16	
	Marker Norm/Delta	
Sig Count On/Off		
Noise Meas On/Off		
Phase Noise >	Phase Noise On/Off	
	Ref Point Level	
	Ref Point Time / Ref Point Frequency	
	Peak Search	
	Ph. Noise Auto Peak Search	
	Select Marker (No) >	Marker 1
		Marker 2
		Marker 3
		Marker 4
		Marker 5
		Marker 6
		Marker Norm/Delta
		More >
		Marker 7
		Marker 8
		Marker 9
		Marker 10
		Marker 11
		Marker 12
		Marker Norm/Delta
		More >
		Marker 13
		Marker 14
		Marker 15
		Marker 16
		Marker Norm/Delta
Ref Fixed >	Ref. Fixed On/Off	
	Ref Point Level	
	Ref Point Time / Ref Point Frequency	
	Peak Search	
Marker Demod >	Mkr Demod On/Off	
	AM	
	FM	
	Mkr Stop Time	
	Continuous Demod	
n dB down		
Marker Peak List >	New Search	
	Sort Mode Freq/Lvl	
	Peak Excursion	
	Left Limit	
	Right Limit	
	Threshold	
	Peak List Off	
	More >	
	ASCII File Export	
	Decim Sep	

Select Marker (No)

Opens a submenu to select one of 16 markers and define whether the marker is a normal or a delta marker ("[Marker Norm/Delta](#)" softkey). "(No)" indicates the number of the currently active marker.

See the "[More Markers](#)" softkey of the "Marker" menu on page "148".

Sig Count On/Off

Switches the frequency counter on/off. The frequency is counted at the position of the reference marker (marker 1). If no marker is activated, marker 1 is switched on and set at the largest signal.

The sweep stops at the reference marker until the frequency counter has delivered a result. The result is displayed in the marker field (see "[Figure 5: Marker values](#)" on page "146"), labeled with [Tx CNT]. For more details see "[Frequency Measurement with the Frequency Counter](#)" on page "161".

→ Remote: [CALC:MARK1:COUN ON](#)

→ Remote: [CALC:MARK:COUN:FREQ?](#)

Noise Meas On/Off

Switches the noise measurement for the active marker on or off. The corresponding marker becomes the normal marker. For more details on noise measurement see "[Measurement of Noise Density](#)" on page "162".

→ Remote: [CALC:MARK:FUNC:NOIS ON](#)

→ Remote: [CALC:MARK:FUNC:NOIS:RES?](#)

Phase Noise

This softkey opens the Phase noise submenu.

The submenu contains the following commands:

Phase Noise On/Off
Ref Point Level
Ref Point Time / Ref Point
Frequency
Peak Search
Ph. Noise Auto Peak Search
Select Marker (No) >

Phase Noise On/Off

Switches the relative measurement to a fixed reference value on or off. The level and frequency or time values of marker 1 immediately become the reference point, but can be altered using the corresponding softkeys ("[Ref Point Level](#)", "[Ref Point Time](#)" and "[Peak Search](#)").

→ Remote: [CALC:DELT2:FUNC:FIX ON](#)

Ref Point Level

Opens an edit dialog box to enter a reference level value. All relative level values of the delta markers refer to this reference level.

→ Remote: [CALC:DELT2:FUNC:FIX:RPO:Y -10dBm](#)

Ref Point Frequency (span > 0) / Ref Point Time (zero span)

Opens an edit dialog box to enter a frequency reference or time value. All relative frequency or time values of the delta markers refer to this frequency reference. For phase noise measurement, input of reference time is not possible..

→ Remote: [CALC:DELT2:FUNC:FIX:RPO:X 10.7MHz](#)

→ Remote: [CALC:DELT2:FUNC:FIX:RPO:X 5MS](#)

Peak Search

Sets the maximum value of the selected trace as the reference point.

→ Remote: [CALC:DELT:FUNC:FIX:RPO:MAX](#)

Ph. Noise Auto Peak Search

Activates an automatic peak search for the reference fixed marker 1 at the end of each particular sweep.

This function can be used to track a drifting source during a phase noise measurement. The delta marker 2, which shows the phase noise measurement result, keeps the delta frequency value. Therefore the phase noise measurement leads to reliable results in a certain offset although the source is drifting. Only if the marker 2 reaches the border of the span, the delta marker value is adjusted to be within the span. In these cases, select a larger span.

→ Remote: [CALC:DELT:FUNC:PNO:AUTO ON | OFF](#)

Measurement example for Phase Noise Auto Peak Search

The phase noise of a CW signal at 100 MHz with 0 dBm level is to be measured at 800 kHz from the carrier

"PRESET"	The R&S FSP is set to the default setting.
"CENTER": 100 MHz	The center frequency is set to 100 MHz.
"SPAN": 2 MHz	The span is set to 2 MHz.
"AMPT": 0 dBm	The reference level is set to 0 dBm.
"MKR FCTN"	MARKER 1 is switched on and positioned at the maximum of the displayed trace.
"PHASE NOISE": 800 kHz	The phase noise measurement is switched on. The delta marker is positioned on the main marker and the measured phase noise value is displayed in the marker info field. The sample detector is used and the video bandwidth is set to 3 × RBW. When the phase noise measurement function is enabled, the entry of the delta marker frequency is activated. It can be entered directly.

Ref Fixed

Opens a submenu to set all values of a reference point. Instead of using the current values of the reference marker (marker 1) as reference point for the delta markers, level and frequency or time are set to fixed values and used as reference point.

The submenu contains the following commands:

Ref. Fixed On/Off
Ref Point Level
Ref Point Time / Ref Point
Frequency
Peak Search

Ref. Fixed On/Off

Switches the relative measurement to a fixed reference value on or off. The level and frequency or time values of marker 1 immediately become the reference point, but can be altered using the corresponding softkeys (" [Ref Point Level](#)", "[Ref Point Time](#)" and "[Peak Search](#)").

→ Remote: [CALC:DELT2:FUNC:FIX ON](#)

Marker Demod

Opens a submenu to set the demodulation mode and duration. For more details see also "[AF Demodulation](#)" on page "161". This softkey is only available with option R&S FSV B3.

The submenu contains the following commands:

Mkr Demod On/Off
AM
FM
Mkr Stop Time
Continuous Demod

Mkr Demod On/Off

Switches the demodulation on/off. For more details see also "[AF Demodulation](#)" on page "161".

→ Remote: [CALC:MARK1:FUNC:DEM ON](#)

AM

Sets AM as demodulation mode. This is the default setting. For more details see also "[AF Demodulation](#)" on page "161".

→ Remote: [CALC:MARK1:FUNC:DEM:SEL AM](#)

FM

Sets FM as demodulation mode. Default setting is AM. For more details see also "[AF Demodulation](#)" on page "161".

→ Remote: [CALC:MARK1:FUNC:DEM:SEL FM](#)

Mkr Stop Time

Opens an edit dialog box to enter the demodulation stop time for span > 0. For more details see also "[AF Demodulation](#)" on page "161".

→ Remote: [CALC:MARK1:FUNC:DEM:HOLD 3s](#)

Continuous Demod (span > 0)

Switches the continuous demodulation on or off. If the sweep time is long enough, the set frequency range can be monitored acoustically. For more details see also "[AF Demodulation](#)" on page "161".

→ Remote: [CALC:MARK1:FUNC:DEM:CONT ON](#)

n dB down

Opens an edit dialog box to enter a value to define the level spacing of the two temporary markers to the right and left of marker 1 (default setting: 3 dB). Activates the temporary markers T1 and T2. The values of the temporary markers (T1, T2) and the entered value (ndB) are displayed in the marker field.

If a positive value is entered, the markers T1 and T2 are placed below the active reference marker. If a negative value (e.g. for notch filter measurements) is entered, the markers T1 and T2 are placed above the active reference marker. Marker T1 is placed to the left and marker T2 to the right of the reference marker.

In marker field, the following results are displayed:

Span setting	Parameter name	Description
span > 0	Bw	frequency spacing of the two temporary markers
	Q factor	quality of the displayed bandwidth value (Bw)
span = 0	PWid	pulse width between the two temporary markers

If it is not possible to form the frequency spacing for the n dB value (e.g. because of noise display), dashes instead of a measured value are displayed.

- Remote: [CALC:MARK1:FUNC:NDBD:STAT ON](#)
- Remote: [CALC:MARK1:FUNC:NDBD 3dB](#)
- Remote: [CALC:MARK1:FUNC:NDBD:RES?](#)
- Remote: [CALC:MARK:FUNC:NDBD:QFAC?](#)
- Remote: [CALC:MARK1:FUNC:NDBD:FREQ? \(span > 0\)](#)
- Remote: [CALC:MARK1:FUNC:NDBD:TIME? \(span = 0\)](#)

Marker Peak List

Opens the "Peak List" dialog box and a submenu to define criteria for the sort order and the contents of the peak list. The number of listed peaks is indicated in the title bar. For all listed peaks the frequency and level values are given. Maximal 50 entries are listed.

The submenu contains the following commands:

New Search
Sort Mode Freq/Lvl
Peak Excursion
Left Limit
Right Limit
Threshold
Peak List Off
ASCII Trace Export
Decim Sep

- Remote: [CALC:MARK:FUNC:FPE:COUN?](#)
- Remote: [CALC:MARK:FUNC:FPE:X?](#)
- Remote: [CALC:MARK:FUNC:FPE:Y?](#)

New Search

Starts a new peak search and enters the results in the peak list.

- Remote: [CALC:MARK:FUNC:FPE 3](#)

Sort Mode Freq/Lvl

Defines the criteria for sorting:

- "Freq" sorting in ascending order of frequency values (span > 0) or time values (span = 0)
- "Lvl" sorting in ascending order of the level

→ Remote: [CALC:MARK:FUNC:FPE:SORT Y](#)

Peak Excursion

Opens - for level measurements - an edit dialog box to enter the minimum level value by which a signal must rise or fall so that it will be identified as a maximum or a minimum by the search functions. Entries from 0 dB to 80 dB are allowed; the resolution is 0.1 dB. The default setting for the peak excursion is 6 dB.

For details see also "[Specifying the Suitable Peak Excursion](#)" on page "169" and "[Effect of Different Peak Excursion Settings \(Example\)](#)" on page "170".

→ Remote: [CALC:MARK:PEXC 10dB](#)

Left Limit

Opens an edit dialog box to enter a value for the lower limit (left vertical line: S1 for span > 0; T1 for zero span). The search is performed between the lines of the left and right limit (see also "[Right Limit](#)" softkey).

→ Remote: [CALC:MARK:X:SLIM:LEFT 1MHZ](#)

Right Limit

Opens an edit dialog box to enter a value for the upper limit (left vertical line: S2 for span > 0; T2 for zero span). The search is performed between the lines of the left and right limit (see also "[Left Limit](#)" softkey). If no value is set, the upper limit corresponds to the stop frequency.

→ Remote: [CALC:MARK:X:SLIM:RIGH 10MHZ](#)

Threshold

Opens an edit dialog box to define the threshold line. The threshold line represents the lower level limit for a "Peak" search and the upper level limit for a "Min" search.

Opens an edit dialog box to define the threshold line. The threshold line represents the lower limit of the peak search level range.

→ Remote: [CALC:THR -20dBm](#)

→ Remote: [CALC:THR ON](#)

Peak List Off

Switches the peak list function off.

ASCII File Export

Opens the "ASCII File Export Name" dialog box and saves the active marker value in ASCII format to the specified file and directory.

The file consists of the header containing important scaling parameters and a data section containing the marker data. For details on an ASCII file see "[ASCII File Export Format](#)" on page "137".

This format can be processed by spreadsheet calculation programs, e.g. MS-Excel. It is necessary to define ';' as a separator for the data import. Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between separators '.' (decimal point) and ',' (comma) using the "[Decim Sep](#)" softkey.

→ Remote: [FORM ASC](#)

→ Remote: [MMEM:STOR:PEAK 'test'](#)

Decim Sep (./)

For details refer to the "[Decim Sep](#)" softkey in the "Trace" menu.

4.3.3.2 Setting a Fixed Reference Point (Phase Noise Measurement)

1. Press the "[Phase Noise](#)" softkey.
The submenu with the "[Phase Noise On/Off](#)" softkey switched on is displayed. The level and frequency or time values of marker 1 immediately become the reference point.
2. Setting the maximum of the selected trace as reference point, press the "[Peak Search](#)" softkey.
3. To define the values for the reference point, proceed as follows:
 - a) Press the "[Ref Fixed](#)" softkey.
 - b) Press the "[Ref Point Level](#)" softkey and enter a reference level value.
 - c) If span > 0, press the "[Ref Point Frequency](#)" softkey and enter a frequency reference value.
 - d) If span = 0, press the "[Ref Point Time](#)" softkey and enter a reference time value.

4.3.3.3 Setting the Demodulation Mode and Duration

1. Press the "[Marker Demod](#)" softkey.
The submenu with the "[Mkr Demod On/Off](#)" softkey switched on is displayed.
2. To change the demodulation mode, press the "[AM](#)" or "[FM](#)" softkey.
For details see "[AF Demodulation](#)" on page "161".
3. To modify the demodulation time for span > 0, press the "[Mkr Stop Time](#)" softkey.
4. To change to continuous demodulation for span > 0, press the "[Continuous Demod](#)" softkey.

4.3.3.4 AF Demodulation

The R&S FSV provides demodulators for AM and FM signals. With these demodulators, a displayed signal can be identified acoustically by using headphones.

Caution: Check the volume setting carefully before putting on the headphones in order to protect your hearing.

For span > 0, the demodulation is not continuous. The frequency at which the demodulation takes place is set by the active marker. If the level of the selected frequency is above the threshold line, the sweep stops for the selected time (stop time) and the RF signal is demodulated. For span = 0, the demodulation is continuously active irrespective of the stop time set.

4.3.3.5 Frequency Measurement with the Frequency Counter

In order to accurately determine the frequency of a signal, the R&S FSV is equipped with a frequency counter which measures the frequency of the RF signal at the intermediate frequency. Using the measured IF, the R&S FSV calculates the frequency of the RF input signal by applying the known frequency conversion factors.

The frequency measurement uncertainty depends only upon the accuracy of the frequency reference used (external or internal reference). Although the R&S FSV always operates synchronously irrespective of the set span, the frequency counter delivers a more exact result than a measurement performed with a marker. This is due to the following:

- ◆ The marker measures only the position of the point on the trace and infers from this value the signal frequency. The trace, however, contains only a limited number of points. Depending upon the selected span, each point may contain many measurement values, which therefore limits the frequency resolution.
- ◆ The resolution, with which the frequency can be measured with a marker, is dependant on the selected resolution bandwidth which in return affects the necessary measurement time. For this reason, the bandwidth is normally made as wide as possible and the sweep time as short as possible. This results in a loss of frequency resolution. For the measurement with the frequency counter, the sweep is stopped at the reference marker, the frequency is counted with the desired resolution and then the sweep is allowed to continue.

4.3.3.6 Measurement of Noise Density

During noise measurement, the noise power density is measured at the position of the marker. For span = 0, all points of the trace are used to determine the noise power density. For span > 0, two points to the right and left of the marker are used for the measurement to obtain a stable result.

The noise power density is indicated in the marker field. With logarithmic amplitude units (dBm, dBmV, dBm μ V, dB μ A), the noise power density is output in dBm/Hz, i.e. as level in 1 Hz bandwidth with reference to 1 mW. With linear amplitude units (V, A, W), the noise voltage density is evaluated in μ V/Hz, the noise current density in μ A/Hz or the noise power density in μ W/Hz.

In the default setting, the R&S FSV uses the sample detector for the noise function. With the sample detector, the trace can additionally be set to AVERAGE to stabilize the measured values. With RMS detector used, trace averaging must not be used since in this case it produces too low noise levels which cannot be corrected. Instead, the sweep time can be increased to obtain stable measurement results.

Prerequisite settings

The following settings have to be made to ensure that the power density measurement yields correct values:

- ◆ Detector: Sample or RMS
- ◆ Video bandwidth:
 - ≤ 0.1 resolution bandwidth with sample detector
 - ≥ 3 x resolution bandwidth with RMS detector
- ◆ Trace averaging:

With the sample detector, the trace can additionally be set to average to stabilize the measured values. With RMS detector used, trace averaging must not be used since in this case it produces too low noise levels which cannot be corrected. Instead, the sweep time can be increased to obtain stable measurement results.

Correction factors

The R&S FSV uses the following correction factors to evaluate the noise density from the marker level:

- ◆ Since the noise power is indicated with reference to 1 Hz bandwidth, the bandwidth correction value is deducted from the marker level. It is $10 \times \lg(1 \text{ Hz}/\text{BWNoise})$, where BWNoise is the noise or power bandwidth of the set resolution filter (RBW).
- ◆ RMS detector: With the exception of bandwidth correction, no further corrections are required since this detector already indicates the power with every point of the trace.
- ◆ Sample detector: As a result of video filter averaging and trace averaging, 1.05 dB is added to the marker level. This is the difference between the average value and the RMS value of white noise. With a logarithmic level axis, 1.45 dB is added additionally. Logarithmic averaging is thus fully taken into account which yields a value that is 1.45 dB lower than that of linear averaging.
- ◆ To allow a more stable noise display the adjacent (symmetric to the measurement frequency) points of the trace are averaged.
- ◆ For span > 0, the measured values are averaged versus time (after a sweep).

Note: The R&S FSV noise figure can be calculated from the measured power density level. It is calculated by deducting the set RF attenuation (RF Att) from the displayed noise level and adding 174 to the result.

4.3.4 Changing Settings via Markers - MKR-> Key

The "MKR"-> key is used for search functions of measurement markers, assignment of the marker frequency as center frequency, restriction of the search area and characterization of maxima and minima. For details on markers in general, see "[Using Markers and Delta Markers - MKR Key](#)" on page "146".

To open the marker-> menu

- ◆ Press the "MKR"-> key.
The marker-> menu is displayed. If no marker is active, marker 1 will be activated and a peak search on the trace carried out. Otherwise, the edit dialog box for the last activated marker is opened and the current frequency / time value is displayed.

Menu and softkey description

- ◆ "[Softkeys of the MKR-> Menu](#)"

Further information

- ◆ "[Effect of Different Peak Excursion Settings \(Example\)](#)" on page "170"

Tasks

- ◆ ["Searching for a Maximum"](#) on page "168"
- ◆ ["Searching for a Minimum"](#) on page "168"
- ◆ ["Specifying the Search Limits"](#) on page "168"
- ◆ ["Specifying the Search Range"](#) on page "168"
- ◆ ["Examining a Signal at the Center in Detail"](#) on page "169"
- ◆ ["Specifying the Suitable Peak Excursion"](#) on page "169"

4.3.4.1 Softkeys of the MKR-> Menu

The following table shows all softkeys available in the marker-> menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Select Marker (No) >	
Peak	
Next Peak	
Center =Mkr Freq	
Ref Lvl =Mkr Lvl	
Marker to Trace	
More >	
Select Marker (No) >	
Min	
Next Min	
Auto Max Peak	
Auto Min Peak	
Search Limits >	Left Limit
	Right Limit
	Threshold
	Search Lim Off
More >	
Select Marker (No) >	
Next Mode </abs/>	
Exclude LO	
Peak Excursion	

Select Marker (No)

See the ["More Markers"](#) softkey of the Marker menu on page "148".

Peak

Sets the active marker/delta marker to the highest maximum of the trace.

- Remote: [CALC:MARK:MAX](#)
- Remote: [CALC:DELT:MAX](#)

Next Peak

Sets the active marker/delta marker to the next maximum of the selected trace according to the mode selected using the "[Next Mode </abs/>](#)" softkey.

Center =Mkr Freq (span > 0)

Sets the center frequency to the current marker or delta marker frequency. A signal can thus be set to as center frequency, for example to examine it in detail with a smaller span.

Remote: [CALC:MARK:FUNC:CENT](#)

Ref Lvl =Mkr Lvl

Sets the reference level to the current marker level.

→ Remote: [CALC:MARK:FUNC:REF](#)

Marker to Trace

Opens an edit dialog box to enter the number of the trace, on which the marker is to be placed.

→ Remote: [CALC:MARK1:TRAC 1](#)

→ Remote: [CALC:DELT:TRAC 1](#)

Min

Sets the active marker/delta marker to the minimum of the selected trace.

→ Remote: [CALC:MARK:MIN](#)

→ Remote: [CALC:DELT:MIN](#)

Next Min

Sets the active marker/delta marker to the next minimum of the selected trace according to the mode selected using the "[Next Mode </abs/>](#)" softkey.

→ Remote: [CALC:MARK:MIN:NEXT](#)

→ Remote: [CALC:DELT:MIN:NEXT](#)

Auto Max Peak / Auto Min Peak

Adds an automatic peak search action for marker 1 at the end of each particular sweep. This function may be used during adjustments of a device under test to keep track of the current peak marker position and level.

The current marker search limit settings ("[Left Limit](#)", "[Right Limit](#)", "[Threshold](#)" softkeys) are taken into account.

→ Remote: [CALC:MARK:MIN:AUTO ON](#)

→ Remote: [CALC:MARK:MAX:AUTO ON](#)

Search Limits

Opens a submenu to set the limits for maximum or minimum search in the x and y direction.

The submenu contains the following commands:

Left Limit
Right Limit
Threshold
Search Lim Off

→ Remote: [CALC:MARK:X:SLIM ON](#)

Left Limit

See the "[Left Limit](#)" softkey of the "MKR FUNC" menu on page "159".

Right Limit

See the "[Right Limit](#)" softkey of the "MKR FUNC" menu on page "159".

Threshold

See the "[Threshold](#)" softkey of the "MKR FUNC" menu on page "159".

Search Lim Off

Deactivates all limits of the search range.

→ Remote: [CALC:MARK:X:SLIM OFF](#)

→ Remote: [CALC:THR:STAT OFF](#)

Next Mode </abs/>

Selects the mode of the "[Next Peak](#)" or "[Next Min](#)" softkey. Three settings are available:

- < Sets the active marker/delta marker to the next maximum/minimum left to the marker of the selected trace.
- abs Sets the active marker/delta marker to the next lower maximum/higher minimum of the selected trace.
- > Sets the active marker/delta marker to the next maximum/minimum right to the marker of the selected trace.

Next Peak:

- Remote: [CALC:MARK:MAX:LEFT](#) (>)
- Remote: [CALC:DELT:MAX:LEFT](#) (<)
- Remote: [CALC:MARK:MAX:RIGH](#) (>)
- Remote: [CALC:DELT:MAX:RIGH](#) (>)
- Remote: [CALC:MARK:MAX:NEXT](#) (abs)
- Remote: [CALC:DELT:MAX:NEXT](#) (abs)

Next Min:

- Remote: [CALC:MARK:MIN:LEFT](#) (>)
- Remote: [CALC:DELT:MIN:LEFT](#) (<)
- Remote: [CALC:MARK:MIN:RIGH](#) (>)
- Remote: [CALC:DELT:MIN:RIGH](#) (>)
- Remote: [CALC:MARK:MIN:NEXT](#) (abs)
- Remote: [CALC:DELT:MIN:NEXT](#) (abs)

Exclude LO

Switches the frequency range limit for the marker search functions on or off.

activated	minimum frequency $\geq 6 \times$ resolution bandwidth (RBW) Because of the interference by the first local oscillator to the first intermediate frequency at the input mixer, the LO is represented as a signal at 0 Hz. To avoid the marker jumping to the LO at 0 Hz with the peak function when setting the display range, this frequency is excluded.
deactivated	no restriction to the search range. The frequency 0 Hz is included in the marker search functions.

- Remote: [CALC:MARK:LOEX ON](#)

Peak Excursion

See the "[Peak Excursion](#)" softkey of the "MKR FUNC" menu on page "159".

4.3.4.2 Searching for a Maximum

- ◆ To search for the highest maximum, press the "[Peak](#)" softkey.
- ◆ To define the search mode for the next maximum, use the "[Next Mode </abs/>](#)" softkey.
- ◆ To start the search, press the "[Next Peak](#)" softkey.

Tip: You can define an automatic peak search action for marker 1 at the end of each particular sweep using the "[Auto Max Peak / Auto Min Peak](#)" softkey.

4.3.4.3 Searching for a Minimum

- ◆ To search for the minimum, press the "[Min](#)" softkey.
- ◆ To define the search mode for the next maximum, use the "[Next Mode </abs/>](#)" softkey.
- ◆ To start the search, press the "[Next Min](#)" softkey.

Tip: You can define an automatic peak search action for marker 1 at the end of each particular sweep using the "[Auto Max Peak / Auto Min Peak](#)" softkey.

4.3.4.4 Specifying the Search Limits

- ◆ To define the lower limit, press the "[Left Limit](#)" softkey.
- ◆ To define the upper limit, press the "[Right Limit](#)" softkey.
- ◆ To define the threshold, press the "[Threshold](#)" softkey.
- ◆ To switch the search limits off, press the "[Search Lim Off](#)" softkey.

4.3.4.5 Specifying the Search Range

- ◆ Press the "[Exclude LO](#)" softkey to deactivate the "Exclude LO" mode in order to include the frequency down to 0 Hz in the marker search functions.

4.3.4.6 Examining a Signal at the Center in Detail

1. Press the "PRESET" key to set the R&S FSV to the default setting.
2. Press the "MKR"-> key to open the marker-> menu.
3. Marker 1 is activated and set to the largest signal of the trace.
4. Press the "[Center =Mkr Freq](#)" softkey to set to the marker frequency.
5. The span is adapted in such a way that the minimum frequency (= 0 Hz) or the maximum frequency is not exceeded.
6. Press the "[Ref Lvl =Mkr Lvl](#)" softkey to set the reference level to the measured marker level.
7. Press the "SPAN" key.
8. The edit dialog box to enter a frequency span is displayed.
9. Reduce the span, e.g. using the rotary knob.

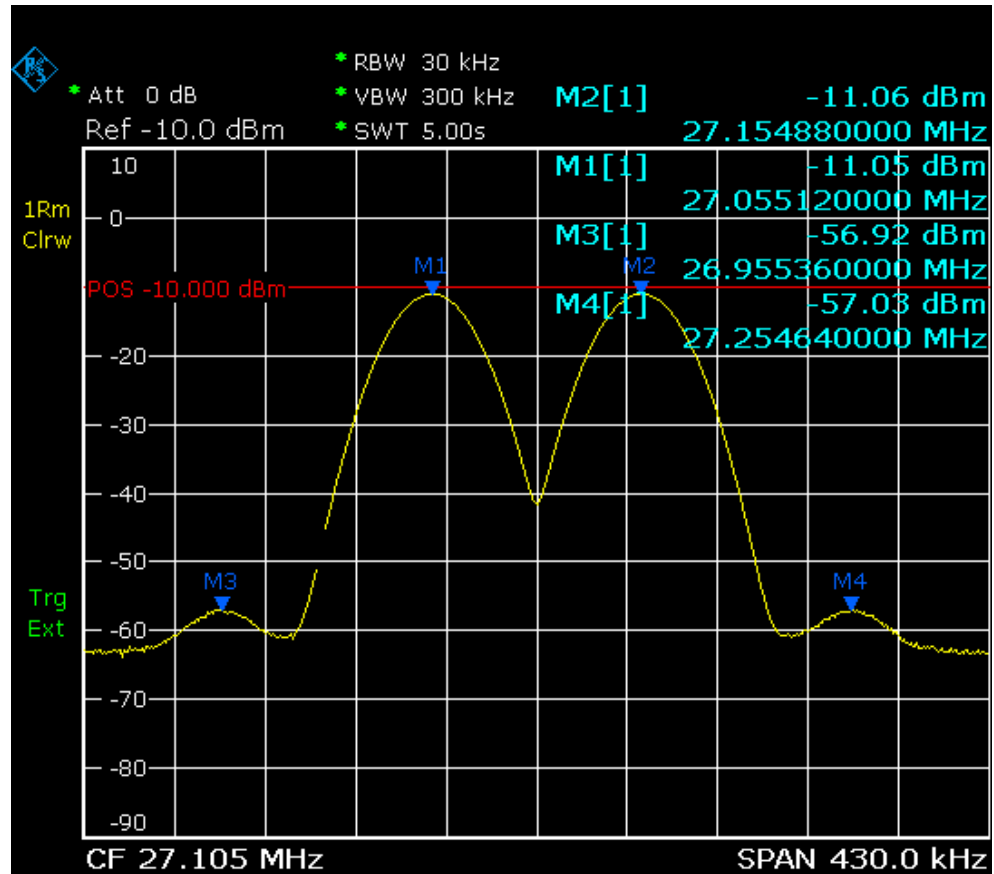
4.3.4.7 Specifying the Suitable Peak Excursion

1. If the "[Peak Excursion](#)" softkey is used, the default value is sufficient, since, in this mode, the next lower maximum or next higher minimum will always be detected.
2. If the "Next Mode" < or > of the softkey "[Next Mode </abs/>](#)" is used, the 6 dB level change set as a default value may already be attained by the inherent noise of the instrument. To avoid identifying noise peaks as maxima or minima, enter a peak excursion value that is higher than the difference between the highest and the lowest value measured for the displayed inherent noise.

4.3.4.8 Effect of Different Peak Excursion Settings (Example)

The following figure shows a trace to be examined.

Figure 30: Trace example



The following table lists the signals as indicated by the marker numbers in the diagram above, as well as the minimum of the amplitude decrease to both sides of the signal:

Signal #	Min. amplitude decrease to both sides of the signal
1	30 dB
2	29.85 dB
3	7 dB
4	7 dB

The detected signals and their order are different depending on the peak excursion setting and the peak search method (whether the next lower maximum or the next relative maximum is searched). The following results are obtained. All tests start with the marker set to signal 1 by pressing the softkey "Peak" .

◆ 40 dB peak excursion

Result: With both methods apart from signal 1 no signal is detected, as the signal level does not decrease by more than 30 dB to either side of any signal.

Next lower maximum	Next relative maximum
Next Mode abs: signal 1 (no further signal detected)	Next Mode <: signal 1 (no further signal detected)
	Next Mode >: signal 1 (no further signal detected)

◆ 20 dB peak excursion

Result: With both methods apart from signal 1 signal 2 is detected, as the signal level decreases at least by 29.85 dB to either side of this signal, which is now greater than the peak excursion.

Next lower maximum	Next relative maximum
Next Mode abs: signal 2	Next Mode <: signal 1 (no further signal detected)
Next Mode abs: signal 2 (no further signal detected)	Next Mode >: signal 2
	Next Mode >: signal 2 (no further signal detected)

◆ 6 dB peak excursion

Result: With both methods all signals are detected.

Next lower maximum	Next relative maximum
Next Mode abs: signal 2	Next Mode <: signal 3
Next Mode abs: signal 3	Next Mode >: signal 1
Next Mode abs: signal 4	Next Mode >: signal 2
	Next Mode >: signal 4

4.3.5 Power Measurements - MEAS Key

With its power measurement functions, the R&S FSV is able to measure all the necessary parameters with high accuracy in a wide dynamic range.

A modulated carrier is almost always used (except e.g. SSB-AM) for high-frequency transmission of information. Due to the information modulated upon the carrier, the latter covers a spectrum which is defined by the modulation, the transmission data rate and the signal filtering. Within a transmission band each carrier is assigned a channel taking into account these parameters. In order to ensure error-free transmission, each transmitter must be conforming to the specified parameters. These include among others:

- ◆ the output power
- ◆ the occupied bandwidth, i.e. the bandwidth which must contain a defined percentage of the power
- ◆ the power dissipation allowed in the adjacent channels

The "MEAS" key is used for complex measurement functions as power measurements, occupied bandwidth, signal statistic, carrier to noise spacing, AM modulation depth, third-order intercept point, harmonics and spurious emissions. For measurement examples refer to chapter "Advanced Measurement Examples" and to the Quick Start Guide, chapter 5, "Basic Measurement Examples".

The following measurements can be performed:

- ◆ Power in zero span ("[Time Domain Power](#)" softkey; for details see "[Measuring the Power](#)" on page "208").
- ◆ Channel power and adjacent-channel power with span > 0 and with a single or several carriers ("[Ch Power ACLR](#)" softkey); for details see "[Predefined CP / ACLR Standards](#)" on page "210" and "[Settings of CP / ACLR Test Parameters](#)" on page "211"
- ◆ Occupied bandwidth ("[OBW](#)" softkey, for details see "[Measuring the Occupied Bandwidth](#)" on page "208")
- ◆ Carrier-to-noise ratio ("[C/N, C/No](#)" softkey); for details see "[Measuring the Carrier-to-Noise Ratio](#)" on page "207"
- ◆ Amplitude probability distribution ("[APD](#)" and "[CCDF](#)" softkeys, for details refer to chapter "Advanced Measurement Examples", "Amplitude Distribution Measurement")
- ◆ Modulation depth ("[AM Mod Depth](#)" softkey)
- ◆ 3rd order intercept ("[TOI](#)" softkey, for details refer to chapter "Advanced Measurement Examples", "Intermodulation Measurements")
- ◆ Spectrum Emission Mask measurements ("[Spectrum Emission Mask](#)" softkey); see also "[Ranges and Range Settings](#)" on page "213", "[Provided XML Files for the Spectrum Emission Mask Measurement](#)" on page "214" and the subsequent sections
- ◆ Spurious Emissions measurements ("[Spurious Emissions](#)" softkey)
- ◆ Harmonic Distortion measurements ("[Harmonic Distortion](#)" softkey)

To open the power measurement menu

- ◆ Press the "MEAS" key. WCDMA SkId Meas FSPB.
The power measurement menu is displayed.

Menu and softkey description

- ◆ "[Softkeys of the Power Measurement Menu](#)" on page "173"

Further information

- ◆ "[Predefined CP / ACLR Standards](#)" on page "210"
- ◆ "[Settings of CP / ACLR Test Parameters](#)" on page "211"
- ◆ "[Ranges and Range Settings](#)" on page "213"
- ◆ "[Provided XML Files for the Spectrum Emission Mask Measurement](#)" on page "214"
- ◆ "[Format Description of Spectrum Emission Mask XML Files](#)" on page "215"
- ◆ "[ASCII File Export Format \(Spectrum Emission Mask\)](#)" on page "221"

Tasks

- ◆ "[Measuring the Power in Zero Span](#)" on page "208"
- ◆ "[Measuring the Occupied Bandwidth](#)" on page "208"
- ◆ "[Setting the Channel Configuration](#)" on page "213"
- ◆ "[Measuring Signal Statistics](#)" on page "207"
- ◆ "[Measuring the Carrier-to-Noise Ratio](#)" on page "207"
- ◆ "[Defining Gated Triggering for APD](#)" on page "221"

4.3.5.1 Softkeys of the Power Measurement Menu

The following table shows all softkeys available in the power measurement menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Submenu / Command	Submenu / Command	Submenu / Command	Command
Ch Power ACLR>	CP / ACLR Standard			
	CP / ACLR Settings >	# of TX Chan		
		# of Adj Chan		
		Channel Settings >	Channel Bandwidth	
			Channel Spacing	
			Chan Pwr/Hz	
			ACLR Ref Setting	
			Weighting Filter >	Weight TX (On/Off)
				Weight TX Alpha
				Weight ADJ (On/Off)
				Weight ADJ Alpha
			Adjust Ref Lvl	
			Adjust Settings	
		Limit Checking >	Limit Chk On/Off	
			Edit ACLR Limits	
		Power Mode>	Clear/Write	
			Max Hold	
		Select Trace		
		ACLR (Abs/Rel		
		Adjust Settings		
	Sweep Time			
	Fast ACLR (On/Off)			
	Set CP Reference			
	Noise Correction			
	Adjust Ref Lvl			
C/N, C/No >	C/N			
	C/No			
	Channel Bandwidth			
OBW >	% Power Bandwidth			

Menu / Command	Submenu / Command	Submenu / Command	Submenu / Command	Command
	Channel Bandwidth			
	Adjust Ref Lvl			
	Adjust Settings			
Spectrum Emission Mask >	Sweep List >	Edit Sweep List/Close Sweep List		
		Insert before Range		
		Insert after Range		
		Delete Range		
		Adjust Ref Lvl		
		Edit Reference Range		
	List Evaluation >	List Evaluation (On/Off)		
		Margin		
		Peaks per Range		
		Show Peaks		
		Save Evaluation List >	ASCII File Export	
			Decim Sep	
	Edit Reference Range			
	Edit Power Classes			
	Load Standard			
	Save As Standard			
	Meas Start/Stop			
	Restore Standard Files			
Spurious Emissions >	Sweep List>	Edit Sweep List/Close Sweep List		
		Insert before Range		
		Insert after Range		
		Delete Range		
		Adjust Ref Lvl		
		Adjust X-Axis		
	List Evaluation >	List Evaluation (On/Off)		
		Details On/Off		
		Margin		
		Peaks per Range		
		Show Peaks		
		More >		
		Save Evaluation List >	ASCII File Export	
			Decim Sep	
	Adjust Ref Lvl			
	Adjust X-Axis			
	Meas Start/Stop			
Time Domain Power >	Peak			
	RMS			
	Mean			
	Std Dev			
	Limits (On/Off)			
	Left Limit			
	Right Limit			
All Functions Off				
More >				
APD >	Res BW			
	# of Samples			
	Scaling >	x-Axis Ref Level		

Menu / Command	Submenu / Command	Submenu / Command	Submenu / Command	Command
		x-Axis Range		
		y-Axis Max Value		
		y-Axis Min Value		
		y-Unit %/Abs		
		Default Settings		
		Adjust Settings		
	Gated Trigger (On/Off)			
	Gate Ranges			
	Adjust Settings			
CCDF >	Percent Marker			
	Res BW			
	# of Samples			
	Scaling >	x-Axis Ref Level		
		x-Axis Range		
		y-Axis Max Value		
		y-Axis Min Value		
		y-Unit %/Abs		
		Default Settings		
		Adjust Settings		
	Gated Trigger (On/Off)			
	Gate Ranges			
	Adjust Settings			
TOI >	Marker 1			
	Marker 2			
	Marker 3			
	Search Signals			
AM Mod Depth >	Marker 1			
	Marker 2			
	Marker 3			
	Search Signals			
Harmonic Distortion >	No. of Harmonics			
	Harmonic Sweep Time			
	Harmonic RBW Auto			
	Adjust Settings			
All Functions Off				

Ch Power ACLR

Activates the active channel or adjacent-channel power measurement either for a single carrier signal or for several carrier signals, depending on the current measurement configuration, and opens a submenu to configure the channel power measurement. With default settings the measurement is performed by integrating the powers at the display points within the specified channels (IBW method).

If multi-carrier ACLR (MC-ACLR) measurement is activated, the number of measured values is increased to ensure that adjacent-channel powers are measured with adequate accuracy.

The submenu contains the following commands:

CP / ACLR Standard
CP / ACLR Settings >
Sweep Time
Fast ACLR (On/Off)
Set CP Reference
Noise Correction
Adjust Ref Lvl

- Remote: [CALC:MARK:FUNC:POW:SEL CPOW|ACP|MCAC](#)
- Remote: [CALC:MARK:FUNC:POW:RES? CPOW|ACP|MCAC](#)
- Remote: [CALC:MARK:FUNC:POW OFF](#)

CP / ACLR Standard

Opens an edit dialog box to select the settings according to predefined standards. For details on the available standards see "[Predefined CP / ACLR Standards](#)" on page "210". By default no standard is set.

The selection of the standard influences the following parameters:

- ◆ channel spacing and adjacent-channel spacing
- ◆ channel bandwidth, adjacent-channel bandwidth, and type of filtering
- ◆ resolution bandwidth
- ◆ video bandwidth
- ◆ detector
- ◆ # of adjacent channels
- ◆ trace averaging (switched off)
- Remote: [CALC:MARK:FUNC:POW:PRES <standard>](#)

CP / ACLR Settings

Opens a submenu to configure the channel power and adjacent channel power measurement independently of the predefined standards (for details see also "[Setting the Channel Configuration](#)" on page "213" and "[Settings of CP / ACLR Test Parameters](#)" on page "211").

The submenu contains the following commands:

of TX Chan
of Adj Chan
Channel Settings >
Limit Checking >
Power Mode>
Select Trace
ACLR (Abs/Rel)
Adjust Settings

of TX Chan (MC-ACP)

Opens an edit dialog box to enter the number of carrier signals to be taken into account in channel and adjacent-channel power measurements. Values from 1 to 12 are allowed.

→ Remote: [POW:ACH:TXCH:COUN 4](#)

of Adj Chan

Opens an edit dialog box to enter the number of adjacent channels to be considered in the adjacent-channel power measurement. Values from 0 to 12 are allowed.

The following measurements are performed depending on the number of the channels:

- 0 Only the channel powers are measured.
- 1 The channel powers and the power of the upper and lower adjacent channel are measured.
- 2 The channel powers, the power of the upper and lower adjacent channel, and of the next higher and lower channel (alternate channel 1) are measured.
- 3 The channel power, the power of the upper and lower adjacent channel, the power of the next higher and lower channel (alternate channel 1), and of the next but one higher and lower adjacent channel (alternate channel 2) are measured.
- ...
- 12 The channel power, the power of the upper and lower adjacent channel, and the power of the all higher and lower channels (alternate channel 1 to 11) are measured.

→ Remote: [POW:ACH:ACP 1](#)

Channel Settings

Opens a submenu to define the channel settings.

The submenu contains the following commands:

Channel Bandwidth
Channel Spacing
Chan Pwr/Hz
ACLR Ref Setting
Weighting Filter >
Adjust Ref Lvl
Adjust Settings

Channel Bandwidth

Opens the "TX/ACLR Channel Bandwidth" dialog box to enter the channel bandwidths for the transmission channels and the adjacent channels. The entry "TX" is only available for the multi-carrier ACLR measurement.

The transmission-channel bandwidth is normally defined by the transmission standard. The correct bandwidth is set automatically for the selected standard (see "[CP / ACLR Standard](#)" softkey).

- ◆ Measurements in zero span (see "[Fast ACLR \(On/Off\)](#)" softkey) are performed in the zero span mode. The channel limits are indicated by vertical lines. For measurements requiring channel bandwidths deviating from those defined in the selected standard the IBW method is to be used.
- ◆ With the IBW method (see "[Fast ACLR \(On/Off\)](#)" softkey), the channel bandwidth limits are marked by two vertical lines right and left of the channel center frequency. It can in this way be visually checked whether the entire power of the signal under test is within the selected channel bandwidth.
If measuring according to the IBW method ("Fast ACLR Off"), the bandwidths of the different adjacent channels are to be entered numerically. Since all adjacent channels often have the same bandwidth, the other channels Alt1 and Alt2 are set to the bandwidth of the adjacent channel on entering the adjacent-channel bandwidth (ADJ). Thus only one value needs to be entered in case of equal adjacent channel bandwidths. The same holds true for the ALT2 channels (alternate channels 2) if the bandwidth of the ALT1 channel (alternate channel 1) is entered.

For details on available channel filters see "[Selecting the Appropriate Filter](#)" on page "119".

- Remote: [POW:ACH:BWID 30kHz](#)
- Remote: [POW:ACH:BWID:ACH 30kHz](#)
- Remote: [POW:ACH:BWID:ALT2 30kHz](#)

Channel Spacing

Opens the "TX / ACLR Channel Spacing" dialog box to enter the channel spacings for the TX channels and for the adjacent channels.

The entry "TX" is only available for the multi-carrier ACLR measurement.

- ◆ TX channels (left column)

TX1-2	spacing between the first and the second carrier
TX2-3	spacing between the second and the third carrier
...	...

The spacings between all adjacent TX channels can be defined separately. In order to allow a convenient setup for the system with equal TX channel spacing, the value of TX spacing 1-2 is copied in all the spacing below after entry, the TX spacing 2-3 is copied in all the spacing below after entry and so forth. For different spacings, a setup from top to bottom is necessary.

If the spacings are not equal, the channel distribution according to the center frequency is as follows:

Odd number of TX channels	The middle TX channel is centered to center frequency.
Even number of TX channels	The two TX channels in the middle are used to calculate the frequency between those two channels. This frequency is aligned to the center frequency.

◆ Adjacent channels (right column)

Since all the adjacent channels often have the same distance to each other, the modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, ...): they are all multiplied by the same factor (new spacing value / old spacing value). Thus only one value needs to be entered in case of equal channel spacing. A modification of a higher adjacent-channel spacing (ALT1, ALT2, ...) causes a change by the same factor in all higher adjacent-channel spacings, while the lower adjacent-channel spacings remain unchanged.

Example:

In the default setting, the adjacent channels have the following spacing: 20 kHz ("ADJ"), 40 kHz ("ALT1"), 60 kHz ("ALT2"), 80 kHz ("ALT3"), 100 kHz ("ALT4"), ... If the spacing of the first adjacent channel ("ADJ") is set to 40 kHz, the spacing of all other adjacent channels is multiplied by factor 2 to result in 80 kHz ("ALT1"), 120 kHz ("ALT2"), 160 kHz ("ALT3"), ...

If, starting from the default setting, the spacing of the 5th adjacent channel ("ALT4") is set to 150 kHz, the spacing of all higher adjacent channels is multiplied by factor 1.5 to result in 180 kHz ("ALT5"), 210 kHz ("ALT6"), 240 kHz ("ALT7"), ...

If a ACLR or MC-ACLR measurement is started, all settings according to the standard including the channel bandwidths and channel spacings are set and can be adjusted afterwards.

- Remote: [POW:ACH:SPAC:CHAN 25kHz](#)
- Remote: [POW:ACH:SPAC 33kHz](#)
- Remote: [POW:ACH:SPAC:ALT1 100kHz](#)

Chan Pwr/Hz

If deactivated, the channel power is displayed in dBm. If activated, the channel power density is displayed instead. Thus, the absolute unit of the channel power is switched from dBm to dBm/Hz. The channel power density in dBm/Hz corresponds to the power inside a bandwidth of 1 Hz and is calculated as follows:

$$\text{channel power density} = \text{channel power} - \log_{10}(\text{channel bandwidth})$$

By means of this function it is possible e.g. to measure the signal/noise power density or use the additional functions "[ACLR \(Abs/Rel\)](#)" and "[ACLR Ref Setting](#)" to obtain the signal to noise ratio.

→ Remote: [CALC:MARK:FUNC:POW:RES:PHZ ON](#)

ACLR Ref Setting (MC-ACLR)

Opens an edit dialog box to select the transmission channel to which the adjacent-channel relative power values should be referenced.

TX Channel 1 - 12	Selection of one of channels 1 to 12.
Min Power TX Channel	The transmission channel with the lowest power is used as a reference channel.
Max Power TX Channel	The transmission channel with the highest power is used as a reference channel.
Lowest & Highest Channel	The outer left-hand transmission channel is the reference channel for the lower adjacent channels, the outer right-hand transmission channel that for the upper adjacent channels.

→ Remote: [POW:ACH:REF:TXCH:MAN 3](#)

→ Remote: [POW:ACH:REF:TXCH:AUTO MAX](#)

Weighting Filter

Opens a submenu to define weighting filters. Weighting filters are not available for all supported standards and cannot always be defined manually where they are available.

The submenu contains the following commands:

Weight TX (On/Off)
Weight TX Alpha
Weight ADJ (On/Off)
Weight ADJ Alpha

Weight TX (On/Off)

Activates the weighting filter for the TX channel.

→ Remote: [POW:ACH:FILT:CHA1 ON](#)

Weight TX Alpha

Opens an edit dialog box to enter the alpha value for the weighting filter.

→ Remote: [POW:ACH:FILT:ALPH:CHAN1 0,35](#)

Weight ADJ (On/Off)

Activates the weighting filter for the adjacent channel.

→ Remote: [POW:ACH:FILT:ACH ON](#)

→ Remote: [POW:ACH:FILT:ALT1 ON](#)

Weight ADJ Alpha

Opens an edit dialog box to enter the alpha value for the weighting filter for the adjacent channel.

→ Remote: [POW:ACH:FILT:ALPH:ACH 0,35](#)

→ Remote: [POW:ACH:FILT:ALPH:ALT1 0,35](#)

Adjust Ref Lvl

Adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSV or limiting the dynamic range by a too small S/N ratio. For details on manual settings see "[Settings of CP / ACLR Test Parameters](#)" on page "211".

The reference level is not influenced by the selection of a standard. To achieve an optimum dynamic range, the reference level has to be set in a way that places the signal maximum close to the reference level without forcing an overload message. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

→ Remote: [POW:ACH:PRES:RLEV](#)

Adjust Settings

Adjusts the level settings according to the measured difference between peak and minimum power for APD measurement or peak and mean power for CCDF measurement in order to obtain maximum power resolution. Adapts the probability scale to the selected number of samples. Adjusts the reference level to the current input signal. For details see also "[Adjust Ref Lvl](#)" softkey.

→ Remote: [CALC:STAT:SCAL:AUTO ONCE](#)

Limit Checking

Opens a submenu to activate and define the limits for the ACLR measurement.

The submenu contains the following commands:

Limit Chk On/Off

Edit ACLR Limits

Limit Chk On/Off

Activates or deactivates the limit check for the ACLR measurement.

- Remote: [CALC:LIM:ACP ON](#)
- Remote: [CALC:LIM:ACP:ACH:RES?](#)
- Remote: [CALC:LIM:ACP:ALT:RES?](#)

Edit ACLR Limits

Opens the "ACLR Limits" dialog box to define the limits for the ACLR measurement.

The following rules apply for the limits:

- ◆ A separate limit can be defined for each adjacent channel. The limit applies to both the upper and the lower adjacent channel.
- ◆ A relative and/or absolute limit can be defined. The check of both limit values can be activated independently.
- ◆ The R&S FSV checks adherence to the limits irrespective of whether the limits are absolute or relative or whether the measurement is carried out with absolute or relative levels. If both limits are active and if the higher of both limit values is exceeded, the measured value is marked by a preceding asterisk.

- Remote: [CALC:LIM:ACP ON](#)
- Remote: `CALC:LIM:ACP:<adjacent-channel> 0dB,0dB`
- Remote: `CALC:LIM:ACP:<adjacent-channel>:STAT ON`
- Remote: `CALC:LIM:ACP:<adjacent-channel>:ABS -10dBm,-10dBm`
- Remote: `CALC:LIM:ACP:<adjacent-channel>:ABS:STAT ON`

For details refer to chapter "Remote Control - Commands", section "[CALCulate:LIMit:ACPower Subsystem](#)".

Power Mode

Opens a submenu to select the power mode.

The submenu contains the following commands:

Clear/Write
Max Hold

Clear/Write

If this mode is activated, the channel power and the adjacent channel powers are calculated directly from the current trace (default mode).

- Remote: [CALC:MARK:FUNC:POW:MODE WRIT](#)

Max Hold

If this mode is activated, the power values are calculated from the current trace and compared with the previous power value using a maximum algorithm. The higher value is retained. If activated, the enhancement label "Pwr Max" is displayed.

- Remote: [CALC:MARK:FUNC:POW:MODE MAXH](#)

Select Trace

Opens an edit dialog box to enter the trace number on which the CP/ACLR measurement is to be performed. Only activated traces can be selected (for details on trace modes see "[Trace Mode Overview](#)" on page "133").

→ Remote: [POW:TRAC 2](#)

ACLR (Abs/Rel)

Switches between absolute and relative power measurement in the adjacent channels.

Abs The absolute power in the adjacent channels is displayed in the unit of the y-axis, e.g. in dBm, dB μ V.

Rel The level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

→ Remote: [POW:ACH:MODE REL](#)

Adjust Settings

Optimizes automatically all instrument settings for the selected channel configuration (channel bandwidth, channel spacing) within a specific frequency range (channel bandwidth). The adjustment is carried out only once. If necessary, the instrument settings can be changed later.

For details on the settings of span, resolution bandwidth, video bandwidth, detector and trace averaging see "[Settings of CP / ACLR Test Parameters](#)" on page "211".

→ Remote: [POW:ACH:PRES ACP](#)

Sweep Time

Opens an edit dialog box to enter the sweep time. With the RMS detector, a longer sweep time increases the stability of the measurement results.

The function of this softkey is identical to the "[Sweptime Manual](#)" softkey in the bandwidth menu.

→ Remote: [SWE:TIM <value>](#)

Fast ACLR (On/Off)

Switches between the IBW method ("Fast ACLR Off") and the zero span method ("Fast ACLR On").

When switched on, the R&S FSV sets the center frequency consecutively to the different channel center frequencies and measures the power with the selected measurement time (= sweep time/number of channels). The RBW filters suitable for the selected standard and frequency offset are automatically used (e.g. root raised cos with IS 136). For details on available channel filters see "[Selecting the Appropriate Filter](#)" on page "119".

The RMS detector is used for obtaining correct power measurement results. Therefore this requires no software correction factors.

Measured values are output as a list. The powers of the transmission channels are output in dBm, the powers of the adjacent channels in dBm.

The sweep time is selected depending on the desired reproducibility of results. Reproducibility increases with sweep time since power measurement is then performed over a longer time period. As a general approach, it can be assumed that approx. 500 non-correlated measured values are required for a reproducibility of 0.5 dB (99% of the measurements are within 0.5 dB of the true measured value). This holds true for white noise. The measured values are considered as non-correlated if their time interval corresponds to the reciprocal of the measured bandwidth. With IS 136 the measurement bandwidth is approx. 25 kHz, i.e. measured values at an interval of 40 µs are considered as non-correlated. A measurement time of 40 ms is thus required per channel for 1000 measured values. This is the default sweep time which the R&S FSV sets in coupled mode. Approx. 5000 measured values are required for a reproducibility of 0.1 dB (99%), i.e. the measurement time is to be increased to 200 ms.

→ Remote: [POW:HSP ON](#)

Set CP Reference

Defines the currently measured channel power as the reference value if channel power measurement is activated. The reference value is displayed in the "Tx1 (Ref) Power" field; the default value is 0 dBm.

The softkey is available only for multi carrier ACLR measurements.

In adjacent-channel power measurement with one or several carrier signals, the power is always referenced to a transmission channel, i.e. no value is displayed for "Tx1 (Ref) Power".

→ Remote: [POW:ACH:REF:AUTO ONCE](#)

Noise Correction

If activated, the results are corrected by the instrument's inherent noise, which increases the dynamic range.

When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined.

The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A disable message is displayed on the screen.

To enable the correction function in conjunction with the changed setting, press the softkey once more. A new reference measurement is carried out.

→ Remote: [SENS:POW:NCOR ON](#)

Adjust Ref Lvl

Adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSV or limiting the dynamic range by a too small S/N ratio. For details on manual settings see "[Settings of CP / ACLR Test Parameters](#)" on page "211".

The reference level is not influenced by the selection of a standard. To achieve an optimum dynamic range, the reference level has to be set in a way that places the signal maximum close to the reference level without forcing an overload message. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

→ Remote: [POW:ACH:PRES:RLEV](#)

C/N, C/No (span > 0)

Opens a submenu to configure the carrier/noise ratio measurement. Measurements without (C/N) and measurements with reference to the bandwidth (C/No) are possible.

The submenu contains the following commands:

C/N
C/No
Channel Bandwidth

C/N (span > 0)

Switches the measurement of the carrier/noise ratio on or off. If no marker is active, marker 1 is activated.

The measurement is performed on the trace where marker 1 is located. To shift marker 1 and measure another trace, use the "[Marker to Trace](#)" softkey in the marker menu.

To determine the maximum value of the current trace, use the "[Phase Noise](#)" softkey in the marker menu.

→ Remote: [CALC:MARK:FUNC:POW:SEL CN](#)

→ Remote: [CALC:MARK:FUNC:POW:RES? CN](#)

→ Remote: [CALC:MARK:FUNC:POW OFF](#)

C/No (span > 0)

Switches the measurement of the carrier/noise ratio with reference to a 1 Hz bandwidth on or off. If no marker is active, marker 1 is activated.

The measurement is performed on the trace where marker 1 is located. To shift marker 1 and measure another trace, use the "[Marker to Trace](#)" softkey in the marker menu.

To determine the maximum value of the current trace, use the "[Phase Noise](#)" softkey in the marker menu.

→ Remote: [CALC:MARK:FUNC:POW:SEL CN0](#)

→ Remote: [CALC:MARK:FUNC:POW:RES? CN0](#)

→ Remote: [CALC:MARK:FUNC:POW OFF](#)

Channel Bandwidth (span > 0)

Opens an edit dialog box to enter the measurement channel bandwidth. The default setting is 14 kHz.

→ Remote: [POW:ACH:BWID 30kHz](#)

OBW (span > 0)

Activates measurement of the occupied bandwidth according to the current configuration and opens a submenu to configure the measurement. The occupied bandwidth is displayed in the marker display field and marked on the trace by temporary markers. For details see also "[Measuring the Occupied Bandwidth](#)" on page "208".

The measurement is performed on the trace with marker 1. In order to evaluate another trace, marker 1 must be placed on another trace (see "[Marker to Trace](#)" softkey in the marker menu).

The submenu contains the following commands:

% Power Bandwidth
Channel Bandwidth
Adjust Ref Lvl
Adjust Settings

→ Remote: [CALC:MARK:FUNC:POW:SEL OBW](#)

→ Remote: [CALC:MARK:FUNC:POW:RES? OBW](#)

→ Remote: [CALC:MARK:FUNC:POW OFF](#)

% Power Bandwidth (span > 0)

Opens an edit dialog box to enter the percentage of total power in the displayed frequency range which defines the occupied bandwidth. Values from 10% to 99.9% are allowed.

→ Remote: [POW:BWID 95PCT](#)

Channel Bandwidth (span > 0)

Opens an edit dialog box to enter the channel bandwidth for the transmission channel. The specified channel bandwidth is used for optimization of the test parameters (for details see "[Settings of CP / ACLR Test Parameters](#)" on page "211"). The default setting is 14 kHz.

For measurements in line with a specific transmission standard, the bandwidth specified by the standard for the transmission channel must be entered.

→ Remote: [POW:ACH:BWID 30kHz](#)

Adjust Ref Lvl (span > 0)

Adjusts the reference level to the measured total power of the signal. the softkey is activated after the first sweep with active measurement of the occupied bandwidth has been completed and the total power of the signal is thus known.

Adjusting the reference level ensures that the signal path will not be overloaded and the dynamic range not limited by too low a reference level. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is distinctly below the reference level. If the measured channel power is equal to the reference level, the signal path cannot be overloaded.

→ Remote: [POW:ACH:PRES:RLEV](#)

Adjust Settings (span > 0)

Enables the RMS detector (see also "[Detector Overview](#)" on page "135") and adjusts the span to the selected channel bandwidth according to:

$$4 \times \text{channel bandwidth} + \text{measurement margin}$$

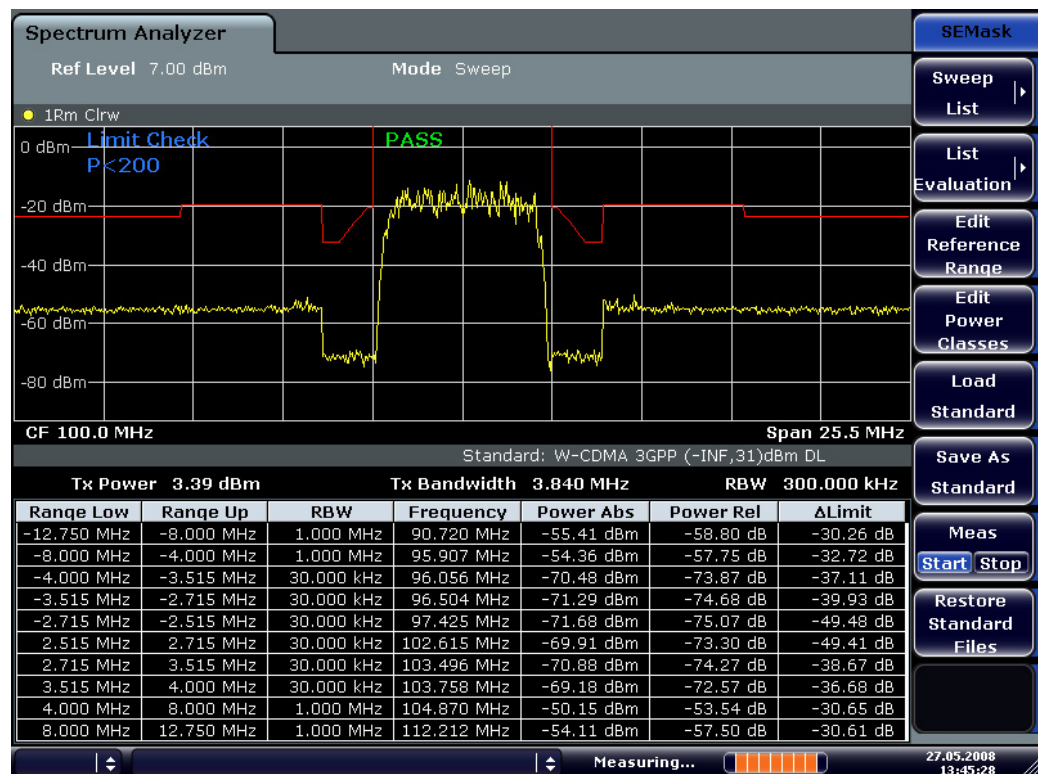
The adjustment is performed once; if necessary, the setting can be changed later on.

→ Remote: [POW:ACH:PRES CN | CNO](#)

Spectrum Emission Mask

Opens a submenu to configure the Spectrum Emission Mask measurement.

The Spectrum Emission Mask (SEM) measurement defines a measurement that monitors compliance with a spectral mask. The SEM measurement of the base unit allows a flexible definition of all parameters in the SEM measurement.



The submenu contains the following commands:

Sweep List >
List Evaluation >
Edit Reference Range
Edit Power Classes
Load Standard
Save As Standard
Meas Start/Stop
Restore Standard Files

→ Remote: [SWE:MODE ESP](#)

Sweep List

Opens a submenu to edit the sweep list and displays the "Sweep List" dialog box. After a preset, the sweep list contains a set of default ranges and parameters. For each range, you can change the parameters listed below. To insert or delete ranges, use the "[Insert before Range](#)", "[Insert after Range](#)", "[Delete Range](#)" softkeys. The measurement results are not updated during editing but on closing the dialog box ("[Close Sweep List](#)" softkey).

The submenu contains the following commands:

Edit Sweep List/Close Sweep List
Insert before Range
Insert after Range
Delete Range
Adjust Ref Lvl
Edit Reference Range

Spectrum Emission Mask measurement:

The changes of the sweep list are only kept until you load another parameter set (by pressing "PRESET" or by loading an XML file). If you want a parameter set to be available permanently, create an XML file for this configuration (for details refer to "[Format Description of Spectrum Emission Mask XML Files](#)" on page "214").

If you load one of the provided XML files ("[Load Standard](#)" softkey), the sweep list contains ranges and parameters according to the selected standard. For further details refer also to "[Provided XML Files for the Spectrum Emission Mask Measurement](#)" on page "214".

Note: If you edit the sweep list, always follow the rules described in "[Ranges and Range Settings](#)" on page "213".

Parameter	Restriction
Range Start	
Range Stop	
Filter Type	
RBW	
VBW	
Sweep Time Mode	
Sweep Time	
Detector	Spurious Emissions measurement only
Ref. Level	
RF Att. Mode	
RF Attenuator	
Preamp	
Sweep Points	Spurious Emissions measurement only
Stop after Sweep	Spurious Emissions measurement only
(Spurious Emissions)	
Transd. Factor	
Limit Check 1-4	
Abs Limit Start	
Abs Limit Stop	
Rel Limit Start	Spectrum Emission Mask measurement only
Rel Limit Stop	Spectrum Emission Mask measurement only

Range Start/Range Stop

Sets the start frequency/stop frequency of the selected range. Follow the rules described in "[Ranges and Range Settings](#)" on page "213".

In order to change the start/stop frequency of the first/last range, select the appropriate span with the "SPAN" key. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last ranges are adapted to the given span as long as the minimum span of 20 Hz is not violated.

◆ Spectrum Emission Mask measurement:

Frequency values for each range have to be defined relative to the center frequency. The reference range has to be centered on the center frequency. The minimum span of the reference range is given by the current TX Bandwidth. For details refer to the "[Spectrum Emission Mask](#)" softkey description.

- ➔ Remote: [ESP:RANG1:STAR 10000000](#) (Spectrum Emission Mask)
- ➔ Remote: [ESP:RANG3:STOP 10000000](#) (Spectrum Emission Mask)
- ➔ Remote: [LIST:RANG1:STAR 10000000](#) (Spurious Emissions)
- ➔ Remote: [LIST:RANG3:STOP 10000000](#) (Spurious Emissions)

Stop after Sweep (Spurious Emissions)

Configures the sweep behavior.

- On The R&S FSV stops after one range is swept and continues only if you confirm (a message box is displayed).
- Off The R&S FSV sweeps all ranges in one go.

- ➔ Remote: [LIST:RANG1:BRE ON](#)

Filter Type

Sets the filter type for this range. For details on filters see also "[Selecting the Appropriate Filter Type](#)" on page "119".

- Remote: [ESP:RANG1:FILT:TYPE RRC](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG1:FILT:TYPE RRC](#) (Spurious Emissions)

RBW

Sets the RBW value for this range.

- Remote: [ESP:RANG2:BAND:RES 5000](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG2:BAND:RES 5000](#) (Spurious Emissions)

VBW

Sets the VBW value for this range.

- Remote: [ESP:RANG1:BAND:VID 5000000](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG1:BAND:VID 5000000](#) (Spurious Emissions)

Sweep Time Mode

Activates or deactivates the auto mode for the sweep time.

- Remote: [ESP:RANG3:SWE:TIME:AUTO OFF](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG3:SWE:TIME:AUTO OFF](#) (Spurious Emissions)

Sweep Time

Sets the sweep time value for the range.

- Remote: [ESP:RANG1:SWE:TIME 1](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG1:SWE:TIME 1](#) (Spurious Emissions)

Detector (Spurious Emissions)

Sets the detector for the range. For details refer to "[Detector Overview](#)" on page "135".

- Remote: [LIST:RANGe3:DET SAMP](#)

Ref. Level

Sets the reference level for the range.

- Remote: [ESP:RANG2:RLEV 0](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG2:RLEV 0](#) (Spurious Emissions)

RF Att. Mode

Activates or deactivates the auto mode for RF attenuation.

- Remote: [ESP:RANG2:INP:ATT:AUTO OFF](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG2:INP:ATT:AUTO OFF](#) (Spurious Emissions)

RF Attenuator

Sets the attenuation value for that range.

- Remote: [ESP:RANG3:INP:ATT 10](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG3:INP:ATT 10](#) (Spurious Emissions)

Preamp

Switches the preamplifier on or off.

- Remote: [ESP:RANG3:INP:GAIN:STATe ON](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG3:INP:GAIN:STATe ON](#) (Spurious Emissions)

Transd. Factor

Sets a transducer for the specified range. You can only choose a transducer that fulfills the following conditions:

- ◆ The transducer overlaps or equals the span of the range.
- ◆ The x-axis is linear.
- ◆ The unit is dB.
- Remote: [ESP:RANG1:TRAN 'test'](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG1:TRAN 'test'](#) (Spurious Emissions)

Limit Check 1-4

Sets the type of limit check for all ranges. Possible states are:

Absolute	Checks only the absolute limits defined.
Relative	Checks only the relative limits. Relative limits are defined as relative to the measured power in the reference range.
Abs and Rel	Combines the absolute and relative limit. The limit check fails when both limits are violated.
Abs or Rel	Combines the absolute and relative limit. The limit check fails when one of the limits is violated.

The limit state affects the availability of all limit settings (" [Abs Limit Start](#)", "[Abs Limit Stop](#)", "[Rel Limit Start](#)", "[Rel Limit Stop](#)").

Depending on the number of active power classes (see "Power Class" dialog box), the number of limits that can be set varies. Up to four limits are possible. The sweep list is extended accordingly.

- Remote: [ESP:RANG3:LIM:STAT AND](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG3:LIM:STAT ON](#) (Spurious Emissions)
- Remote: [CALC:LIM3:FAIL?](#)

Abs Limit Start

Sets an absolute limit value at the start frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "[Limit Check 1-4](#)" parameter).

- Remote: [ESP:RANG1:LIM:ABS:STAR 10](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG1:LIM:STAR 10](#) (Spurious Emissions)

Abs Limit Stop

Sets an absolute limit value at the stop frequency of the range [dBm].

This parameter is only available if the limit check is set accordingly (see "[Limit Check 1-4](#)" parameter).

→ Remote: [ESP:RANG1:LIM:ABS:STOP 20](#) (Spectrum Emission Mask)

→ Remote: [LIST:RANG1:LIM:STOP 20](#) (Spurious Emissions)

Rel Limit Start(Spectrum Emission Mask)

Sets a relative limit value at the start frequency of the range [dBc].

This parameter is only available if the limit check is set accordingly (see "[Limit Check 1-4](#)" parameter).

→ Remote: [ESP:RANG3:LIM:REL:STAR -20](#)

Rel Limit Stop(Spectrum Emission Mask)

Sets a relative limit value at the stop frequency of the range [dBc].

This parameter is only available if the limit check is set accordingly (see "[Limit Check 1-4](#)" parameter).

→ Remote: [ESP:RANG3:LIM:REL:STOP 20](#)

Sweep Points(Spurious Emissions)

Sets the number of sweep points per range. For details on possible values refer to the "[Sweep Points](#)" softkey of the sweep menu.

→ Remote: [LIST:RANG3:POIN 601](#)

Edit Sweep List/Close Sweep List

Opens/closes the "Sweep List" dialog box. Closing the dialog box updates the measurement results.

For further details refer to "[Ranges and Range Settings](#)" on page "213".

Insert before Range

Inserts a new range to the left of the currently focused range. The range numbers of the currently focused range and all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "[Ranges and Range Settings](#)" on page "213".

→ Remote: [ESP:RANG3:INS BEF](#) (Spectrum Emission Mask)

Insert after Range

Inserts a new range to the right of the currently focused range. The range numbers of all higher ranges are increased accordingly. The maximum number of ranges is 20.

For further details refer to "[Ranges and Range Settings](#)" on page "213".

→ Remote: [ESP:RANG1:INS AFT](#) (Spectrum Emission Mask)

Delete Range

Deletes the currently focused range, if possible. The range numbers are updated accordingly. For further details refer to "[Ranges and Range Settings](#)" on page "213".

- Remote: [ESP:RANG4:DEL](#) (Spectrum Emission Mask)
- Remote: [LIST:RANG4:DEL](#) (Spurious Emissions)

Adjust Ref Lvl (span > 0)

Adjusts the reference level to the measured total power of the signal. The softkey is activated after the first sweep with active measurement of the occupied bandwidth has been completed and the total power of the signal is thus known.

Adjusting the reference level ensures that the signal path will not be overloaded and the dynamic range not limited by too low a reference level. Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is distinctly below the reference level. If the measured channel power is equal to the reference level, the signal path cannot be overloaded.

- Remote: POW:ACH:PRES:RLEV

Edit Reference Range

Opens the "Reference Range" dialog box to edit the additional settings used for SEM measurements.

Reference Range

Power Reference Type

Power Reference Type: Channel Power Peak Power

Channel Power Settings

Tx Bandwidth: 3.84 MHz

RRC Filter State: ON OFF

RRC Filter Settings

Alpha: 0.22

Two different power reference types are supported:

- ◆ "Peak Power"
Measures the highest peak within the reference range.
- ◆ "Channel Power"
Measures the channel power within the reference range (integral bandwidth method).
If the "Channel Power" reference power type is activated, the dialog box is extended to define additional settings:
- ◆ "Tx Bandwidth"
Defines the bandwidth used for measuring the channel power:
minimum span ≤ value ≤ span of reference range
- ◆ "RRC Filter State"
Activates or deactivates the use of an RRC filter.
- ◆ "RRC Filter Settings"
Sets the alpha value of the RRC filter. This pane is only available if the RRC filter is activated.

For further details refer to "[Ranges and Range Settings](#)" on page "213".

- Remote: [ESP:RTYP PEAK](#)
- Remote: [ESP:BWID 1MHZ](#)
- Remote: [ESP:FILT OFF](#)
- Remote: [ESP:FILT:ALPH 0.5](#)

List Evaluation

Opens a submenu to edit the list evaluation settings.

The submenu contains the following commands:

List Evaluation (On/Off)
Margin
Peaks per Range
Show Peaks
Save Evaluation List >

List Evaluation (On/Off)

Activates or deactivates the list evaluation.

- Remote: [CALC:ESP:PSE:AUTO OFF](#) (Spectrum Emission Mask)
- Remote: [CALC:PSE:AUTO OFF](#) (Spurious Emissions)
- Remote: [TRAC? LIST](#)

Margin

Opens an edit dialog box to enter the margin used for the limit check/peak search.

- Remote: [CALC:ESP:PSE:MARG 100](#) (Spectrum Emission Mask)
- Remote: [CALC:PEAK:MARG 100](#) (Spurious Emissions)

Peaks per Range

Opens an edit dialog box to enter the number of peaks per range that are stored in the list. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range. The maximum value is 50.

→ Remote: [CALC:PSE:SUBR 10](#)

Show Peaks

In the diagram, marks all peaks with blue squares that have been listed during an active list evaluation.

→ Remote: [CALC:ESP:PSE:PSH ON](#) (Spectrum Emission Mask)

→ Remote: [CALC:PSE:PSH ON](#) (Spurious Emissions)

Save Evaluation List

Opens the "ASCII File Export Name" dialog box to save the result in ASCII format to a specified file and directory. For further details refer also to the "[ASCII File Export](#)" softkey.

→ Remote: [M MEM:STOR:LIST 'test'](#)

ASCII File Export

An example of an output file is given in "[ASCII File Export Format \(Spectrum Emission Mask\)](#)" on page "221". For further details refer also to the "[Average](#)" softkey in the trace menu of the base unit.

→ Remote: [M MEM:STOR:LIST 'test'](#)

Decim Sep

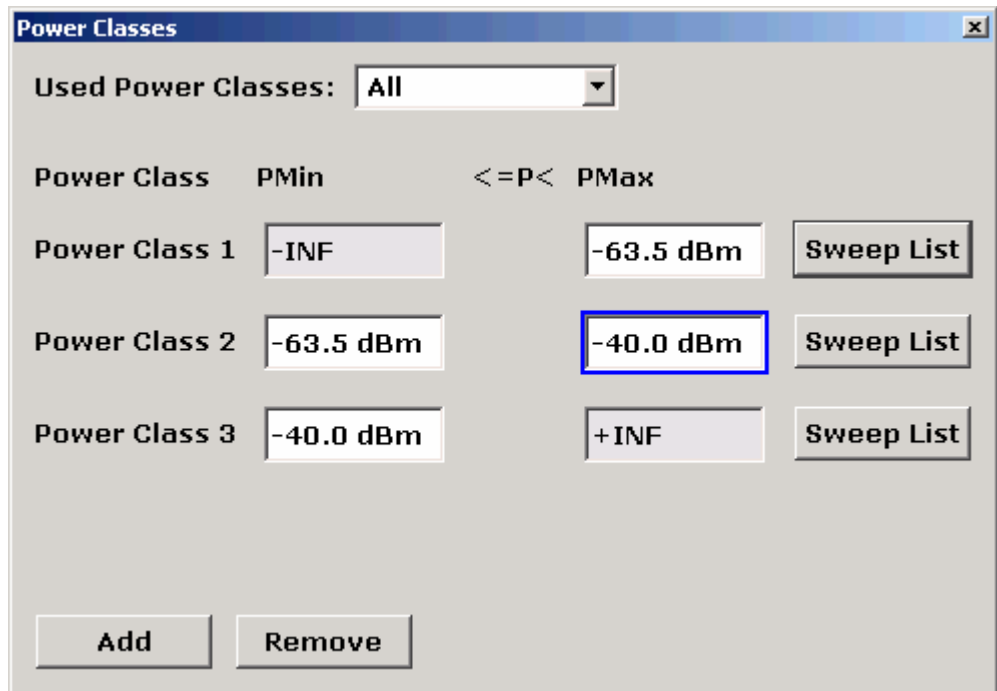
For details refer to the "[Decim Sep](#)" softkey in the "Trace" menu.

Edit Reference Range

See "[Edit Reference Range](#)" above.

Edit Power Classes

Opens a dialog box to modify the power class settings.



The dialog box contains the following elements:

Used Power Classes Choose the power classes to be used from this dropdown menu. It is only possible to select either one of the defined power classes or all of the defined power classes together. Only power classes for which limits are defined are available for selection.

PMin / PMax Defines the level limits for each power class. The range always starts at -200 dBm (-INF) and always stops at 200 dBm (+INF). These fields cannot be modified. If more than one Power Class is defined, the value of PMin must be equal to the value of PMax of the last Power Class and vice versa.

Sweep List Opens the sweep list dialog box. For details see the "[Sweep List](#)" dialog box.

Add / Remove Activates or deactivates power classes to be defined. Up to four power classes can be defined. The number of active power classes affects the availability of the items of the Used Power Classes dropdown menu.

- Remote: CALC:ESP:PCL ON
- Remote: CALC:ESP:PCL MIN <numeric_value>
- Remote: CALC:ESP:PCL:MAX <numeric_value>

- Remote: CALC:ESP:PCL:COUN <numeric_value>
- Remote: CALC:ESP:PCL:LIM ABS

Load Standard

Opens a dialog box to select an XML file which includes the desired standard specification. For details on the provided XML files refer to "[Provided XML Files for the Spectrum Emission Mask Measurement](#)" on page "214".

- Remote: [ESP:PRES 'WCDMA\3GPP\DL\PowerClass_31_39.xml'](#)

Save As Standard

Opens the "Save As Standard" dialog box, in which the currently used SEM settings and parameters can be saved and exported into an *.xml file. Enter the name of the file in the "File name" field. For details on the structure and contents of the XML file refer to "[Format Description of Spectrum Emission Mask XML Files](#)" on page 215.

- Remote: SENS:ESP:STOR "<file name>"

Meas Start/Stop

Aborts/restarts the current measurement and displays the status:

"Start" The measurement is currently running.

"Stop" The measurement has been stopped, or, in single sweep mode, the end of the sweep has been reached.

- Remote: [ABOR](#)
- Remote: [INIT:ESP](#) (Spectrum Emission Mask)
- Remote: [INIT:SPUR](#) (Spurious Emissions)
- Remote: [INIT:CONM](#) (Spurious Emissions)

Restore Standard Files

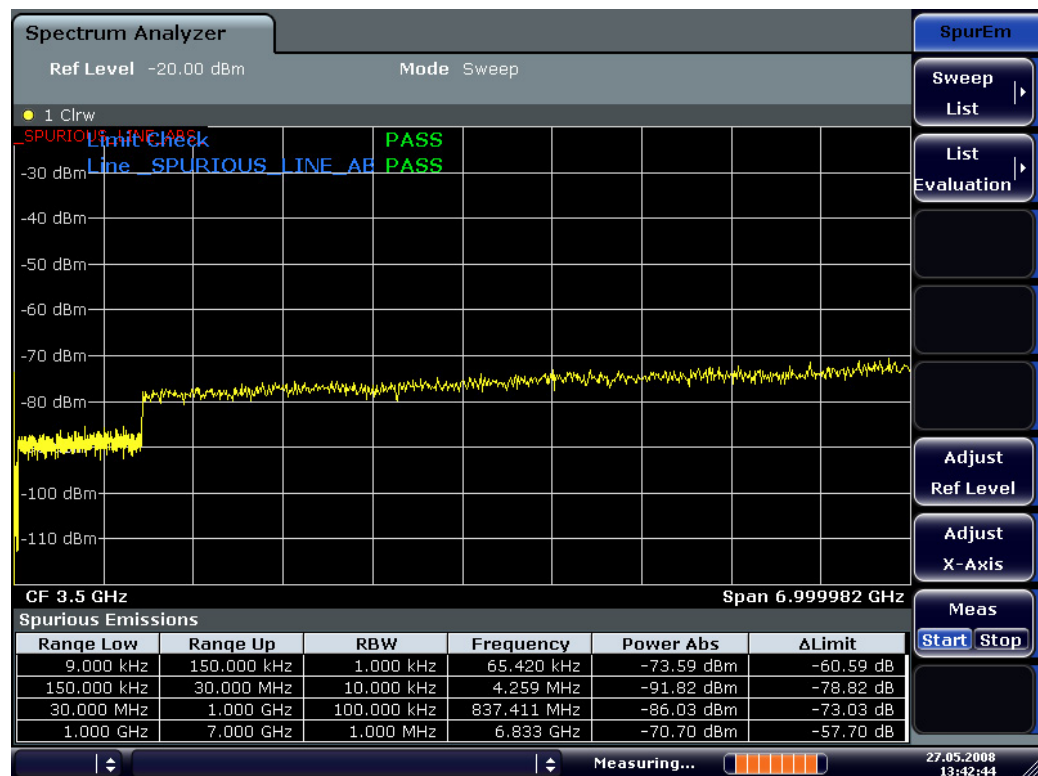
Copies the XML files from the C:\R_S\instr\sem_backup folder to the C:\R_S\instr\sem_std folder. Files of the same name are overwritten.

- Remote: [ESP:PRES:REST](#)

Spurious Emissions

Opens a submenu to configure the Spurious Emissions measurement.

The Spurious Emissions measurement defines a measurement that monitors unwanted RF products outside the assigned frequency band generated by an amplifier. The spurious emissions are usually measured across a wide frequency range. The Spurious Emissions measurement allows a flexible definition of all parameters.



The submenu contains the following commands:

Sweep List >
List Evaluation >
Adjust Ref Lvl
Adjust X-Axis
Meas Start/Stop

→ Remote: [SWE:MODE LIST](#)

Sweep List

Opens a submenu to edit the sweep list and displays the "Sweep List" dialog box. After a preset, the sweep list contains a set of default ranges and parameters. For each range, you can change the parameters listed below. To insert or delete ranges, use the "[Insert before Range](#)", "[Insert after Range](#)", "[Delete Range](#)" softkeys. The measurement results are not updated during editing but on closing the dialog box ("[Close Sweep List](#)" softkey).

The submenu contains the following commands:

Edit Sweep List/Close Sweep List
Insert before Range
Insert after Range
Delete Range
Adjust Ref Lvl
Adjust X-Axis

List evaluation

See "[List Evaluation](#)" above.

Details On/Off

Configures the list contents.

On Displays the whole list contents.

Off Displays only the highest peaks (one peak per range).

Adjust Ref Lvl (span > 0)

See "[Adjust Ref Lvl \(span > 0\)](#)" above.

Adjust X-Axis

Adjusts the frequency axis of measurement diagram automatically so that the start frequency matches the start frequency of the first sweep range, and the stop frequency of the last sweep range.

Meas Start/Stop

See "[Meas Start/Stop](#)" above.

Time Domain Power (zero span)

Activates the power measurement in zero span and opens a submenu to configure the power measurement. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

The submenu contains the following commands:

Peak
RMS
Mean
Std Dev
Limits (On/Off)
Left Limit
Right Limit

→ Remote: [CALC:MARK:FUNC:SUMM:STAT ON](#)

Peak (zero span)

Activates the calculation of the peak value from the points of the displayed trace or a segment thereof. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

→ Remote: [CALC:MARK:FUNC:SUMM:PPE ON](#)

→ Remote: [CALC:MARK:FUNC:SUMM:PPE:RES?](#)

RMS (zero span)

Activates the calculation of the RMS value from the points of the displayed trace or a segment thereof. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:FUNC:SUMM:RMS ON](#)
- Remote: [CALC:MARK:FUNC:SUMM:RMS:RES?](#)

Mean (zero span)

Activates the calculation of the mean value from the points of the displayed trace or a segment thereof. The linear mean value of the equivalent voltages is calculated. This can be used for instance to measure the mean power during a GSM burst. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:FUNC:SUMM:MEAN ON](#)
- Remote: [CALC:MARK:FUNC:SUMM:MEAN:RES?](#)

Std Dev (zero span)

Activates the calculation of the standard deviation of measurement points from the mean value and displays them as measured value. The measurement of the mean power is automatically switched on at the same time. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:FUNC:SUMM:SDEV ON](#)
- Remote: [CALC:MARK:FUNC:SUMM:SDEV:RES?](#)

Limits (On/Off) (zero span)

Switches the limitation of the evaluation range on or off. Default setting is off. If switched off, the evaluation range is not limited. If switched on, the evaluation range is defined by the left and right limit. If only one limit is set, it corresponds to the left limit and the right limit is defined by the stop frequency. If the second limit is also set, it defines the right limit.

For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:X:SLIM OFF](#)

Left Limit (zero span)

Opens an edit dialog box to enter a value for line 1. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:X:SLIM:LEFT <value>](#)

Right Limit (zero span)

Opens an edit dialog box to enter a value for line 2. For more details see also "[Measuring the Power in Zero Span](#)" on page "208".

- Remote: [CALC:MARK:X:SLIM:RIGH <value>](#)

All Functions Off

Switches off all power measurement functions.

→ Remote: `CALC:MARK:FUNC:<function> OFF`

APD

Activates the function to measure the amplitude probability density (APD) and opens a submenu.

The submenu contains the following commands:

Res BW
of Samples
Scaling >
Gated Trigger (On/Off)
Gate Ranges
Adjust Settings

→ Remote: [CALC:STAT:APD ON](#)

Res BW

Opens an edit dialog box to set the resolution bandwidth directly. The function of this softkey is identical to the "[Res BW Manual](#)" softkey in the bandwidth menu.

For correct measurement of the signal statistics the resolution bandwidth has to be wider than the signal bandwidth in order to measure the actual peaks of the signal amplitude correctly. In order not to influence the peak amplitudes the video bandwidth is automatically set to 10 MHz. The sample detector is used for detecting the video voltage.

→ Remote: [BAND 3 MHz](#)

of Samples

Opens an edit dialog box to set the number of power measurements that are taken into account for the statistics.

Apart from the number of measurements the overall measurement time depends also on the set resolution bandwidth as the resolution bandwidth directly influences the sampling rate.

→ Remote: [CALC:STAT:NSAM <value>](#)

Scaling

Opens a submenu to change the scaling parameters of x- and y-axis.

The submenu contains the following commands:

x-Axis Ref Level
x-Axis Range
y-Axis Max Value
y-Axis Min Value
y-Unit %/Abs
Default Settings
Adjust Settings

x-Axis Range

Opens the "Range" submenu to select a value for the level range to be covered by the statistics measurement selected. The function is identical to the "[Range](#)" softkey in amplitude menu.

→ Remote: [CALC:STAT:SCAL:X:RANG <value>](#)

x-Axis Ref Level

Opens an edit dialog box to enter the reference level in the currently active unit (dBm, dBμV, etc). The function of this softkey is identical to the "[Ref Level](#)" softkey in the amplitude menu.

For the APD function this value is mapped to the right diagram border. For the CCDF function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the measured mean power.

→ Remote: [CALC:STAT:SCAL:X:RLEV <value>](#)

y-Axis Max Value

Opens an edit dialog box to define the upper limit of the displayed probability range. Values on the y-axis are normalized which means that the maximum value is 1.0. The y-axis scaling is defined via the "[y-Unit %/Abs](#)" softkey. If the y-axis has logarithmic scale, the distance between max and min value must be at least one decade.

→ Remote: [CALC:STAT:SCAL:Y:UPP <value>](#)

y-Axis Min Value

Opens an edit dialog box to define the lower limit of the displayed probability range. Values in the range $0 < \text{value} < 1$ are allowed. The y-axis scaling is defined via the "[y-Unit %/Abs](#)" softkey. If the y-axis has logarithmic scale, the distance between max and min value must be at least one decade.

→ Remote: [CALC:STAT:SCAL:Y:LOW <value>](#)

y-Unit %/Abs

Defines the scaling type of the y-axis. The default value is absolute scaling.

→ Remote: [CALC:STAT:SCAL:Y:UNIT PCT](#)

Default Settings

Resets the x- and y-axis scalings to their preset values.

x-axis ref level:	-10 dBm
x-axis range APD:	100 dB
x-axis range CCDF:	20 dB
y-axis upper limit:	1.0
y-axis lower limit:	1E-6

→ Remote: [CALC:STAT:PRES](#)

Adjust Settings

See "[Adjust Settings \(span > 0\)](#)" above.

Gated Trigger (On/Off)

Activates and deactivates the gating for statistics functions for the ACP and the CCDF channel. The trigger source is changed to "EXTERN" if this function is switched on.

The gate ranges are defined using the "[Gate Ranges](#)" softkey.

→ Remote: [SWE:EGAT ON](#)

Gate Ranges

Opens a dialog to configure up to 3 gate ranges for each trace. For details on configuration, see "[Defining Gated Triggering for APD and CCDF](#)" on page 221.

Gate Ranges						
	Trace 1	Trace 2	Trace 3	Trace 4	Trace 5	Trace 6
Comment	SlotA					
Period	8 ms	8 ms	8 ms	8 ms	8 ms	8 ms
Range 1 Start	1 ms	1 μs	1 μs	1 μs	1 μs	1 μs
Range 1 Stop	3 ms	1 μs	1 μs	1 μs	1 μs	1 μs
Range 1 Use	On	Off	Off	Off	Off	Off
Range 2 Start	1 μs	1 μs	1 μs	1 μs	1 μs	1 μs
Range 2 Stop	1 μs	1 μs	1 μs	1 μs	1 μs	1 μs
Range 2 Use	Off	Off	Off	Off	Off	Off
Range 3 Start	1 μs	1 μs	1 μs	1 μs	1 μs	1 μs
Range 3 Stop	1 μs	1 μs	1 μs	1 μs	1 μs	1 μs
Range 3 Use	Off	Off	Off	Off	Off	Off

Remote commands:

- [SWE:EGAT ON](#)
Switches on the external gate mode.
- [SWE:EGAT:TRAC1:COMM "SlotA"](#)
Adds a comment to trace 1.
- [SWE:EGAT:TRAC1:STAT1 ON](#)
Activates tracing for range 1 of trace 1.
- [SWE:EGAT:TRAC1:STAR1 3ms](#)
Sets the starting point for range 1 on trace 1 at 3 ms.
- [SWE:EGAT:TRAC1:STop1 5ms](#)
Sets the stopping point for range 1 on trace 1 at 5 ms.
- [SWE:EGAT:TRAC1:PER 5ms](#)
Defines the period for gated triggering to 5 ms.

CCDF

Activates the function to measure the complementary cumulative distribution function (CCDF) and opens a submenu analog to the menu for "[APD](#)".

The submenu contains the following commands:

Percent Marker
Res BW
of Samples
Gated Trigger (On/Off)
Gate Ranges
Scaling >
Adjust Settings

After a CCDF measurement, the results are displayed in a table beneath the diagram.

Mean	Mean power
Peak	Peak power
Crest	Crest factor (peak power – mean power)
0,01%	Level values over 0,01% above mean power
0,1%	Level values over 0,1% above mean power
1%	Level values over 1% above mean power
10%	Level values over 10% above mean power

- Remote: [CALC:STAT:CCDF ON](#)
Activates the CCDF measurement.
- Remote: [CALC:STAT:CCDF:X? P1](#)
Reads out the level values for 1% probability.

Percent Marker

Opens an edit dialog box to enter a probability value and to position marker 1. Thus, the power which is exceeded with a given probability can be determined very easily. If marker 1 is deactivated, it will be switched on automatically.

→ Remote: [CALC:MARK:Y:PERC 0...100%](#)

TOI

Opens a submenu and activates the measurement of the 3rd order intercept point.

The submenu contains the following commands:

Marker 1
Marker 2
Marker 3
Search Signals

A two-tone signal with equal carrier levels is expected at the R&S FSV input. Marker 1 and marker 2 (both normal markers) are set to the maximum of the two signals. Marker 3 and marker 4 (both delta markers) are placed on the intermodulation products. When the function is enabled, the frequency entry is activated for the delta markers. They can be set manually.

The R&S FSV calculates the third order intercept point from the level spacing between normal markers and delta markers and displays it in the marker field.

→ Remote: [CALC:MARK:FUNC:TOI ON](#)

→ Remote: [CALC:MARK:FUNC:TOI:RES?](#)

Search Signals

Activates all markers.

→ Remote: [CALC:MARK:FUNC:TOI:RES?](#)

AM Mod Depth

Opens a submenu and activates the measurement of the AM modulation depth. An AM-modulated carrier is required on the screen for ensuring correct operation.

The submenu contains the following commands:

Marker 1
Marker 2
Marker 3
Search Signals

The level value of marker 1 is taken as the carrier level. When this function is activated, marker 2 and marker 3 are automatically set symmetrically to the carrier on the adjacent peak values of the trace as delta markers and marker 2 is activated for the entry.

When the position of marker 2 (delta) is changed, marker 3 (delta) is moved symmetrically with respect to the reference marker (marker 1).

If the edit dialog box is opened for marker 3, the latter can be moved for fine adjustment irrespective of marker 2.

The R&S FSV calculates the power at the marker positions from the measured levels. The AM modulation depth is calculated from the ratio between the power values at the reference marker and at the delta markers. If the powers of the two AM side bands are unequal, the mean value of the two power values is used for AM modulation depth calculation.

- Remote: [CALC:MARK:FUNC:MDEP ON](#)
- Remote: [CALC:MARK:FUNC:MDEP:RES?](#)

Harmonic Distortion

Opens a submenu to determine the settings for harmonics measurement and activates the harmonic distortion measurement.

The submenu contains the following commands:

No. of Harmonics
Harmonic Sweep Time
Harmonic RBW Auto
Adjust Settings

With this measurement it is possible to measure easily the harmonics e.g. from a VCO. In addition the THD (total harmonic distortion) is calculated in % and dB.

With span > 0 Hz, an automatic search for the first harmonic is carried out within the set frequency range. Also the level is adjusted. In zero span, the center frequency is unchanged.

In the upper pane, the zero span sweeps on all harmonics are shown, separated by display lines. This provides a very good overview about the measurement. In the lower pane, the mean RMS results are displayed in numerical values. The THD values are displayed in the marker field.

- Remote: [CALC:MARK:FUNC:HARM:STAT ON](#)
- Remote: [CALC:MARK:FUNC:HARM:DIST? TOT](#)
- Remote: [CALC:MARK:FUNC:HARM:LIST?](#)

No. of Harmonics

Sets the number of harmonics that shall be measured. The range is from 1 to 26.

- Remote: [CALC:MARK:FUNC:HARM:NHAR 2](#)

Harmonic Sweep Time

For details refer to the "[Sweeptime Manual](#)" softkey in the bandwidth menu.

Harmonic RBW Auto

Enables/disables the automatic adjustment of the resolution bandwidth. The automatic adjustment is carried out according to:

$$RBW_n = RBW_1 * n$$

If RBW_n is not available, the next higher value is used.

→ Remote: [CALC:MARK:FUNC:HARM:BAND:AUTO OFF](#)

Adjust Settings

Activates the frequency search in the frequency range that was set before starting the harmonic measurement (if harmonic measurement was with span > 0) and adjusts the level.

→ Remote: [CALC:MARK:FUNC:HARM:PRES](#)

All Functions Off

Switches off all power measurement functions.

→ Remote: [CALC:MARK:FUNC:<function> OFF](#)

4.3.5.2 Measuring Signal Statistics

- ◆ To activate and configure the measurement of the amplitude probability distribution (APD), press the "[APD](#)" softkey (for details refer to chapter "Advanced Measurement Examples", "Amplitude Distribution Measurement").
The corresponding submenu is displayed.
- ◆ To activate and configure the measurement of the complementary cumulative distribution (CCDF), press the "[CCDF](#)" softkey (for details refer to chapter "Advanced Measurement Examples", "Amplitude Distribution Measurement").
The corresponding submenu is displayed.

4.3.5.3 Measuring the Carrier-to-Noise Ratio

1. Press the "[C/N, C/No](#)" softkey to configure the carrier-to-noise ratio measurement.
The corresponding submenu is displayed.
2. To activate the measurements without reference to the bandwidth, press the "[C/N](#)" softkey.
3. To activate the measurements with reference to the bandwidth, press the "[C/No](#)" softkey.
4. To change the channel bandwidth for the transmission channel, press the "[Channel Bandwidth](#)" softkey.

To optimize the settings for the selected channel configuration, press the "[Adjust Settings](#)" softkey (for details see also "[Settings of CP / ACLR Test Parameters](#)" on page "211").

4.3.5.4 Measuring the Power in Zero Span

With the aid of the power measurement function, the R&S FSV determines the power of the signal in zero span by summing up the power at the individual measurement points and dividing the result by the number of measurement points. In this way it is possible to measure for example the power of TDMA signals during transmission or during the muting phase. Both the mean power and the RMS power can be measured by means of the individual power values.

The result is displayed in the marker field. The measured values are updated after each sweep or averaged over a user-defined number of sweeps in order to determine e.g. the mean power over several bursts. For determination of the peak value the maximum value from several sweeps is displayed.

If both the on and off phase of a burst signal are displayed, the measurement range can be limited to the transmission or to the muting phase with the aid of vertical lines. The ratio between signal and noise power of a TDMA signal for instance can be measured by using a measurement as a reference value and after that varying the measurement range.

Upon switching on power measurement the sample detector is activated.

Procedure

1. Press the "[Time Domain Power](#)" softkey to activate the power measurement. The corresponding submenu is displayed.
2. To limit the power evaluation range, switch on the limits ("[Limits \(On/Off\)](#)" softkey) and enter the limits by using the "[Left Limit](#)" and "[Right Limit](#)" softkeys.
3. Select the type of power measurement by using the "[Mean](#)" or "[RMS](#)" softkey. (RMS or mean power), the settings for max hold and averaging as well as the definition of limits.
4. To calculate and display the peak value, press the "[Peak](#)" softkey.
5. To calculate and display the standard deviation from the mean value, press the "[Std Dev](#)" softkey.

4.3.5.5 Measuring the Occupied Bandwidth

An important characteristic of a modulated signal is its occupied bandwidth. In a radio communications system for instance the occupied bandwidth must be limited to enable distortion-free transmission in adjacent channels. The occupied bandwidth is defined as the bandwidth containing a defined percentage of the total transmitted power. A percentage between 10% and 99.9% can be set.

The measurement principle is the following: The bandwidth containing 99% of the signal power is to be determined, for example. The routine first calculates the total power of all displayed points of the trace. In the next step, the points from the right edge of the trace are summed up until 0.5% of the total power is reached. Auxiliary marker 1 is positioned at the corresponding frequency. Then the points from the left edge of the trace are summed up until 0.5% of the power is reached. Auxiliary marker 2 is positioned at this point. 99% of the power is now between the two markers. The distance between the two frequency markers is the occupied bandwidth which is displayed in the marker field.

To ensure correct power measurement, especially for noise signals, and to obtain the correct occupied bandwidth, the following prerequisites and settings are necessary:

- ◆ Only the signal to be measured is displayed on the screen. An additional signal would falsify the measurement.
- ◆ $RBW \ll$ occupied bandwidth
- ◆ (approx. 1/20 of occupied bandwidth, for voice communication type 300 Hz or 1 kHz)
- ◆ $VBW \geq 3 \times RBW$
- ◆ RMS detector
- ◆ $Span \geq 2$ to $3 \times$ occupied bandwidth

Some of the measurement specifications (e.g. PDC, RCR STD-27B) require measurement of the occupied bandwidth using a peak detector. The detector setting of the R&S FSV has to be changed accordingly then.

Procedure

1. Press the "[OBW](#)" softkey to activate the measurement of the occupied bandwidth. The corresponding submenu is displayed.
2. Press the "[% Power Bandwidth](#)" softkey to enter the percentage of power.
3. To change the channel bandwidth for the transmission channel, press the "[Channel Bandwidth](#)" softkey.
4. To optimize the settings for the selected channel configuration, press the "[Adjust Settings](#)" softkey (for details see also "[Settings of CP / ACLR Test Parameters](#)" on page "211").
5. To adjust the reference level to the measured total power after the first sweep, press the "[Adjust Ref Lvl](#)" softkey.

4.3.5.6 Predefined CP / ACLR Standards

The test parameters for the channel and adjacent-channel measurements are set according to the mobile radio standard. The available standards are listed below.

Parameter	Standard
W-CDMA 3GPP FWD	W-CDMA 3.84 MHz forward
W-CDMA 3GPP REV	W-CDMA 3.84 MHz reverse
CDMA IS95A FWD	CDMA IS95A forward
EUTRa	EUTRA/LTE Square
REUTRa	EUTRA/LTE Square/RRC
CDMA IS95A REV	CDMA IS95A reverse
CDMA IS95C Class 0 FWD	CDMA IS95C Class 0 forward
CDMA IS95C Class 0 REV	CDMA IS95C Class 0 reverse
CDMA J-STD008 FWD	CDMA J-STD008 forward
CDMA J-STD008 REV	CDMA J-STD008 reverse
CDMA IS95C Class 1 FWD	CDMA IS95C Class 1 forward
CDMA IS95C Class 1 REV	CDMA IS95C Class 1 reverse
CDMA 2000	CDMA 2000
TD SCDMA FWD	TD-SCDMA forward
TD SCDMA REV	TD-SCDMA reverse
WLAN 802.11A	WLAN 802.11A
WLAN 802.11B	WLAN 802.11B
WiMAX	WiMAX
WiBRO	WiBRO
RFID 14443	RFID 14443
TETRA	TETRA
PDC	PDC
PHS	PHS
CDPD	CDPD

Note: For the R&S FSV, the channel spacing is defined as the distance between the center frequency of the adjacent channel and the center frequency of the transmission channel. The definition of the adjacent-channel spacing in standards IS95C and CDMA 2000 is different. These standards define the adjacent-channel spacing from the center of the transmission channel to the closest border of the adjacent channel. This definition is also used for the R&S FSV if the standard settings marked with a dagger are selected.

4.3.5.7 Settings of CP / ACLR Test Parameters

◆ "Frequency span"

The frequency span must at least cover the channels to be measured plus a measurement margin of approx. 10%.

Note: *If the frequency span is large in comparison to the channel bandwidth (or the adjacent-channel bandwidths) being examined, only a few points on the trace are available per channel. This reduces the accuracy of the waveform calculation for the channel filter used, which has a negative effect on the measurement accuracy. It is therefore strongly recommended that the formulas mentioned be taken into consideration when selecting the frequency span.*

For channel power measurements the "[Adjust Settings](#)" softkey sets the frequency span as follows:

(No. of transmission channels - 1) x transmission channel spacing + 2 x transmission channel bandwidth + measurement margin

For adjacent-channel power measurements, the "[Adjust Settings](#)" softkey sets the frequency span as a function of the number of transmission channels, the transmission channel spacing, the adjacent-channel spacing, and the bandwidth of one of adjacent-channels ADJ, ALT1 or ALT2, whichever is furthest away from the transmission channels:

(No. of transmission channels - 1) x transmission channel spacing + 2 x (adjacent-channel spacing + adjacent-channel bandwidth) + measurement margin

The measurement margin is approx. 10% of the value obtained by adding the channel spacing and the channel bandwidth.

◆ "Resolution bandwidth" ("RBW")

To ensure both, acceptable measurement speed and required selection (to suppress spectral components outside the channel to be measured, especially of the adjacent channels), the resolution bandwidth must not be selected too small or too large. As a general approach, the resolution bandwidth is to be set to values between 1% and 4% of the channel bandwidth.

A larger resolution bandwidth can be selected if the spectrum within the channel to be measured and around it has a flat characteristic. In the standard setting, e.g. for standard IS95A REV at an adjacent channel bandwidth of 30 kHz, a resolution bandwidth of 30 kHz is used. This yields correct results since the spectrum in the neighborhood of the adjacent channels normally has a constant level.

With the exception of the IS95 CDMA standards, the "[Adjust Settings](#)" softkey sets the resolution bandwidth (RBW) as a function of the channel bandwidth:

$$RBW \leq 1/40 \text{ of channel bandwidth}$$

The maximum possible resolution bandwidth (with respect to the requirement $RBW \leq 1/40$) resulting from the available RBW steps (1, 3) is selected.

◆ "Video bandwidth" ("VBW")

For a correct power measurement, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). The video bandwidth should therefore be selected at least three times the resolution bandwidth:

$$VBW \geq 3 \times RBW$$

The "[Adjust Settings](#)" softkey sets the video bandwidth (VBW) as a function of the channel bandwidth (see formula above) and the smallest possible VBW with regard to the available step size will be selected.

◆ "Detector"

The "[Adjust Settings](#)" softkey selects the RMS detector. This detector is selected since it correctly indicates the power irrespective of the characteristics of the signal to be measured. The whole IF envelope is used to calculate the power for each measurement point. The IF envelope is digitized using a sampling frequency which is at least five times the resolution bandwidth which has been selected. Based on the sample values, the power is calculated for each measurement point using the following formula:

$$P_{RMS} = \sqrt{\frac{1}{N} \cdot \sum_{i=1}^N s_i^2}$$

where:

s_i = linear digitized video voltage at the output of the A/D converter

N = number of A/D converter values per measurement point

P_{RMS} = power represented by a measurement point

When the power has been calculated, the power units are converted into decibels and the value is displayed as a measurement point.

In principle, the sample detector would be possible as well. Due to the limited number of measurement points used to calculate the power in the channel, the sample detector would yield less stable results.

- ◆ "Trace averaging"
The "[Adjust Settings](#)" softkey switches off this function. Averaging, which is often performed to stabilize the measurement results, leads to a too low level indication and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel to be measured.
- ◆ "Reference level"
The "[Adjust Settings](#)" softkey does not influence the reference level. It can be separately adjusted using the "[Adjust Settings](#)" softkey.

4.3.5.8 Setting the Channel Configuration

1. To activate channel or adjacent-channel power measurement, press the "[Ch Power ACLR](#)" softkey.
The corresponding submenu is displayed.
2. To use a predefined standard for measurement, press the "[CP / ACLR Standard](#)" softkey (for details on available standards see "[Predefined CP / ACLR Standards](#)" on page "210").
To configure the parameters independently of the predefined standards, press the "[CP / ACLR](#)" softkey (for details see "[Settings of CP / ACLR Test Parameters](#)" on page "211").
3. To enter the sweep time, press the "[Sweep Time](#)" softkey.
4. To adjust the reference level to the measured channel power, press the "[Adjust Ref Lvl](#)" softkey.

4.3.5.9 Ranges and Range Settings

In the Spectrum Emission Mask and Spurious Emissions measurements, a range defines a segment, for which you can define the following parameters separately: start and stop frequency, RBW, VBW, sweep time, sweep points, reference level, attenuator settings, and limit values. Via the sweep list, you define the ranges and their settings (for details on settings refer to the "[Sweep List](#)" softkey).

The following rules apply to ranges:

- ◆ The minimum span of a range is 20 Hz.
- ◆ The individual ranges must not overlap (but need not directly follow one another).
- ◆ The maximum number of ranges is 20.
- ◆ Spectrum Emission Mask measurement only: A minimum of three ranges is mandatory.
- ◆ Spectrum Emission Mask measurement only: The reference range cannot be deleted (it is marked in blue color).

4.3.5.10 Provided XML Files for the Spectrum Emission Mask Measurement

You can change the settings manually or via XML files. The XML files offer a quick way to change the configuration. A set of ready-made XML files for different standards is already provided. For details see [Table 6](#). You can also create and use your own XML files (for details see "[Format Description of Spectrum Emission Mask XML Files](#)" on page "214"). All XML files are stored under "C:\r_s\instr\sem_std". Use the "[Load Standard](#)" softkey for quick access to the available XML files.

Table 6: Provided XML files

Path	XML file name	Displayed standard characteristics*
cdma2000\DL	default0.xml	CDMA2000 BC0 DL
	default1.xml	CDMA2000 BC1 DL
cdma2000\UL	default0.xml	CDMA2000 BC0 UL
	default1.xml	CDMA2000 BC1 UL
WCDMA\3GPP\DL	PowerClass_31_39.xml	W-CDMA 3GPP (31,39)dBm DL
	PowerClass_39_43.xml	W-CDMA 3GPP (39,43)dBm DL
	PowerClass_43_INF.xml	W-CDMA 3GPP (43,INF)dBm DL
	PowerClass_negINF_31.xml	W-CDMA 3GPP (-INF,31)dBm DL
WiBRO\DL	PowerClass_29_40.xml	WiBro TTA (29,40)dBm DL
	PowerClass_40_INF.xml	WiBro TTA (40,INF)dBm DL
	PowerClass_negINF_29.xml	WiBro TTA (-INF,29)dBm DL
WiBRO\UL	PowerClass_23_INF.xml	WiBro TTA (23,INF)dBm UL
	PowerClass_negINF_23.xml	WiBro TTA (23,INF)dBm UL
WiMAX\DL\ETSI...MHz (1.75 MHz, 2.00 MHz, 3.5 MHz, 7.00 MHz, 14.00 MHz, 28 MHz)	System_Type_E.xml	WiMAX System Type E DL
	System_Type_F.xml	WiMAX System Type F DL
	System_Type_G.xml	WiMAX System Type G DL
WiMAX\DL\IEEE	10MHz.xml	WiMAX 10MHz DL
	20MHz.xml	WiMAX 20MHz DL
WiMAX\UL\ETSI...MHz (1.75 MHz, 2.00 MHz, 3.5 MHz, 7.00 MHz, 14.00 MHz, 28 MHz)	System_Type_E.xml	WiMAX System Type E UL
	System_Type_F.xml	WiMAX System Type F UL
	System_Type_G.xml	WiMAX System Type G UL
WiMAX\UL\IEEE	10MHz.xml	WiMAX 10MHz UL
	20MHz.xml	WiMAX 20MHz UL
WLAN\802_11_TURBO	ETSI.xml	IEEE 802.11
	IEEE.xml	IEEE 802.11
WLAN\802_11a	ETSI.xml	IEEE 802.11a
	IEEE.xml	IEEE 802.11a
WLAN\802_11b	IEEE.xml	IEEE 802.11b
WLAN\802_11j_10MHz	ETSI.xml	IEEE.802.11j
	IEEE.xml	IEEE.802.11j
WLAN\802_11j_20MHz	ETSI.xml	IEEE 802.11j
	IEEE.xml	IEEE 802.11j
EUTRA\LTE\CategoryA\	CategoryA_BW10MHz_Cflarger1GHz.xml	EUTRA/LTE A 10MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW10MHz_Cfsmaller1GHz.xml	EUTRA/LTE A 10MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW1400kHz_Cflarger1GHz.xml	EUTRA/LTE A 1400MHz >1GHz DL

Path	XML file name	Displayed standard characteristics*
EUTRA\LTE\CategoryA\	CategoryA_BW1400kHz_CFsmaller1GHz.xml	EUTRA/LTE A 1400MHz <1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW15MHz_CFlarger1GHz.xml	EUTRA/LTE A 15MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW15MHz_CFsmaller1GHz.xml	EUTRA/LTE A 15MHz <1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW20MHz_CFlarger1GHz.xml	EUTRA/LTE A 20MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW20MHz_CFsmaller1GHz.xml	EUTRA/LTE A 20MHz <1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW3MHz_CFlarger1GHz.xml	EUTRA/LTE A 3MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW3MHz_CFsmaller1GHz.xml	EUTRA/LTE A 3MHz <1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW5MHz_CFlarger1GHz.xml	EUTRA/LTE A 5MHz >1GHz DL
EUTRA\LTE\CategoryA\	CategoryA_BW5MHz_CFsmaller1GHz.xml	EUTRA/LTE A 5MHz <1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW10MHz_CFlarger1GHz.xml	EUTRA/LTE B 10MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW10MHz_CFsmaller1GHz.xml	EUTRA/LTE B 10MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW1400kHz_CFlarger1GHz.xml	EUTRA/LTE B 1400MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW1400kHz_CFsmaller1GHz.xml	EUTRA/LTE B 1400MHz <1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW15MHz_CFlarger1GHz.xml	EUTRA/LTE B 15MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW15MHz_CFsmaller1GHz.xml	EUTRA/LTE B 15MHz <1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW20MHz_CFlarger1GHz.xml	EUTRA/LTE B 20MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW20MHz_CFsmaller1GHz.xml	EUTRA/LTE B 20MHz <1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW3MHz_CFlarger1GHz.xml	EUTRA/LTE B 3MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW3MHz_CFsmaller1GHz.xml	EUTRA/LTE B 3MHz <1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW5MHz_CFlarger1GHz.xml	EUTRA/LTE B 5MHz >1GHz DL
EUTRA\LTE\CategoryB\	CategoryB_BW5MHz_CFsmaller1GHz.xml	EUTRA/LTE B 5MHz <1GHz DL

*Used abbreviations:

BC: band class

UL: uplink

DL: downlink

TTA: Telecommunications Technology Association

4.3.5.11 Format Description of Spectrum Emission Mask XML Files

The files for importing range settings are in XML format and therefore obey the rules of the XML standard. Below, the child nodes, attributes, and structure defined for the data import is described. Build your own XML files according to these conventions because the R&S FSV can only interpret XML files of a known structure. For example files look in the "C:\r_s\instr\sem_std directory".

Note: It is mandatory to follow the structure exactly as shown below or else the R&S FSV is not able to interpret the XML file and error messages are shown on the screen. For this reason is it recommended to make a copy of an existing file (see "[Save As Standard](#)" softkey) and edit the copy of the file. The default files can be found in the "C:\r_s\instr\sem_std" directory.

Alternatively, edit the settings using the "[Spectrum Emission Mask](#) dialog box and the "[Sweep List](#)" dialog box and save the XML file with the "[Save As Standard](#)" softkey afterwards. This way, no modifications have to be done in the XML file itself.

Basically, the file consists of three elements that can be defined.

The "BaseFormat" element

It carries information about basic settings. In this element only the "ReferencePower" child node has any effects on the measurement itself. The other attributes and child nodes are used to display information about the Spectrum Emission Mask Standard on the measurement screen. The child nodes and attributes of this element are shown in "[Attributes and child nodes of the BaseFormat element](#)".

Spectrum Emission Mask Standard: W-CDMA 3GPP DL (39,43)dBm							
Tx Power		-70.75 dBm	Tx Bandwidth		3.840 MHz	RBW	1 MHz
Range [Hz]		RBW [Hz]	Frequency [Hz]	PwrAbs [dBm]	PwrRel [dBc]	ΔLimit [dB]	
-12.750 M	-8.000 M	1 M	2.991974 G	-77.89	-7.14	47.36 *	
-8.000 M	-4.000 M	1 M	2.995923 G	-93.74	-22.99	-82.24	
-4.000 M	-3.515 M	30 k	2.996404 G	-100.18	-29.43	-75.68	
-3.515 M	-2.715 M	30 k	2.996512 G	-105.54	-34.78	-81.04	
-2.715 M	-2.515 M	30 k	2.997318 G	-105.54	-34.78	-93.04	
2.515 M	2.715 M	30 k	3.002548 G	-105.54	-34.78	-93.04	
2.715 M	3.515 M	30 k	3.003382 G	-102.45	-31.70	-79.95	
3.515 M	4.000 M	30 k	3.003919 G	-100.18	-29.43	-75.68	
4.000 M	8.000 M	1 M	3.004026 G	-105.54	-34.78	-81.04	
8.000 M	12.750 M	1 M	3.012724 G	-77.89	-7.14	47.36 *	

In the example above ("PowerClass_39_43.xml" under

"C:\r_s\instr\sem_std\WCDMA\3GPP"), these attributes are defined as follows:

- ◆ Standard="W-CDMA 3GPP"
- ◆ LinkDirection="DL"
- ◆ PowerClass="(39,43)dBm"

The "PowerClass" element

It is embedded in the "BaseFormat" element and contains settings information about the power classes. Up to four different power classes can be defined. For details refer to the "[Sweep List](#)" softkey and the corresponding parameter description. The child nodes and attributes of this element are shown in "[Attributes and child nodes of the PowerClass element](#)".

The Range element

This element is embedded in the "PowerClass" element. It contains the settings information of the range. There have to be at least three defined ranges: one reference range and at least one range to either side of the reference range. The maximum number of ranges is 20. Note that the R&S FSV uses the same ranges in each power class. Therefore, the contents of the ranges of each defined power class have to be identical to the first power class. An exception are the Start and Stop values of the two Limit nodes that are used to determine the power class. Note also, that there are two Limit nodes to be defined: one that gives the limit in absolute values and one in relative values. Make sure units for the Start and Stop nodes are identical for each Limit node.

For details refer to the "[Sweep List](#)" softkey and the corresponding parameter description. The child nodes and attributes of this element are shown in "[Attributes and child nodes of the Range element \(normal ranges\)](#)".

The following tables show the child nodes and attributes of each element and show if a child node or attribute is mandatory for the R&S FSV to interpret the file or not. Since the hierarchy of the XML can not be seen in the tables, either view one of the default files already stored on the R&S FSV in the "C:\r_s\instr\sem_std" directory or check the structure as shown below.

Below, a basic example of the structure of the file is shown, containing all mandatory attributes and child nodes. Note that the "PowerClass" element and the range element are themselves elements of the "BaseFormat" element and are to be inserted where noted. The separation is done here simply for reasons of a better overview. Also, no example values are given here to allow a quick reference to the tables above. Italic font shows the placeholders for the values.

- ◆ The "BaseFormat" element is structured as follows:

```
<RS_SEM_ACP_FileFormat Version="1.0.0.0">
  <Name>Standard</Name>
  <Instrument>
    <Type>Instrument Type</Type>
    <Application>Application</Application>
  </Instrument>
  <LinkDirection Name="Name">
    <ReferencePower>
      <Method>Method</Method>
    </ReferencePower>
    <PowerClass Index="n">
      <!-- For contents of the PowerClass node see
      "Attributes and child nodes of the PowerClass element" -->
      <!-- Define up to four PowerClass nodes -->
    </PowerClass>
  </LinkDirection>
</RS_SEM_ACP_File>
```

- ◆ The PowerClass element is structured as follows:


```

<PowerClass Index="n">
  <StartPower Unit="dBm" InclusiveFlag="true" Value="StartPowerValue"/>
  <StopPower Unit="dBm" InclusiveFlag="false" Value="StopPowerValue"/>
  <DefaultLimitFailMode>Limit Fail Mode</DefaultLimitFailMode>
  <Range Index="n">
    <!-- For contents of the Range node see
    "Attributes and child nodes of the Range element \(normal ranges\)" -->
    <!-- Define up to twenty Range nodes -->
  </Range>
  ...
</PowerClass>

```
- ◆ The Range element is structured as follows:


```

<Range Index="n">
  <Name="Name">
    <ChannelType>Channel Type</Channel Type>
    <WeightingFilter>
      <Type>FilterType</Type>
      <RollOffFactor>Factor</RollOffFactor>
      <Bandwith>Bandwidth</Bandwidth>
    </WeightingFilter>
    <FrequencyRange>
      <Start>RangeStart</Start>
      <Stop>RangeStop</Stop>
    </FrequencyRange>
    <Limit>
      <Start Unit="Unit" Value="Value"/>
      <Stop Unit="Unit" Value="Value"/>
    </Limit>
    <Limit>
      <Start Unit="Unit" Value="Value"/>
      <Stop Unit="Unit" Value="Value"/>
    </Limit>
    <RBW Bandwidth="Bandwidth" Type="FilterType"/>
    <VBW Bandwidth="Bandwidth"/>
    <Detector>Detector</Detector>
    <Sweep Mode="SweepMode" Time="SweepTime"/>
    <Amplitude>
      <ReferenceLevel Unit="dBm" Value="Value"/>
      <RFAttenuation Mode="Auto" Unit="dB" Value="Value"/>
      <Preamplifier State="State"/>
    </Amplitude>
  </Range>

```

Table 7: Attributes and child nodes of the BaseFormat element

Child Node	Attribute	Value	Parameter Description	Mand.
	FileFormatVersion	1.0.0.0		Yes
	Date	YYYY-MM-DD HH:MM:SS	Date in ISO 8601 format	No
Name		<string>	Name of the standard	Yes
Instrument	Type	FSL	Name of the instrument	No
	Application	SA K72 K82	Name of the application	No
LinkDirection	Name	Downlink Uplink None		Yes
	ShortName	DL UL		No
ReferencePower				Yes
Method	TX Channel Power TX Channel Peak Power			Yes
ReferenceChannel	<string>			No

Table 8: Attributes and child nodes of the PowerClass element

Child Node	Attribute	Value	Parameter Description	Mand.
StartPower	Value	<power in dBm>	The start power must be equal to the stop power of the previous power class. The StartPower value of the first range is -200	Yes
	Unit	dBm		Yes
	InclusiveFlag	true		Yes
StopPower	Value	<power in dBm>	The stop power must be equal to the start power of the next power class. The StopPower value of the last range is 200	Yes
	Unit	dBm		
	InclusiveFlag	false		Yes
DefaultLimitFailMode		Absolute Relative Absolute and Relative Absolute or Relative		Yes

Table 9: Attributes and child nodes of the Range element (normal ranges)

Child Node	Attribute	Value	Parameter Description	Mand.
	Index	0..19	Indexes are continuous and have to start with 0	Yes
	Name	<string>	Name of the range	Only if ReferenceChannel contains a name and the range is the reference range
	ShortName	<string>	Short name of the range	No
ChannelType		TX Adjacent		Yes

Child Node	Attribute	Value	Parameter Description	Mand.
WeightingFilter				Only if ReferencePower method is TX Channel Power and the range is the reference range
Type		RRC CFilter	Type of the weighting filter	Yes
Roll Off Factor		0...1	Excess bandwidth of the filter	Only if the filter type is RRC
Bandwidth		<bandwidth in Hz>	Filter bandwidth	Only if the filter type is RRC
FrequencyRange				Yes
Start		<frequency in Hz>	Start value of the range	Yes
Stop		<frequency in Hz>	Stop value of the range	Yes
Limit		dBm/Hz dBm dBc dBr dB	A Range must contain exactly two limit nodes; one of the limit nodes has to have a relative unit (e.g. dBc), the other one must have an absolute unit (e.g. dBm)	Yes
Start	Value	<numeric_value>	Power limit at start frequency	Yes
	Unit	dBm/Hz dBm dBc dBr dB	Sets the unit of the start value	
Stop	Value	<numeric_value>	Power limit at stop frequency	
	Unit	dBm/Hz dBm dBc dBr dB	Sets the unit of the stop value	
LimitFailMode		Absolute Relative Absolute and Relative Absolute or Relative	If used, it has to be identical to DefaultLimitFailMode	No
RBW	Bandwidth	<bandwidth in Hz>	RBW	Yes
	Type	NORM PULS CFIL RRC		No
VBW	Bandwidth	<bandwidth in Hz>	VBW	Yes
Detector		NEG POS SAMP RMS AVER QUAS	Detector If used, it has to be identical in all ranges.	No
Sweep	Mode	Manual Auto	Sweep Time Mode	Yes
	Time	<time in sec>	Sweep Time	No
Amplitude				No
ReferenceLevel	Value	<power in dBm>	Ref. Level	Yes, if the ReferenceLevel child node is used
	Unit	dBm	Defines dBm as unit	Yes, if the ReferenceLevel node is used
RFAttenuation	Mode	Manual Auto	RF Attenuator	Yes, if the ReferenceLevel child node is used
Preamplifier		ON OFF	Preamp	Yes

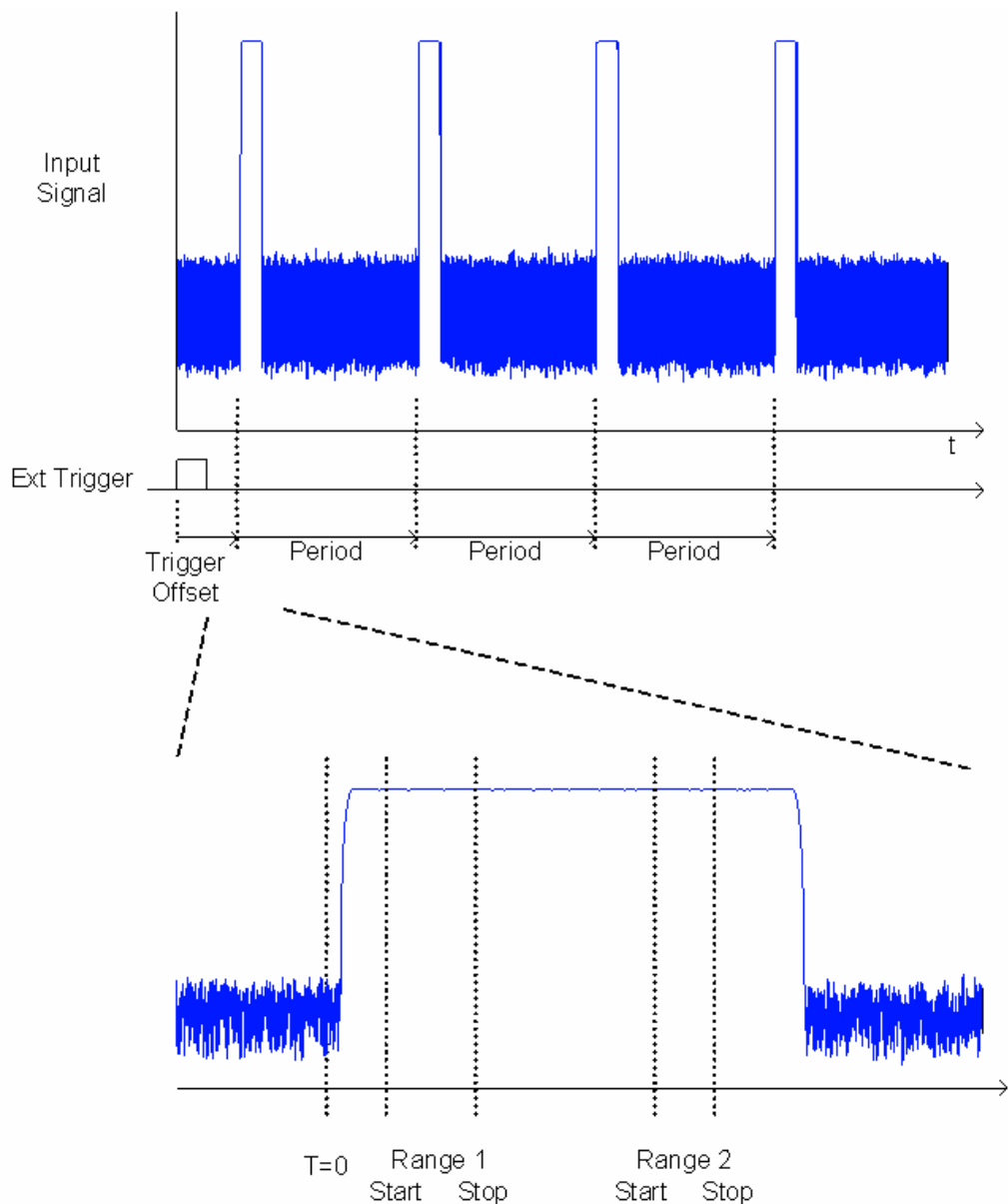
4.3.5.12 ASCII File Export Format (Spectrum Emission Mask)

The first part of the file lists information about the signal analyzer and the general setup. For a detailed description refer to "[ASCII File Export Format](#)" on page "137".

File contents	Description
RefType; CPOWER; TxBandwidth;9540000;Hz Filter State; ON; Alpha;0.22;	reference range setup, for details see " Edit Reference Range " softkey
PeaksPerRange;1; Values;4;	evaluation list information
0;-22500000;-9270000;1000000;2986455000;- 74.762840270996094; -10.576210021972656;-45.762840270996094;PASS; 1;-9270000;-4770000;100000;2991405000;- 100.17695617675781; -35.990325927734375;-1.490325927734375;PASS 3;4770000;9270000;100000;3005445000;- 100.17695617675781; -35.990325927734375;-1.490325927734375;PASS; 4;9270000;22500000;1000000;3018225000;- 74.762840270996094; -10.576210021972656;-45.762840270996094;PASS;	information about each peak: <range number>; <start frequency>; <stop frequency>; <resolution bandwidth of range>; <frequency of peak>; <absolute power in dBm of peak>; <relative power in dBc of peak (related to the channel power)>; <distance to the limit line in dB (positive value means above the limit)>; <limit fail (pass = 0, fail =1)>;

4.3.5.13 Defining Gated Triggering for APD and CCDF

Statistic measurements on pulsed signals can be performed using GATED TRIGGER. An external frame trigger is required as a time (frame) reference.



The gate ranges define the part of the I/Q capture data taken into account for the statistics calculation. These ranges are defined relative to a reference point $T=0$. The gate interval is repeated for each period until the end of the I/Q capture buffer. The reference point $T=0$ is defined by the external trigger event and the instrument's trigger offset.

For each trace you can define up to 3 separate ranges of a single period to be traced.

Defining gated triggering

1. Press the "[Gated Trigger \(On/Off\)](#)" softkey to activate gated triggering.
2. Press the "[Gate Ranges](#)" softkey to open the "Gate Ranges" dialog.
3. Define the length of the period to be analyzed in the "Period" field.

Note: The period is the same for all traces. If you change the period for one trace, it is automatically changed for all traces.

Make sure the defined period is not longer than the acquisition time of the current measurement. Keep in mind that the acquisition time depends on the bandwidth and the number of samples settings.

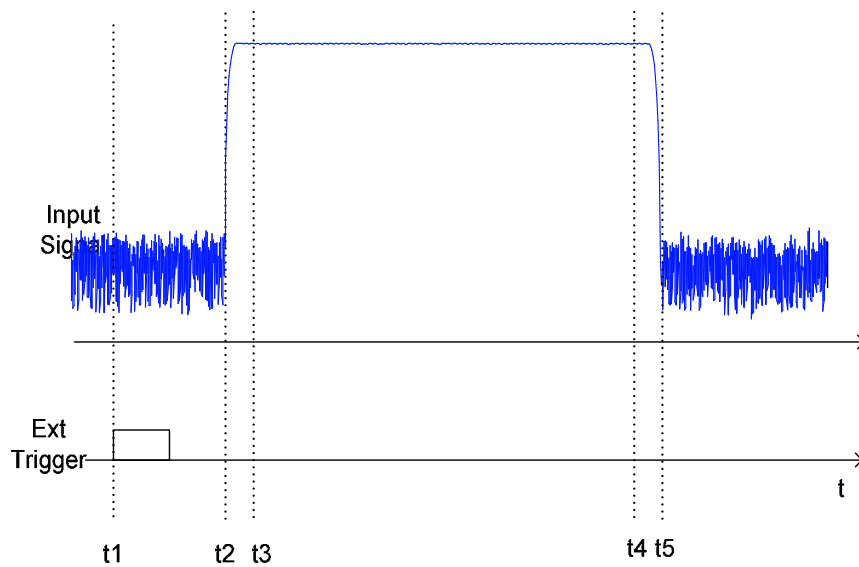
4. Optionally, define a description of the trace in the "Comment" field.
5. Activate tracing for the range by selecting "On" in the "Range <number> Use" field for the corresponding range and trace.
The start and stop time edit fields are ready for input.

Note: The time values have full numerical resolution and are only rounded for display.

6. Define the starting point of the range within the period.
7. Define the stopping point for the range within the period. Make sure the value for the stopping time is smaller than the length of the period.
8. To define further ranges for the same period in the same trace, repeat steps [5–7](#) for the same trace.
To define further ranges for the same period in a different trace, repeat steps [4–7](#) for a different trace.
9. If necessary, activate the configured traces in the "Trace" menu.

Gated statistics configuration example

A statistics evaluation has to be done over the useful part of the signal between t3 and t4. The period of the GSM signal is 4.61536 ms



- t1: External positive trigger slope
- t2: Begin of burst (after 25 μs)
- t3: Begin of useful part, to be used for statistics (after 40 μs)
- t4: End of useful part, to be used for statistics (after 578 μs)
- t5: End of burst (after 602 μs)

The instrument has to be configured as follows:

Trigger Offset	$t_2 - t_1 = 25 \mu\text{s}$	now the gate ranges are relative to t_2
Range1 Start	$t_3 - t_2 = 15 \mu\text{s}$	start of range 1 relative to t_2
Range1 End	$t_4 - t_2 = 553 \mu\text{s}$	end of range 1 relative to t_2

4.3.6 Measurement Configuration – MEAS CONFIG Key

The "MEAS CONFIG" key displays the submenu of the currently activated and running measurement function, e.g. the submenu of "TOI" or "Harmonic Distortion" (see "[Power Measurements - MEAS Key](#)" on page "171"), for quick access to the measurement configuration. If no measurement function is activated, this key has no effect.

4.3.7 Using Limit Lines and Display Lines - LINES Key

The "LINES" key is used to configure limit and display lines.

To open the lines menu

- ◆ Press the "LINES" key.

The lines menu and the "Select Limit Line" dialog box are displayed. For details on the "Select Limit Line" dialog box refer to "[Selecting a Limit Line](#)" on page "232".

Menu and softkey description

- ◆ "[Softkeys of the Lines Menu](#)" on page "225"

Further information

- ◆ "[Display Lines](#)" on page "230"
- ◆ "[Limit Lines](#)" on page "230"

Tasks

- ◆ "[Working with Lines](#)" on page "231"
- ◆ "[Selecting a Limit Line](#)" on page "232"
- ◆ "[Creating a New Limit Line](#)" on page "233"
- ◆ "[Editing an Existing Limit Line](#)" on page "235"
- ◆ "[Creating a New Limit Line Based upon an Existing Limit Line](#)" on page "235"
- ◆ "[Activating / Deactivating a Limit Line](#)" on page "235"

4.3.7.1 Softkeys of the Lines Menu

The following table shows all softkeys available in the lines menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Select Traces to check	
Deselect All	
New >	Edit Name
	Edit Comment
	Edit Margin
	Value
	Insert Value Above
	Delete Value
	Save Limit Line
Edit >	Same as New >
Copy to >	Same as New >
Delete	
X Offset	
Y Offset	
Display Lines >	Display Line 1
	Display Line 2
	Frequency Line 1

	Frequency Line 2
	Time Line 1
	Time Line 2

Select Traces to check

Opens the "Select Traces to Check" dialog box to activate the selected limit line for a trace. One limit line can be activated for several traces simultaneously. For details see also "[Activating / Deactivating a Limit Line](#)" on page "235" .

- Remote: [CALC:LIM2:TRAC 3](#)
- Remote: [CALC:LIM:STAT ON](#)

Deselect All

Deactivates the selected limit line for all assigned traces. For details see also "[Activating / Deactivating a Limit Line](#)" on page "235" .

- Remote: [CALC:LIM:STAT OFF](#)

New

Opens the "Edit Limit Line" dialog box and a submenu to define a new limit line. For details see also "[Limit Lines](#)" on page "230" and "[Selecting a Limit Line](#)" on page "232".

The submenu contains the following commands:

Edit Name
Edit Comment
Edit Margin
Value
Insert Value Above
Delete Value
Save Limit Line

Edit Name

Sets the focus on the "Name" field to enter or change the limit line name. A maximum of 8 characters is permitted for each name. All names must be compatible with the Windows XP conventions for file names. The limit line data are stored under this name. The instrument stores all limit lines with LIM as extension.

- Remote: [CALC:LIM3:NAME "GSM1"](#)

Edit Comment

Sets the focus on the "Comment" field to enter or change a comment for the limit line. The text must not exceed 40 characters.

- Remote: [CALC:LIM5:COMM 'Upper limit for spectrum'](#)

Edit Margin

Sets the focus on the "Margin" field to enter or change a margin for the limit line. The default setting is 0 dB (i.e. no margin).

Value

Opens an edit dialog box to change an existing x or y value, depending on the selected column. The softkey is only available if an existing value is selected.

The desired data points are entered in ascending order (two repeated frequencies/time values are permitted).

- Remote: [CALC:LIM3:CONT:DATA 1MHz, 3MHz, 30MHz](#)
- Remote: [CALC:LIM3:UPP:DATA -10, 0, 0](#)
- Remote: [CALC:LIM3:LOW:DATA -30, -40, -40](#)

Insert Value Above

Creates an empty line above the selected data point to enter a new data point. This softkey corresponds to the "Insert" button in the dialog box.

It is also possible to add a data point at the end of the list, if the focus is set below the last entry line of the list.

The data points are entered in ascending order (two repeated frequencies/time values are permitted). If the entered values are not in accordance with the ascending order rule, an error message is displayed and the values are discarded.

Delete Value

Deletes the selected data point (x and y value). All succeeding data points are shifted up accordingly. This softkey corresponds to the "Delete" button in the dialog box.

The softkey is only available if an existing value is selected.

Save Limit Line

Saves the currently edited limit line under the name defined in the "Name" field.

Edit

Opens a submenu to edit limit lines. For details see also "[Limit Lines](#)" on page "230" and "[Editing an Existing Limit Line](#)" on page "235".

The submenu contains the following commands:

Edit Name
Edit Comment
Edit Margin
Value
Insert Value Above
Delete Value
Save Limit Line

- Remote: For details refer to chapter "Remote Control - Commands", section "[Definition of the limit line](#)".

Copy to

Copies the data of the selected limit line and displays it in the "Edit Limit Line" dialog box. If the limit line is edited and saved under a new name, a new limit line can be easily generated by parallel translation or editing of an existing limit line.

For details see also "[Limit Lines](#)" on page "230" and "[Creating a New Limit Line Based upon an Existing Limit Line](#)" on page "235".

The submenu contains the following commands:

Edit Name
Edit Comment
Edit Margin
Value
Insert Value Above
Delete Value
Save Limit Line

→ Remote: [CALC:LIM3:COPY 2](#)

Delete

Deletes the selected limit line.

→ Remote: [CALC:LIM3:DEL](#)

X Offset

Horizontally shifts a limit line that has been specified for relative frequencies or times (x-axis). The softkey opens an edit dialog box in which the value for shifting can be entered numerically or via the rotary knob.

Note: This softkey does not have any effect on limit lines that represent absolute values for the x-axis.

→ Remote: [CALC:LIM3:CONT:OFFS 10kHz](#)

Y Offset

Vertically shifts a limit line that has relative values for the y-axis (levels or linear units such as volt). The softkey opens an edit dialog box in which the value for shifting can be entered numerically or via the rotary knob.

Note: This softkey does not have any effect on limit lines that represent absolute values for the y-axis.

→ Remote: [CALC:LIM3:LOW:OFFS 3dB](#)

→ Remote: [CALC:LIM3:UPP:OFFS 3dB](#)

Display Lines

Opens a submenu to enable, disable and set display lines. Which softkeys are available depends on the display mode (frequency or time range). For details see also "[Display Lines](#)" on page "230" and "[Working with Lines](#)" on page "231".

Display Line 1 and Display Line 2

Enable or disable the level lines 1/2 and open an edit dialog box to enter the position of the lines. For details see also "[Display Lines](#)" on page "230" and "[Working with Lines](#)" on page "231".

→ Remote: [CALC:DLIN:STAT ON](#)

→ Remote: [CALC:DLIN -20dBm](#)

Frequency Line 1 and Frequency Line 2 (span > 0)

Enable or disable the frequency lines 1/2 and open an edit dialog box to enter the position of the lines. For details see also "[Display Lines](#)" on page "230" and "[Working with Lines](#)" on page "231".

→ Remote: [CALC:FLIN:STAT ON](#)

→ Remote: [CALC:FLIN 120MHz](#)

Time Line 1 and Time Line 2 (zero span)

Enable or disable the time lines 1/2 and open an edit dialog box to enter the position of the lines. For details see also "[Display Lines](#)" on page "230" and "[Working with Lines](#)" on page "231".

→ Remote: [CALC:TLIN:STAT ON](#)

→ Remote: [CALC:TLIN 10ms](#)

4.3.7.2 Display Lines

Display lines help to evaluate a trace - as do markers. The function of a display line is comparable to that of a ruler that can be shifted on the trace in order to mark absolute values. They are exclusively used to optically mark relevant frequencies or points in time (span = 0) as well as constant level values. It is not possible to check automatically whether the points are below or above the marked level values.

For details on setting and switching the display lines on/off see "[Working with Lines](#)" on page "231".

Two different types of display lines are provided:

- ◆ Two horizontal level lines for marking levels - Display Line 1 and 2
The level lines are continuous horizontal lines across the entire width of a diagram and can be shifted in y direction.
- ◆ Two vertical frequency or time lines for marking frequencies or points in time - Frequency/Time Line 1 and 2
The frequency or time lines are continuous vertical lines across the entire height of the diagram and can be shifted in x direction.

Each line is identified by one of the following abbreviations:

- D1: Display Line 1
- D2: Display Line 2
- F1: Frequency Line 1
- F2: Frequency Line 2
- T1: Time Line 1
- T2: Time Line 2

4.3.7.3 Limit Lines (Frequency / Time Lines)

Limit lines are used to define amplitude curves or spectral distribution boundaries on the display screen which are not to be exceeded. They indicate, for example, the upper limits for interference radiation or spurious waves which are allowed from a device under test (DUT). For transmission of information in TDMA systems (e.g. GSM), the amplitude of the bursts in a timeslot must adhere to a curve that falls within a specified tolerance band. The lower and upper limits may each be specified by a limit line. Then, the amplitude curve can be controlled either visually or automatically for any violations of the upper or lower limits (GO/NOGO test).

The instrument supports limit lines with a maximum of 50 data points. 8 of the limit lines stored in the instrument can be activated simultaneously. The number of limit lines stored in the instrument is only limited by the capacity of the flash disk used. Which softkeys are available depends on the display mode (frequency or time range). For details see also "[Selecting a Limit Line](#)" on page "232".

Limit lines are compatible with the current measurement settings, if the following applies:

- ◆ The x unit of the limit line has to be identical to the current setting.
- ◆ The y unit of the limit line has to be identical to the current setting with the exception of dB based units; all dB based units are compatible with each other.

At the time of entry, the R&S FSV immediately checks that all limit lines are in accordance with the following guidelines:

- ◆ The frequencies/times for each data point must be entered in ascending order, however, for any single frequency/time, two data points may be entered (vertical segment of a limit line).
- ◆ The data points are allocated in order of ascending frequency/time. Gaps are not allowed. If gaps are desired, two separate limit lines must be defined and then both enabled.
- ◆ The entered frequencies/times need not necessarily be selectable in R&S FSV. A limit line may also exceed the specified frequency or time range. The minimum frequency for a data point is -200 GHz, the maximum frequency is 200 GHz. For the time range representation, negative times may also be entered. The allowed range is -1000 s to +1000 s.

4.3.7.4 Working with Lines

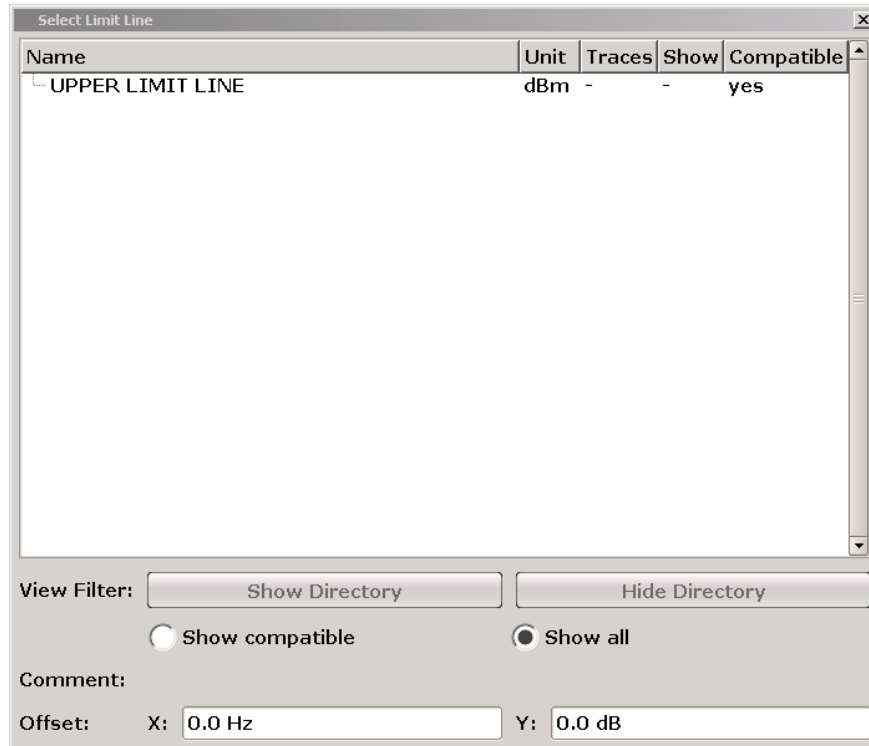
If a line is switched on, the softkey is highlighted.

Switching a line on or off:

1. Press the "[Display Lines](#)" softkey.
2. Press the softkey for the required line, e.g. "[Display Line 1](#)".
An edit dialog box is opened to enter the position of the line (by rotary knob, step keys or numerical entry). If the line was switched off, it is switched on. If it was switched on, it remains switched on.
3. If another softkey is pressed, the edit dialog box for the line is closed, but the line remains switched on (softkey with highlighted background).
4. When you press the "[Display Line 1](#)" softkey for the second time, the edit dialog box for the line is opened again.
5. When you press the "[Display Line 1](#)" softkey the third time, the line is switched off (softkey without highlighted background).

4.3.7.5 Selecting a Limit Line

1. To display the "Select Limit Line" dialog box, press the "LINES" key.



All limit lines saved in the default directory and all subdirectories are displayed. For each limit line, the following information is given:

"Unit"	unit of the y-axis
"Traces"	selected traces to check
"Show"	limit line displayed in the measurement diagram or hidden
"Compatible"	compatibility of the limit line to the current measurement settings

To display only the limit lines that are compatible, activate the "Show compatible" option. For details on compatibility refer to "[Limit Lines](#)" on page "230".

2. To navigate into a subdirectory, use the "Show Directory" and "Hide Directory" buttons.

4.3.7.6 Creating a New Limit Line

Press the "[New](#)" softkey to define a new limit line.

The "Edit Limit Line" dialog box is displayed. For more details on limit lines refer also to "[Limit Lines](#)" on page "230". The following settings can be defined:

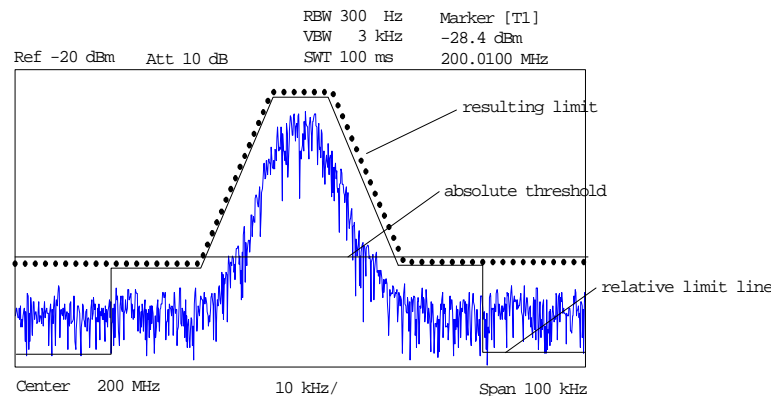
Name	The name under which the limit line is to be stored in the main directory. To save the limit line in an existing subdirectory, enter the relative path. A new subdirectory can only be created using the "FILE" key (for details refer to section "Instrument Functions - Basic Settings", " Saving and Recalling Settings Files – SAVE / RCL Key ").
Comment	Optional description
Threshold	Absolute threshold value that works as a lower limit for the relative limit values (only for relative scaling of the y-axis).
Margin	A signal-level distance to the limit line.
Position	Position of data point
Value	Value of data point
X-Axis:	
Span setting	<ul style="list-style-type: none"> ◆ "Hz" for span > 0 Hz ◆ "s" for zero span
Scale mode	<ul style="list-style-type: none"> ◆ Absolute: The frequencies or times are interpreted as absolute physical units. ◆ Relative: In the data point table, the frequencies are referred to the currently set center frequency. In the zero span mode, the left boundary of the diagram constitutes the reference. Relative scaling is always suitable if masks for bursts are to be defined in zero span or if masks for modulated signals are required for span > 0 Hz.
Scale	<ul style="list-style-type: none"> ◆ Linear ◆ Logarithmic
Y-Axis:	
Scale unit	Unit of the y-axis
Scale mode	<ul style="list-style-type: none"> ◆ Absolute: The limit values refer to absolute levels or voltages. ◆ Relative: The limit values refer to the reference level (Ref Level). Limit values with the unit dB are always relative values.
Limit type	<ul style="list-style-type: none"> ◆ Upper limit ◆ Lower limit

In addition, the following functions are available for the limit line:

Defining a threshold

If the scaling of the y-axis is relative, you can define an absolute threshold value that works as a lower limit for the relative limit values (see figure below). Enter a value in the "Threshold" field of the "Edit Limit Line" dialog box.

The function is especially useful for mobile radio applications provided the limit values are defined in relation to the carrier power as long as they are above an absolute limit value.



Defining a margin

To define a signal-level distance to the limit line, enter a value in the "Margin" field of the "Edit limit Line" dialog box.

If the limit line is defined as an upper limit, the margin means that the level is below the limit line. If the limit line is defined as a lower limit, the margin means that the level is above the limit line.

Entering a new data point

1. Press the "Insert" button in the dialog, or select an existing data point in the table and press the ["Insert Value Above"](#) softkey.
2. Enter the new position (x) and value (y) in the edit dialog boxes.

Changing a data point

1. Press on the data point to be changed in the table.
2. Enter the new position (x) and value (y) in the edit dialog boxes.

Deleting a data point

1. Press on the data point to be deleted in the table.
2. Press the "Delete" button in the dialog.

Shifting a limit line horizontally

- ◆ Select the "Shift x" button and enter a shift width for the x value in the edit dialog box.

Shifting a limit line vertically

- ◆ Select the "Shift y" button and enter a shift width for the y value in the edit dialog box.

Saving the limit line settings

- ◆ Press the "Save" button in the dialog.
If an existing name is used, a message box is displayed. You have to confirm before the limit line is overwritten.

4.3.7.7 Editing an Existing Limit Line

In the "Select Limit Line" dialog box, select the limit line you want to change. For details see also ["Selecting a Limit Line"](#) on page "232".

1. Press the ["Edit"](#) softkey.
2. Edit the data as described in ["Creating a New Limit Line"](#) on page "233".
3. Save the limit line (["Save Limit Line"](#) softkey).

4.3.7.8 Creating a New Limit Line Based upon an Existing Limit Line

1. In the "Select Limit Line" dialog box, select the limit line you want to use as a basis for a new limit line. For details see also ["Selecting a Limit Line"](#) on page "232".
2. Press the ["Copy to"](#) softkey to transfer the data of the limit line into the "Edit Limit Line" dialog box.
3. Press the ["Edit Name"](#) softkey and enter a new name.
4. To shift the complete limit line parallel in the horizontal direction, select the "Shift x" button and enter an x shift value. In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally.
5. To shift the complete limit line parallel in the vertical direction, select the "Shift y" button and enter a y shift value. In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted in Y direction
6. If required, edit the data as described in ["Selecting a Limit Line"](#) on page "232".
7. Save the limit line (["Save Limit Line"](#) softkey).

4.3.7.9 Activating / Deactivating a Limit Line

Prerequisites:

The x- and y-units of limit line and current measurement setting have to be compatible. For details refer to ["Limit Lines"](#) on page "230".

The limit line has to consist of 2 or more data points.

1. In the "Select Limit Line" dialog box, select the limit line you want to activate/deactivate. For details see also ["Selecting a Limit Line"](#) on page "232".
2. To activate or deactivate a limit line for a trace, press the ["Select Traces to check"](#) softkey and select or deselect the trace(s) to which this limit line applies.
3. To deactivate the limit line for all traces, press the ["Deselect All"](#) softkey.

4.3.8 Input/ Output Configuration – INPUT/OUTPUT Key

The "INPUT/OUTPUT" key is used to configure input and output sources for measurement functions.

Menu and softkey description

- ◆ "[Softkeys of the Input/ Output Menu](#)" on page "236"

4.3.8.1 Softkeys of the Input/ Output Menu

The following table shows all softkeys available in the Input/ Output menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is provided in the corresponding softkey description.

Menu / Command	Command
Input (AC/DC)	
Noise Source	
Video Output	
Power Sensor (K9) >	

Input (AC/DC)

Toggles the RF input of the R&S FSV between AC and DC coupling.

- Remote: [INP:COUP AC](#)

Noise Source

Switches the supply voltage for an external noise source on or off. For details on connectors refer to the Quick Start Guide, chapter 1 "Front and Rear Panel" .

- Remote: [DIAG:SERV:NSO ON](#)

Video Output

Sends a video output signal according to the measured level to the connector on the rear panel of the R&S FSV.

- Remote: [OUTP IF VID](#)

Note: Video output does not return valid values in IQ or FFT mode..

4.3.9 Performing Measurements – RUN/RUN CONT Keys

The "RUN" and "RUN CONT" keys are used to start measurement tasks.

- ◆ "RUN" switches to single sweep mode and performs a single sweep, just as the ["Single Sweep"](#) softkey in the "SWEEP" menu does.
- ◆ "RUN CONT" switches to continuous sweep mode and starts sweeping, just as the ["Continuous Sweep"](#) softkey in the "SWEEP" menu does.

4.4 Measurement Modes

This section describes the provided measurement modes, the change of measurement modes and the access to the menus of all active measurement modes. For details refer to the following sections:

- ◆ ["Measurement Mode Selection - MODE Key" on page "237"](#)
- ◆ ["Measurement Mode Menus - HOME Key" on page "239"](#)

4.4.1 Measurement Mode Selection - MODE Key

The "MODE" key provides a quick access to the menu of the current measurement mode and a fast change of the measurement mode. You can choose from the following measurement modes:

- ◆ ["Spectrum Analyzer Mode"](#)
- ◆ ["Analog Demodulation Mode \(Analog Demodulation Option, R&S FSV-K7\)"](#)
- ◆ ["3G FDD BTS Mode \(3GPP Base Station Measurements Option, R&S FSV-K72\)"](#)
- ◆ ["WiMAX Mode \(WiMAX IEEE 802.16 OFDM, OFDMA Measurements Option, R&S FSV-K93\)"](#)

Note: The "Power Sensor Mode" can be accessed via the "Input/Output" key.

The Power Sensor mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for Power Sensors. For details refer to ["Firmware Option Power Sensor Support R&S FSV-K9"](#) at the end of this document.

(Currently not available.)

To change the measurement mode

1. Press the "MODE" key.
A menu with the currently available measurement modes is displayed.
2. To activate a different mode, press the corresponding softkey.

4.4.1.1 Spectrum Analyzer Mode

In the "Spectrum Analyzer" mode the functions provided correspond to those of a conventional spectrum analyzer. The analyzer measures the frequency spectrum of the test signal over the selected frequency range with the selected resolution and sweep time, or, for a fixed frequency, displays the waveform of the video signal. This mode is set in the initial configuration.

4.4.1.2 Analog Demodulation Mode (Analog Demodulation Option, R&S FSV-K7)

The "Analog Demodulation" mode requires an instrument equipped with the corresponding optional software. This mode provides measurement functions for demodulating AM, FM, or PM signals. For details refer to "[Firmware Option Analog Demodulation R&S FSV-K7](#)".

4.4.1.3 3G FDD BTS Mode (3GPP Base Station Measurements Option, R&S FSV-K72)

The "3G FDD BTS" mode requires an instrument equipped with the corresponding optional software. This mode provides test measurements for WCDMA downlink signals (base station signals) according to the test specification. For details refer to "Firmware Option 3GPP Base Station Measurements R&S FSV-K72" at the end of this document.

4.4.1.4 WLAN MWiMAX Mode (WiMAX IEEE 802.16 OFDM, OFDMA Measurements Option, R&S FSV-K93)

The "WiMAX" mode requires an instrument equipped with the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSPB-K93). This mode provides WiMAX and WiBro measurement functions according to IEEE standards 802.16-2004 OFDM and 802.16e-2005 OFDMA/WiBro. It includes the WiMAX 802.16 OFDM Measurements option (R&S FSPB-K92). For details refer to "[Firmware Option WiMAX, WiBro Measurements R&S FSV-K93](#)" at the end of this document.

4.4.2 Measurement Mode Menus - HOME Key

The "HOME" key provides a quick access to the menu of the current measurement mode. For the basic "Spectrum Analyzer" mode, the softkeys of this menu are identical to the "[Softkeys of the Frequency Menu](#)" described on page "97". For details on changing the mode refer to "[Measurement Mode Selection - MODE Key](#)" on page "237".

4.5 Instrument Functions - Basic Settings

In this section, all basic settings functions of the R&S FSV and their application are explained in detail. The analyzer functions are described in section "[Instrument Functions - Analyzer](#)".

For every key a table is provided in which all submenus and corresponding commands are listed. The description of the submenus and commands follows the order of the table. The commands for the optional remote control (if any) are indicated for each softkey. The description includes the following:

"[General Settings, Printout and Instrument Settings](#)" on page "241"

This section provides information on how to prepare measurements and process their results: setting the instrument, managing and retrieving data, returning to manual operation, and printout.

More basic information on operation is given in the Quick Start Guide. The front and the rear view of the instrument together with a table of all available keys and a short description are provided in chapter "Front and Rear Panel". Chapter "Preparing for Use" informs how to start working with the instrument for the first time. A brief introduction on handling the instrument is given in chapter "Basic Operations". This includes also the description of the keys for basic operations like switching the instrument on and off or starting a measurement.

4.6 General Settings, Printout and Instrument Settings

After putting the instrument into operation and becoming familiar with the handling of the instrument (for details see Quick Start Guide) the preparations for measurements can start. In this section the general settings of the instrument, the data management and the processing of measurement results are described. This includes the following topics and keys:

- ◆ "[Instrument Setup and Interface Configuration - SETUP Key](#)" on page "242"
- ◆ "[Saving and Recalling Settings Files - SAVE/RCL Key](#)" on page "260"
- ◆ "[Manual Operation - Local Menu](#)" on page "268"
- ◆ "[Measurement Documentation - PRINT Key](#)" on page "269"

4.6.1 Instrument Setup and Interface Configuration - SETUP Key

The "SETUP" key is used to set or display the default settings of the instrument: reference frequency, noise source, level correction values, date, time, LAN interface, firmware update and enabling of options, information about instrument configuration and service support functions. For further details refer also to the Quick Start Guide, chapter 2 "Preparing for Use".

To open the setup menu

- ◆ Press the "SETUP" key.
The setup menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the Setup Menu"](#) on page "242"

4.6.1.1 Softkeys of the Setup Menu

The following table shows all softkeys available in the setup menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Submenu / Command	Submenu / Command	Command
Reference Int/Ext			
Transducer >	Active (On/Off)		
	Edit >	Insert Line	
		Delete Line	
		Edit Name	
		Edit Unit	
		Edit Value	
		Interpolation Lin/Log	
		Save Factor	
	New	same contents as Edit menu	
	Copy to	same contents as Edit menu	
	Delete		
	Ref Level Adjust (Man/Auto)		
	Show Directory		
Alignment >	Self Alignment		
	Show Align Results		
	Touch Screen Alignment		
	Corr Data (On/Off)		
General Setup >	Configure Network		
	Network Address >	Computer Name	
		IP Address	
		Subnet Mask	
		DHCP (On/Off)	
	GPIB >	GPIB Address	
		ID String Factory	
		ID String User	

General Settings, Printout and Instrument Settings

Menu / Command	Submenu / Command	Submenu / Command	Command
		Compatibility Mode >	
			Mode Default
			Mode R&S FSP
			Mode R&S FSU
		Display Update (On/Off)	
		GPIO Terminator LFEOL/EOI	
		*IDN Format Leg./New	
		I/O Logging (On/Off)	
	Time+Date		
	More >		
	Monitor Int/Ext		
	Soft Frontpanel		
Display Setup >	Tool Bar State (On/Off)		
	Screen Title		
	Time+Date (On/Off)		
	Time+Date Format		
	Print Logo (On/Off)		
	Annotation (On/Off)		
	More >		
	Theme Selection		
	Screen Colors>	Select Screen Color Set	
		Color (On/Off)	
		Select Object	
		Predefined Colors	
		User Defined Colors	
		Set to Default	
	Print Colors >	Select Print Color Set	
		Color (On/Off)	
		Select Object	
		Predefined Colors	
		User Defined Colors	
		Set to Default	
	Display Pwr Save (On/Off)		
System Info >	Hardware Info		
	Versions+Options		
	System Messages		
	Clear All Messages		
More >			
	Firmware Update		
Option Licenses >	Install Option		
Service >	Input (RF/Cal)		
	Cal Frequency		
	Reset Password		
	Selftest		
	Selftest Results		
	Password		
	Service Function		

Reference Int/Ext

Switches between the internal and external reference signal source. The default setting is internal reference. It is important that the external reference signal is deactivated when switching from external to internal reference to avoid interactions. If the reference signal is missing when switching to external reference, the message "EXREF" is displayed to indicate that no synchronization is performed. The R&S FSV can use the internal reference source or an external reference source as frequency standard from which all internal oscillators are derived. A 10 MHz crystal oscillator is used as internal reference source. In the external reference setting, all internal oscillators of the R&S FSV are synchronized to the external reference frequency, which can be set from 1-20 MHz in 1 MHz steps. For details on connectors refer to the Quick Start Guide, chapter 1 "Front and Rear Panel".

- Remote: [ROSC:SOUR INT](#)
- Remote: [ROSC:SOUR:EXT:10](#)

Transducer

Opens the "Select Transducer" dialog box and a submenu to activate or deactivate defined transducer factors, to generate new transducer factors or to edit existing ones. In the "Select Transducer" dialog box, a transducer factor can be edited, deleted or copied, if selected, using the corresponding softkeys. The default directory, in which the transducer factors are saved, is displayed (C:\R_S\INSTR\TRD; the extension of transducer factor files is *.TDF). Subdirectories can be added or deleted via the file manager. They are displayed or hidden using the arrow keys or the "[Show Directory](#)" softkey / "Hide Directory" button.

Two different directory views are possible: If the "Show all" option is activated, all transducer factors in the directory are displayed. If the "Show compatible" option is activated, only the compatible transducer factors in the directory are displayed. For details on transducer factors refer to chapter "Advanced Measurement Examples".

The submenu contains the following commands:

Active
Edit >
New
Copy to
Delete
Ref Level Adjust (Man/Auto)
Show Directory

- Remote: [CORR:TRAN:SEL FACTOR1](#)

Active (On/Off)

Activates or deactivates the selected transducer factor. A maximum of 10 transducer factors can be activated at the same time. If an additional transducer factor is activated, its unit compatibility is checked. If one factor has a different unit than dB, all the other activated factors must have the unit dB.

- Remote: [CORR:TRAN:SEL <name>](#)
- Remote: [CORR:TRAN ON](#)

Edit

Opens the "Edit Transducer" dialog box with the data of the selected factor, as well as a submenu. During editing, a transducer factor remains stored in the background until the factor is saved using the "[Save Factor](#)" softkey.

The submenu contains the following commands:

Insert Line
Delete Line
Edit Name
Edit Unit
Edit Value
Interpolation Lin/Log
Save Factor

- Remote: Comment: [CORR:TRAN:COMM <string>](#)

Insert Line

Inserts an empty line above the selected reference value to enter a new reference value. When entering a new reference value in the line, the ascending order of frequencies must be taken into consideration, however.

Delete Line

Deletes the selected reference value (complete line). The reference values that follow move one line up.

Edit Name

Sets the focus on the "Name" field to enter a file name. The extension is added automatically.

- Remote: [CORR:TRAN:SEL <name>](#)

Edit Unit

Sets the focus on the "Unit" field to select the unit.

- Remote: [CORR:TRAN:UNIT <string>](#)

Edit Value

Sets the focus to enter positions and values as frequency/level pairs. The entered data are also displayed graphically. Using the "Shift x" or "Shift y" button, all entered values can be shifted in x or y direction.

→ Remote: [CORR:TRAN:DATA <freq>,<level>](#)

Interpolation Lin/Log

Sets the scaling of the x-axis to linear or logarithmic.

→ Remote: [CORR:TRAN:SCAL LIN|LOG](#)

Save Factor

Saves the changed factor to a file on the internal flash disk. If a transducer factor with the same name already exists, a confirmation query is displayed. If the new factor is active, the new values are immediately applied.

→ Remote: In remote control, the save operation is performed automatically after the definition of the reference values.

New

Opens the "Edit Transducer" dialog box to enter data for a new factor.

This dialog box contains the same contents as the "[Edit](#)" softkey.

The submenu contains the following commands:

Insert Line
Delete Line
Edit Name
Edit Unit
Edit Value
Interpolation Lin/Log
Save Factor

Copy to

Opens the "Edit Transducer" dialog box to copy the selected factor.

This dialog box contains the same contents as the "[Edit](#)" softkey.

The submenu contains the following commands:

Insert Line
Delete Line
Edit Name
Edit Unit
Edit Value
Interpolation Lin/Log
Save Factor

Delete

Deletes the selected factor after confirmation.

→ Remote: [CORR:TRAN DEL](#)

Ref Level Adjust (Man/Auto)

Activates or deactivates the automatic adjustment of the reference level to the selected transducer factor.

"Auto" Activates the automatic adjustment.

"Man" Deactivates the automatic adjustment. Adjust the reference level via the amplitude menu.

If a transducer factor is used (active), the trace is moved by a calculated shift. However, an upward shift reduces the dynamic range for the displayed values. With this softkey set to "Auto", the original dynamic range is restored by also shifting the reference level by the maximum value of the transducer factor.

→ Remote: [CORR:TRAN:ADJ:RLEV ON](#)

Show Directory

Displays the subdirectory of the selected directory.

Alignment

Opens a submenu with the available functions for recording, displaying and activating the data for self alignment.

The correction data and characteristics required for the alignment are determined by comparison of the results at different settings with the known characteristics of the high-precision calibration signal source at 65.83 MHz. The correction data are stored as a file on flash disk and can be displayed using the "[Show Align Results](#)" softkey.

The submenu contains the following commands:

Self Alignment
Show Align Results
Touch Screen Alignment
Corr Data (On/Off)

Self Alignment

Starts the recording of correction data of the instrument. If the correction data acquisition has failed or if the correction values are deactivated, a corresponding message is displayed in the status field.

As long as the self alignment data is collected the procedure can be cancelled using the "Abort" button.

→ Remote: [*CAL?](#)

Show Align Results

Opens a dialog box that displays the correction data of the alignment:

- ◆ date and time of last correction data record
- ◆ overall results of correction data record
- ◆ list of found correction values according to function/module

The results are classified as follows:

"PASSED"	calibration successful without any restrictions
"CHECK"	deviation of correction value larger than expected, correction could however be performed
"FAILED"	deviations of correction value too large, no correction was possible. The found correction data are not applicable.

→ Remote: [CAL:RES?](#)

Touch Screen Alignment

Displays a touch screen alignment dialog. For details, see section "2.3 R&S FSV Setup" in the Quick Start Guide.

Corr Data (On/Off)

Activates and deactivates the alignment data, e.g. for service purposes the correction data can be deactivated.

→ Remote: [CAL:STAT ON](#)

General Setup

Opens a submenu for all general settings such as IP address and LAN settings, date and time, remote control (optional) and measurement display.

The submenu contains the following commands:

Configure Network
Network Address >
GPIB >
Time+Date
Monitor Int/Ext
Soft Frontpanel

Configure Network

Opens the "Network Connections" dialog box to change the LAN settings. For details refer to the Quick Start Guide, chapter 2 "Preparing for Use" and appendix B "LAN Interface".

Network Address

Opens a submenu to configure the internet protocol properties and the computer name.

The submenu contains the following commands:

Computer Name
IP Address
Subnet Mask
DHCP (On/Off)

Computer Name

Opens an edit dialog box to enter the computer name via the keypad. The naming conventions of Windows apply. If too many characters and/or numbers are entered, in the status line, an according message is displayed. For step-by-step instructions refer to the Quick Start Guide, appendix B "LAN Interface".

IP Address

Opens an edit dialog box to enter the IP address via the keypad. The TCP/IP protocol is preinstalled with the IP address 10.0.0.10. If the DHCP server is available ("DHCP On"), the dialog box entry is read-only.

The IP address consists of four number blocks separated by dots. Each block contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a block (as an example see the preinstalled address). For step-by-step instructions refer to the Quick Start Guide, chapter 2 "Preparing for Use".

Subnet Mask

Opens an edit dialog box to enter the subnet mask via the keypad. The TCP/IP protocol is preinstalled with the subnet mask 255.255.255.0. If the DHCP server is available ("DHCP On"), the dialog box entry is read-only.

The subnet mask consists of four number blocks separated by dots. Each block contains 3 numbers in maximum (e.g. 100.100.100.100), but also one or two numbers are allowed in a block (as an example see the preinstalled address). For step-by-step instructions refer to the Quick Start Guide, chapter 2 "Preparing for Use".

DHCP (On/Off)

Switches between DHCP server available (On) or not available (Off). If a DHCP server is available in the network, the IP address and subnet mask of the instrument are obtained automatically from the DHCP server. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

GPIB

Opens a submenu to set the parameters of the remote control interface.

The submenu contains the following commands:

GPIB Address
ID String Factory
ID String User
Compatibility Mode >
Display Update (On/Off)
GPIB Terminator LFEOI/EOI
*IDN Format Leg./New
I/O Logging (On/Off)

GPIB Address

Opens an edit dialog box to enter the GPIB address. Values from 0 to 30 are allowed. The default address is 20.

If, e.g. after a firmware update, the R&S FSV does not maintain the GPIB address after reboot, the shutdown file needs to be recreated. Perform the following steps:

1. Set the GPIB address.
2. Create a shutdown file by switching the R&S FSV in the standby mode:
3. Press the ON/STANDBY key on the front panel and wait until the yellow LED is on. With the battery pack option, use a USB keyboard and terminate the R&S FSV firmware with ALT+F4 to create the shutdown file.

If the shutdown file was created once, the R&S FSV boots with exactly those settings after a reboot with the main switch on the rear panel. During a firmware update or cold boot for service reasons the shutdown file is deleted, and the setup is necessary once again.

→ Remote: [SYST:COMM:GPIB:ADDR 20](#)

ID String Factory

Selects the default response to the *IDN? query.

ID String User

Opens an edit dialog box to enter a user-defined response to the *IDN? query. Max. 36 characters are allowed.

Compatibility Mode

Sets the R&S FSV in a state compatible to previous R&S devices, enabling the usage of existing external control applications. In particular, the number of measurement points and available bandwidths are adjusted to those of other devices.

The following modes are available:

Mode Default	Standard R&S FSV operation
Mode R&S FSP	Compatible to R&S FSP
Mode R&S FSU	Compatible to R&S FSU

→ Remote: [SYS:COMP FSP](#)

Mode Default

Resets the number of measurement points and available bandwidths to default R&S FSV values.

→ Remote: [SYST:COMP:DEF](#)

Mode R&S FSP

Sets the number of measurement points and available bandwidths as in R&S FSP devices.

→ [Remote: SYST:COMP:FSP](#)

Mode R&S FSU

Sets the number of measurement points and available bandwidths as in R&S FSU devices.

→ [Remote: SYST:COMP:FSU](#)

Display Update (On/Off)

Defines whether the instrument display is switched off when changing from manual operation to remote control. In remote control mode, this softkey is displayed in the local menu (for details refer to section "[Manual Operation - Local Menu](#)" on page "268").

→ Remote: [SYST:DISP:UPD ON](#)

GPIB Terminator LFEOI/EOI

Changes the GPIB receive terminator.

According to the standard the terminator in ASCII is <LF> and/or <EOI>. For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by changing the receive terminator to EOI.

→ Remote: [SYST:COMM:GPIB:RTER EOI](#)

*IDN Format Leg./New

Defines the response format to the [*IDN?](#) remote command. This function is intended for re-use of existing control programs together with the R&S FSV.

"Leg". Legacy format, compatible to the R&S FSP/FSU/FSQ family

"New" R&S FSV format

→ Remote: [SYST:FORM:IDEN LEG](#)

I/O Logging (On/Off)

Activates or deactivates the SCPI error log function. All remote control commands received by the R&S FSV are recorded in the following log file:

C:\R_S\instr\ScpiLogging\ScpiLog.txt

Logging the commands may be extremely useful for debug purposes, e.g. in order to find misspelled keywords in control programs.

Time+Date

Opens an edit dialog box to enter time and date for the internal real time clock. For details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

→ Remote: [SYST:TIME 12,30](#)

→ Remote: [SYST:DATE 2004,10,01](#)

Monitor Int/Ext

Switches from the internal monitor ("Int") to the external monitor ("Ext"). For external, the R&S FSV display is disabled (turns dark). The screen content formerly displayed on the R&S FSV is displayed on the external screen.

The softkey is only effective if an external monitor is connected. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

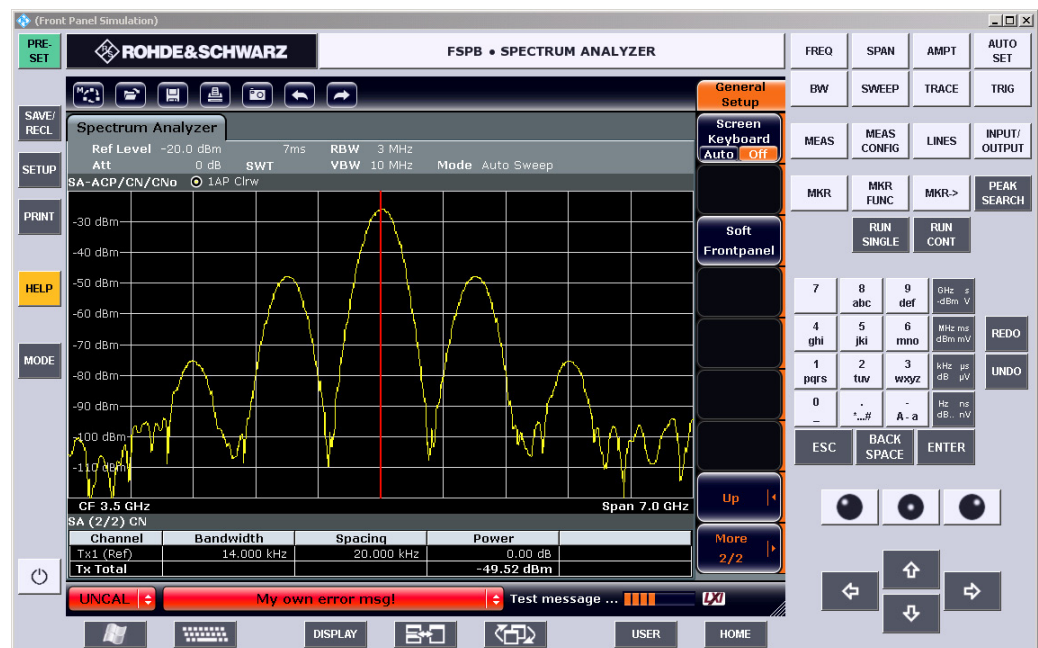
Soft Frontpanel

Activates or deactivates the display of the instrument emulation.

deactivated Only the measurement screen is displayed. This is the setting for working at the R&S FSV.

activated In addition to the measurement screen, the whole front panel is displayed, i.e. the hardkeys and other hardware controls of the device are simulated on the screen. This is the setting for working at a computer with XP Remote Desktop or at an external monitor.

Figure 31: Soft Frontpanel



Alternatively to this softkey, you can use the F6 key.

→ Remote: [SYST:DISP:FPAN ON](#)

Display Setup

Opens a submenu to define the display settings.

The following display settings are available:

Tool Bar State (On/Off)
Screen Title
Time+Date (On/Off)
Time+Date Format
Print Logo (On/Off)
Annotation (On/Off)
Theme Selection
Screen Colors>
Print Colors >
Display Pwr Save (On/Off)

Tool Bar State (On/Off)

Displays or removes the tool bar above the diagram for standard file functions. For details refer to the Quick Start Guide, chapter 4.2 "Means of User Interaction".

→ Remote: [DISP:TBAR ON](#)

Screen Title (On/Off)

Activates/deactivates the display of a diagram title (if available) and opens an edit dialog box to enter a new title for the active diagram. Max. 20 characters are allowed.

→ Remote: [DISP:TEXT 'Noise Meas'](#)

→ Remote: [DISP:TEXT:STATE ON](#)

Time+Date (On/Off)

Activates/deactivates the display of date and time beneath the diagram.

→ Remote: [DISP:TIME OFF](#)

Time+Date Format

Switches the time and date display on the screen between US and German (DE).

→ Remote: [DISP:TIME:FORM US](#)

Print Logo (On/Off)

Activates/deactivates the display of the Rohde & Schwarz company logo in the upper left corner.

→ Remote: [DISP:LOGO ON](#)

Annotation (On/Off)

Activates/deactivates the display of the frequency information in the diagram footer. For example to protect confidential data it can be useful to hide the frequency information.

→ Remote: [DISP:ANN:FREQ ON](#)

Theme Selection

Opens a selection list of available themes for the screen display. The theme defines the colors used for keys and screen elements, for example. The default theme is "BlueOcean".

→ Remote: [DISP:THEM:SEL](#)

Screen Colors

Opens a submenu to configure the screen colors. For details on screen colors refer to the Quick Start Guide, chapter 2 "Preparing for Use".

The submenu contains the following commands:

Select Screen Color Set
Color (On/Off)
Select Object
Predefined Colors
User Defined Colors
Set to Default

→ Remote: [DISP:CMAP2:HSL 0.3,0.8,1.0](#)

Select Screen Color Set

Opens the "Select Screen Color Set" dialog box to select default or user defined color settings.

If one of the default settings is selected ("Default Colors 1"/"2"), the default settings for brightness, color tint and color saturation for all display screen elements are restored. The default color schemes provide optimum visibility of all picture elements at an angle of vision from above or below. Default setting is "Default Colors 1".

If "User Defined Colors" is selected, a user-defined color set can be defined. For step-by-step instruction refer to the Quick Start Guide, chapter 2 "Preparing for Use".

→ Remote: [DISP:CMAP:DEF2](#)

Color (On/Off)

Switches from color display to black-and-white display and back. The default setting is color display.

Select Object

Opens the "Color Setup" dialog box to select the color settings for a selected object. The "Selected Object" list is displayed to select the object. For setting the color the predefined colors are displayed.

→ Remote: [DISP:CMAP2:HSL 0.3,0.8,1.0](#) (screen colors)

→ Remote: [HCOP:CMAP2:HSL 0.3,0.8,1.0](#) (print colors)

Predefined Colors

In the "Color Setup" dialog box, displays the "Predefined Colors" (alternative to the "Predefined Colors" button). This softkey is only available if, in the "Select Color Set" dialog box, the "User Defined Colors" option is selected or the "Color Setup" dialog box is displayed. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

- Remote: [DISP:CMAP2:PDEF GRE](#) (screen colors)
- Remote: [HCOP:CMAP2:PDEF GRE](#) (print colors)

User Defined Colors

In the "Color Setup" dialog box, displays the "User Defined Colors" (alternative to the "User Defined Colors" button). This softkey is only available if, in the "Select Color Set" dialog box, the "User Defined Colors" option is selected or the "Color Setup" dialog box is displayed. For further details refer to the Quick Start Guide, chapter 2 "Preparing for Use".

- Remote: [DISP:CMAP2:HSL 0.3,0.8,1.0](#) (screen colors)
- Remote: [HCOP:CMAP2:HSL 0.3,0.8,1.0](#) (print colors)

Set to Default

Opens the "Set to Default" dialog box to select one of the factory default color settings.

- Remote: [DISP:CMAP:DEF2](#) (screen colors)
- Remote: [HCOP:CMAP:DEF2](#) (print colors)

Print Colors

Opens a submenu to select the colors for the printout. To facilitate color selection, the selected color combination is displayed when the menu is entered. The previous colors are restored when the menu is exited. For details on screen colors refer to the Quick Start Guide, chapter 2 "Preparing for Use".

The submenu contains the following commands:

Select Print Color Set
Color (On/Off)
Select Object
Predefined Colors
User Defined Colors
Set to Default

- Remote: [HCOPY:CMAP2:HSL 0.3,0.8,1.0](#)

Select Print Color Set

Opens the "Select Print Color Set" dialog box to select the color settings for printout.

- | | |
|--------------------------|--|
| Screen Colors (Print) | Selects the current screen colors for the printout. The background is always printed in white and the grid in black. |
| Screen Colors (Hardcopy) | Selects the current screen colors without any changes |

	for a hardcopy. The output format is set via the " Device Setup " softkey in the print menu.
Optimized Colors	Selects an optimized color setting for the printout to improve the visibility of the colors (default setting). Trace 1 is blue, trace 2 black, trace 3 green, and the markers are turquoise. The background is always printed in white and the grid in black.
User Defined Colors	Enables the softkeys to define colors for the printout.
	→ Remote: HCOP:CMAP:DEF1

Color (On/Off)

Switches from color printout to black-and-white printout and back. All colored areas are printed in white and all colored lines in black. This improves the contrast. The default setting is color printout, provided that the selected printer can produce color printouts.

→ Remote: [HCOP:DEV:COL ON](#)

Display Pwr Save (On/Off)

Switches the power-save mode for the display (On/Off) and opens an edit dialog box to enter the time for the power-save function to respond. After the elapse of this time the display is completely switched off, i.e. including backlighting. This mode is recommended when the instrument is exclusively operated in remote control. For details on the power-save mode for the display refer to the Quick Start Guide, chapter 2 "Preparing for Use".

→ Remote: [DISP:PSAV ON](#)

→ Remote: [DISP:PSAV:HOLD 15](#)

System Info

Opens a submenu to display detailed information on module data, device statistics and system messages.

The submenu contains the following commands:

Hardware Info
Versions+Options
System Messages
Clear All Messages

Hardware Info

Opens a dialog box that displays hardware information, e.g. on the frontend and motherboard. Every listed component is described by its serial number, order number, model information, hardware code, and hardware revision.

→ Remote: [DIAG:SERV:HWIN?](#)

Versions+Options

Opens a dialog box that displays a list of hardware and firmware information, e.g. the firmware version, the image version, BIOS version, data sheet version of the basic device, installed options (hardware and firmware options).

For details on options refer to the Quick Start Guide, chapter 2 "Checking the Furnished Items".

→ Remote: [*IDN?](#)

→ Remote: [*OPT?](#)

System Messages

Opens the "System Messages" dialog box that displays the generated system messages in the order of their occurrence. The most recent messages are placed at the top of the list. Messages that have occurred since the last display of system messages menu are marked with an asterisk '*'. The following information is available:

"No"	device-specific error code
"Message"	brief description of the message
"Component"	hardware messages: name of the affected module software messages: name of the affected software
"Date"/"Time"	date and time of the occurrence of the message

If the number of error messages exceeds the capacity of the error buffer, "Message buffer overflow" is displayed. To delete messages see "[Clear All Messages](#)" softkey.

→ Remote: [SYST:ERR:LIST?](#)

Clear All Messages

Deletes all system messages. The softkey is only available if the "System Messages" dialog box is displayed.

→ Remote: [SYST:ERR:CLE:ALL?](#)

Firmware Update

Opens the "Firmware Update" dialog box. The update path is changed by entering the new path or via the "Browse" button. The installation is started via the "Execute" button. For details on installation refer to the Quick Start Guide, chapter 3 "Firmware Update and Installation of Firmware Options".

The submenu contains the following commands:

[Install Option](#)

→ Remote: [SYST:FIRM:UPD 'D:\FW_UPDATE'](#)

Option Licenses

Opens a submenu to install options. For details on options refer to the Quick Start Guide, chapter 3 "Firmware Update and Installation of Firmware Options".

Install Option

Opens an edit dialog box to enter the license key for the option that you want to install. If an option is about to expire, a message box is displayed to inform you. You can then use this softkey to enter a new license key.

If an option has already expired, a message box appears for you to confirm. In this case, all instrument functions are unavailable (including remote control) until the R&S FSV is rebooted. You must then use the "Install Option" softkey to enter the new license key.

For more information about the option in question refer to the "[System Info](#)" softkey in the "Setup" menu.

Service

Opens a submenu that contains additional functions for maintenance and/or troubleshooting.

Attention: *The service functions are not necessary for normal measurement operation. However, incorrect use can affect correct operation and/or data integrity of the R&S FSV.*

Therefore, many of the functions can only be used after entering a password. They are described in the instrument service manual.

The submenu contains the following commands:

Input (RF/Cal)
Cal Frequency
Reset Password
Selftest
Selftest Results
Password
Service Function

Input (RF/Cal)

Selects the input for measurement.

RF Switches the input of the R&S FSV to the input connector (normal position). This is the default setting.

Cal Switches the RF input of the R&S FSV to the internal calibration source (65.83 MHz) and activates the data entry of the output level of the calibration source. Possible values are 0 dB and -30 dB.

→ Remote: [DIAG:SERV:INP_RF|CAL](#)

Cal Frequency

Opens an edit dialog box to set the comb generator frequency for the internal calibration.

→ Remote: [DIAG:SERV:INP:PULS:PRAT_COMB64](#)

Reset Password

Deactivates all set passwords.

→ Remote: [SYST:PASS:RES](#)

Selftest

Initiates the self test of the instrument modules to identify a defective module in case of failure . All modules are checked consecutively and the test result is displayed.

→ Remote: [*TST?](#)

Selftest Results

Opens the "Selftest Result" dialog box that contains the test results. In case of failure a short description of the failed test, the defective module, the associated value range and the corresponding test results are indicated.

→ Remote: [DIAG:SERV:STE:RES?](#)

Password

Opens an edit dialog box to enter the password. This ensures that the service functions are only used by authorized personnel.

→ Remote: [SYST:PASS "Password"](#)

Service Function

Opens the "Service Function" dialog box to start special service functions. For further information refer to the service manual.

→ Remote: [DIAG:SERV:SFUNC <value>,<value>...](#)

4.6.2 Saving and Recalling Settings Files - SAVE/RCL Key

The "SAVE/RCL" key is used to store and load instrument settings and to manage stored files.

The SAVE/RCL menu includes functions for storing ("[Save](#)" softkey) instrument settings such as instrument configurations (measurement/display settings, etc) and measurement results on permanent storage media, or to load ("[Recall](#)" softkey) stored data back onto the instrument.

Functions for management of storage media ("[File Manager](#)" softkey) include among others functions for listing, copying, and deleting/renaming files.

The R&S FSV is capable of internally storing complete instrument settings with instrument configurations and measurement data in the form of settings files. The respective data are stored on the internal flash disk or, if selected, on a memory stick or network drive. The mass media are assigned to the volume names as follows:

Drive	Designation	Comment
C	operating system, firmware and stored instrument settings	for customer data
A	USB floppy drive	if connected
D	USB memory stick or USB CD-ROM	if connected
E ...Z	additional USB mass storage devices or mounted LAN volumes	if connected

To open the SAVE/RCL menu

- ◆ Press the "SAVE/RCL" key.
The SAVE/Recall menu is displayed.

Menu and softkey description

- ◆ "[Softkeys of the SAVE/RCL Menu](#)" on page "261"

Further information

- ◆ "[Navigation in the Dialog Boxes for Saving and Loading Settings Files](#)" on page "261"
- ◆ "[Navigation in the File Manager](#)" on page "268"

4.6.2.1 Softkeys of the SAVE/RCL Menu

The following table shows all softkeys available in the SAVE/RCL menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Submenu / Command	Command	
Save >	Save File		
	Select Path		
	Select File		
	Edit File Name		
	Edit Comment		
	Select Items >	Select Items	
		Enable all Items	
		Disable all Items	
		Delete File	
	Recall >	Recall File	
Select Path			
Select File			
Edit File Name			
Edit Comment			
Select Items >		Select Items	
		Enable all Items	
		Disable all Items	
	Delete File		
Startup Recall >	Startup Recall (On/Off)		
	Select Dataset		
ScreenShot			
Export			
Import			
File Manager >	Edit Path		
	New Folder		
	Copy		
	Rename		
	Cut		
	Paste		
	Delete		
	More >		
	Sort Mode >	Name	
		Date	
		Extension	
		Size	
		File Lists (1/2)	
	Current File List (1/2)		
Network Drive >	Map Network Drive		
	Disconnect Network Drive		

Save

Opens the "Save" dialog box to define and store the settings file. To navigate in the dialog box and define/enter data, use the corresponding softkeys. For details see also ["Navigation in the Dialog Boxes for Saving and Loading Settings Files"](#) on page "261".

Path	Directory in which the settings file is stored. The default path for user settings files is C:\r_s\instr\user
Files	List of settings files already stored
File Name	Name of settings file
Comment	Comment regarding the settings file
[Items]	Selection of items to be saved in the settings file

The submenu contains the following commands:

Save File
Select Path
Select File
Edit File Name
Edit Comment
Select Items >
Delete File

Save File / Recall File

Saves the settings file with the defined file name ("Save" dialog box), or recalls the selected settings file ("Recall" dialog box). If the file name already exists, upon saving, a message is displayed. Selecting "Yes" overwrites the existing file, selecting "No" aborts the saving process.

For details on the file name conventions refer to the ["Edit File Name"](#) softkey description.

- Remote: [M MEM:STOR:STAT 1, 'Save'](#)
- Remote: [M MEM:STOR:STAT:NEXT](#)
- Remote: [M MEM:LOAD:STAT 1, 'C:\R_S\Instr\user\TEST01'](#)

Select Path

Opens the directory list to select the drive and folder for the settings file to be stored or loaded. The default path is C:\r_s\instr\user. For details see also ["Navigation in the Dialog Boxes for Saving and Loading Settings Files"](#) on page "261"..

Select File

Sets the focus on the "Files" list. For details see also ["Navigation in the Dialog Boxes for Saving and Loading Settings Files"](#) on page "261"..

- Remote: [M MEM:CAT? 'C:\R_S\Instr\user*.DFL'](#)

Edit File Name

Sets the focus on the "File Name" field.

In the "Save" dialog box, the field already contains a suggestion for a new name: the file name used in the last saving process is counted up to the next unused name. For example, if the name last used was "test_004", the new name "test_005" is suggested, but only if this name is not in use. If the name "test_005" is already in use, the next free name is suggested, e.g. "test_006". You can change the suggested name to any name conform to the following naming conventions.

The name of a settings file consists of a base name followed by an underscore and three numbers, e.g. limit_lines_005. In the example, the base name is "limit_lines". The base name can contain characters, numbers and underscores. The file extension is added automatically.

Edit Comment

Sets the focus on the "Comment" field to enter a comment for the settings file. Max. 60 characters are allowed. For details see also "[Navigation in the Dialog Boxes for Saving and Loading Settings Files](#)" on page "261"..

Select Items

Displays the softkey submenu for selecting the items to be stored or loaded.

The submenu contains the following commands:

Select Items
Enable all Items
Disable all Items

Select Items

Sets the focus on the items list. For details see also "[Navigation in the Dialog Boxes for Saving and Loading Settings Files](#)" on page "261".

In the "Save" dialog box, all items that can be saved are displayed. The number of displayed items depends on the installed options, as for some options additional items can be stored.

In the "Recall" dialog box, the items saved in the selected file are displayed.

- Remote: [MMEM:SEL:HWS ON](#)
- Remote: [MMEM:SEL:LIN:ALL ON](#)
- Remote: [MMEM:SEL:TRAC ON](#)
- Remote: [MMEM:SEL:TRAN:ALL ON](#)

Enable all Items

Selects all items for saving or loading.

- Remote: [MMEM:SEL:ALL](#)

Disable all Items

Selects none of the items for saving or loading.

→ Remote: [M MEM:SEL:NONE](#)

Delete File

Deletes the selected settings file.

→ Remote: [M MEM:CLE:STAT 1, 'TEST'](#)

Recall

Opens the "Recall" dialog box to load a settings file. To navigate in the dialog box, use the corresponding softkeys. For details see also "[Navigation in the Dialog Boxes for Saving and Loading Settings Files](#)" on page "261".

Path	Directory from which the settings file is loaded. The default path for user settings files is C:\r_s\instr\user
Files	List of stored settings files
File Name	Name of settings file
Comment	Comment of the settings file
[Items]	Items saved in the settings file

The submenu contains the following commands:

Recall File
Select Path
Select File
Edit File Name
Edit Comment
Select Items >
Delete File

→ Remote: [M MEM:LOAD:STAT 1, 'C:\R_S\Instr\user\TEST'](#)

Startup Recall

Opens a submenu to activate or deactivate and set up the startup recall function.

The submenu contains the following commands:

Startup Recall (On/Off)
Select Dataset

Startup Recall (On/Off)

Activates or deactivates the startup recall function. If activated, the settings stored in the file selected via the "[Select Dataset](#)" softkey are loaded when booting or for preset. If deactivated, the default settings are loaded.

→ Remote: [M MEM:LOAD:AUTO 1, 'C:\R_S\Instr\user\TEST'](#)

Select Dataset

Opens the "Startup Recall" dialog box to select the settings file for the startup recall function (see also "[Startup Recall \(On/Off\)](#)" softkey).

ScreenShot

Saves the current measurement screen as a file (screenshot). This function can also be performed via the "Screenshot" icon in the toolbar, if available.

→ Remote: [HCOP](#)

Export

Opens a submenu to configure exports of trace data. For details see section "[ASCII Trace Export](#)".

Import

This function is currently not available.

File Manager

Opens the "File Manager" dialog box and a submenu to manage mass storage media and files. In the upper left corner, the current drive is displayed. Below the folders and subfolders of the current directory are displayed. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

The following tasks can be performed:

- ◆ copying files from flash disk to other media
- ◆ copying files into another directory
- ◆ renaming and deleting files

The submenu contains the following commands:

Edit Path
New Folder
Copy
Rename
Cut
Paste
Delete
Sort Mode >
File Lists (1/2)
Current File List (1/2)
Network Drive >

Edit Path

For details see "[Select Path](#)" softkey.

→ Remote: [MMEM:MSIS "D:"](#)

→ Remote: [MMEM:CDIR "C:\R_S\Instr\user"](#)

New Folder

Creates a new folder and opens an edit dialog box to enter name and path (absolute or relative to the current directory) of the new folder.

→ Remote: [M MEM:MDIR "C:\R_S\Instr\user\TEST"](#)

Copy

Copies the selected item to the clipboard. The item can be copied later using the "Paste" softkey. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

→ Remote: [M MEM:COPY "C:\R_S\Instr\user\set.cfg", "E:"](#)

Rename

Opens an edit dialog box to enter a new file or folder name:. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

→ Remote: [M MEM:MOVE "test02.cfg", "set2.cfg"](#)

Cut

Copies the selected file to the clipboard. If the file is later copied to a different directory using the "Paste" softkey, it is deleted in the current directory. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

Paste

Copies a file from the clipboard to the currently selected directory. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

Delete

Deletes the selected item after confirmation. For details on navigation see also "[Navigation in the File Manager](#)" on page "268".

→ Remote: [M MEM:DEL "test01.hcp"](#)

→ Remote: [M MEM:RDIR "C:\R_S\Instr\user\TEST"](#)

Sort Mode

Opens a submenu to select the sorting mode for the displayed files. The entry for the next higher directory level (".") and the folders are always located at the top of the list. The submenu contains the following commands:

Name
Date
Extension
Size

Name

Sorts the displayed files in alphabetical order of the file names.

Date

Sorts the displayed files in respect to the date.

Extension

Sorts the displayed files in respect to the extension.

Size

Sorts the displayed files in respect to the size.

File Lists (1/2)

Splits the screen to copy files from one directory to the other. The focus between the two panes is switched using the "FIELD RIGHT" and "FIELD LEFT" keys.

Current File List (1/2)

Changes the focus to the selected file list.

Network Drive

Opens the "Map Network Drive" dialog box and submenu. For further information refer to the Quick Start Guide.

The submenu contains the following commands:

Map Network Drive
Disconnect Network Drive

Map Network Drive

Sets the focus on the "Drive" list. For further information refer to the Quick Start Guide.

- Remote: [M MEM:NETW:MAP 'T:', '\\server\folder'](#)
- Remote: [M MEM:NETW:USED ON](#)
- Remote: [M MEM:NETW:UNUS?](#)

Disconnect Network Drive

Opens the "Disconnect Network Drive" dialog box. In the "Drive" list, select the drive you want to disconnect and confirm with "OK".

- Remote: [M MEM:NETW:DISC 'T:'](#)

4.6.2.2 Navigation in the Dialog Boxes for Saving and Loading Settings Files

The "Save" and "Recall" dialog boxes are used to save and recall settings files. For both dialog boxes, the same navigation principle applies. Press the "[Save](#)" or "[Recall](#)" softkey to open the corresponding dialog box.

- ◆ "Path" field

To change the directory, press the "[Select Path](#)" softkey.

To select a folder, use the rotary knob or the "UPARROW" and "DNARROW" keys. To open a subfolder, press the "RIGHTARROW" key. To close subfolders, press the "LEFTARROW" key. To confirm the selection, press the rotary knob or the "ENTER" key.

- ◆ "Files" list

If the "Recall" or "Startup Recall" dialog box is opened, the focus is on the "Files" list. To set the focus on the "Files" list, press the ["Select File"](#) softkey.

To select a folder, use the rotary knob or the "UPARROW" and "DNARROW" keys. To open a subfolder, press the "ENTER" key. To select a file, use the rotary knob or the "UPARROW" and "DNARROW" keys. To load the selected file, press the rotary knob or the "ENTER" key. To delete the selected file, press the softkey.

- ◆ "File Name" field

If the "Save" dialog box is opened, the focus is on the "File Name" field. To set the focus on "File Name" field, press the ["Edit File Name"](#) softkey. Enter the name in the "File Name" field. The extension of the data name is ignored (for details on entering the name, refer to the Quick Start Guide, chapter 4 "Basic Operations").

- ◆ "Comment" field

To enter a comment, press the ["Edit Comment"](#) softkey (for details on entering the name, refer to the Quick Start Guide, chapter 4 "Basic Operations").

- ◆ Items saved in the settings file

To select a special item, set the focus on the entry using the arrow keys or the rotary knob. To confirm the selection, press the "ENTER" key. To deselect the item, press the "ENTER" key again.

4.6.2.3 Navigation in the File Manager

- ◆ To change from one subfolder to another, use the "ENTER" key.
- ◆ To change to the next higher directory, select the dots "..".
- ◆ To change into a subfolder, use the "RIGHTARROW" and "LEFTARROW" keys.
- ◆ To select a file or a folder, use the "UPARROW" and "DNARROW" keys.
- ◆ To confirm the selection of a file or folder, press the "ENTER" key.

4.6.3 Manual Operation - Local Menu

When switched on, the instrument is always in the manual measurement mode and can be operated via the front panel. As soon as the instrument receives a remote command, it is switched to the remote control mode.

In remote control mode, all keys of the instrument except the "PRESET" key are disabled. The "LOCAL" softkey and the ["Display Update \(On/Off\)"](#) softkey are displayed. Depending on the setting of the ["Display Update \(On/Off\)"](#) softkey, the diagrams, traces and display fields are displayed or hidden. For further details on the ["Display Update \(On/Off\)"](#) softkey refer to section ["Instrument Setup and Interface Configuration - SETUP Key"](#).

For details on remote control refer to chapter 5 "Remote Control - Basics".

The change to manual operation consists of:

- ◆ Enabling the Front Panel Keys
Returning to manual mode enables all inactive keys. The main softkey menu of the current mode is displayed.
- ◆ Displaying the measurement diagrams again.
The diagrams, traces and display fields are displayed again.
- ◆ Generating the "OPERATION COMPLETE" message
If, at the time of pressing the "LOCAL" softkey, the synchronization mechanism via *OPC, *OPC? or *WAI is active, the currently running measurement procedure is aborted and synchronization is achieved by setting the corresponding bits in the registers of the status reporting system.
- ◆ Setting Bit 6 (User Request) of the Event Status Register
With a corresponding configuration of the status reporting system, this bit immediately causes the generation of a service request (SRQ) to inform the control software that the user wishes to return to front panel control. For example this can be used to interrupt the control program and to correct instrument settings manually. This bit is set each time the "LOCAL" softkey is pressed.

To return to manual operation

- ◆ Press the "LOCAL" softkey.
The instrument switches from remote to manual operation, but only if the local lockout function has not been activated in the remote control mode.

4.6.4 Measurement Documentation - PRINT Key

The "PRINT" key is used to select and configure the printer and to customize the screen printout. For detailed information on printer selection and installation refer to the Quick Start Guide.

To open the print menu

- ◆ Press the "PRINT" key.
The print menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the Print Menu"](#) on page "269"

4.6.4.1 Softkeys of the Print Menu

The following table shows all softkeys available in the print menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Submenu / Command
Print Screen	
Device Setup	
Device (1/2)	
Colors >	Select Print Color Set
	Color (On/Off)
	Select Object
	Predefined Colors
	User Defined Colors
	Set to Default
Comment	
Install Printer	

Print Screen

Starts to printout all test results displayed on the screen: diagrams, traces, markers, marker lists, limit lines etc. Comments, title, date, and time are included at the bottom margin of the printout. All displayed items belonging to the instrument software (softkeys, tables, dialog boxes) are not printed out.

The output is defined via the "[Device Setup](#)" softkey. If the output is saved in a file, the file name used in the last saving process is counted up to the next unused name. If you use a file name that already exists, upon saving, a message is displayed. Selecting "Yes" overwrites the existing file, selecting "No" aborts the saving process. For further details on the file name and an example, refer to the SAVE/RCL menu, "[Edit File Name](#)" softkey.

Path Directory in which the file is stored. The default path is C:\r_s\instr\user
Files List of the existing files in the same format
File Name Name of the file

- Remote: [HCOP:ITEM:ALL](#)
- Remote: [HCOP](#)
- Remote: [HCOP:NEXT](#)

Device Setup

Opens the "Hardcopy Setup" dialog box to define the output: image file, clipboard, or the printer. The dialog box consists of two tabs which are selected via the "[Device \(1/2\)](#)" softkey. For further information refer to the Quick Start Guide.

- Remote: [HCOP:DEV:LANG GDI](#)
- Remote: [SYST:COMM:PRIN:ENUM:FIRS?](#)
- Remote: [SYST:COMM:PRIN:ENUM:NEXT?](#)
- Remote: [SYST:COMM:PRIN:SEL <Printer>](#)
- Remote: [HCOP:PAGE:ORI PORT](#)
- Remote: [HCOP:DEST "SYST:COMM:PRIN"](#)
- Remote: [HCOP:TDST:STAT?](#)
- Remote: [HCOP:TDST:STAT OFF](#)

Device (1/2)

Selects the tab of the device in the "Device Setup" dialog box. The analyzer is able to manage two print settings independently of each other. For each device the print setting is displayed on the corresponding tab of the "Device Setup" dialog box ("[Device Setup](#)" softkey). For further information refer to the Quick Start Guide.

Colors

Opens a submenu to define the colors to be used. For details see "[Print Colors](#)" softkey of the setup menu.

The submenu contains the following commands:

Select Print Color Set
Color (On/Off)
Select Object
Predefined Colors
User Defined Colors
Set to Default

Select Print Color Set

For details see "[Select Print Color Set](#)" softkey of the setup menu.

Color (On/Off)

For details see "[Color \(On/Off\)](#)" softkey of the setup menu.

Select Object

For details see "[Select Object](#)" softkey of the setup menu.

Predefined Colors

For details see "[Predefined Colors](#)" softkey of the setup menu.

User Defined Colors

For details see "[User Defined Colors](#)" softkey of the setup menu.

Set to Default

For details see "[Set to Default](#)" softkey of the setup menu.

Comment

Opens dialog box to enter a comment. Max. 120 characters are allowed. 60 characters fit in one line. In the first line, at any point a manual line-feed can be forced by entering "@".

Date and time are inserted automatically. The comment is printed below the diagram area, but not displayed on the screen. If a comment should not be printed, it must be deleted.

For details on the alphanumeric entries refer to the Quick Start Guide, chapter 4 "Basic Operations".

Install Printer

Opens the "Printers and Faxes" window to install a new printer. All printers that are already installed are displayed. For details refer to the Quick Start Guide, appendix A, "Printer Interface".

5 Remote Control - Basics

This chapter assumes basic knowledge of programming and operation of the controller. It provides the following:

- ◆ Instructions on how to put the R&S FSV into operation via remote control.
- ◆ A general introduction to remote control of programmable instruments. This includes the description of the command structure and syntax according to the SCPI standard, the description of command execution and of the status registers.
- ◆ Diagrams and tables describing the status registers used in the R&S FSV.
- ◆ A description of the interfaces and protocols used for remote control.
- ◆ In chapter "Instrument Functions" of this manual and in the Online Help, the remote control commands available for an instrument function are listed after each function description. In the Online Help, these remote control commands are linked to their description, provided in the manual in chapter "Remote Control - Commands". Program examples for the R&S FSV are given in chapter 7 "Remote Control - Programming Examples".

5.1 Introduction

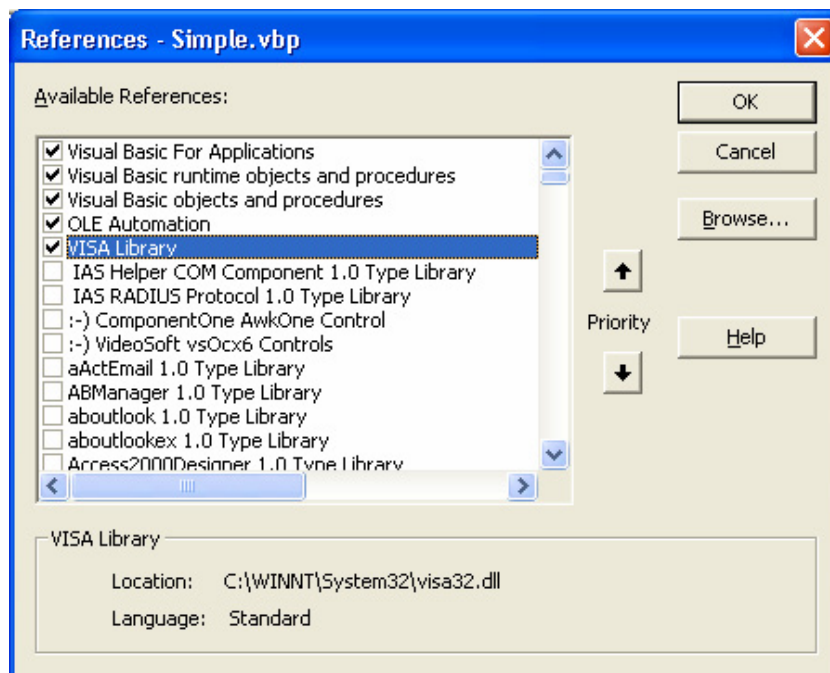
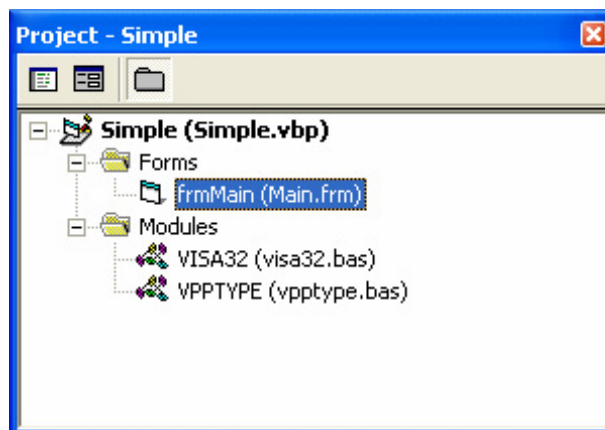
The instrument is equipped with the following interfaces for remote control:

- ◆ LAN interface: The protocol is based on TCP/IP and supports the VXI-11 standard.
- ◆ Option GPIB Interface, R&S FSV-B10: GPIB interface according to standard IEC 625/IEEE 488
The connectors are located at the rear of the instrument and permit a connection to a controller for remote control via a local area network (LAN) or directly (option GPIB Interface, R&S FSV-B10).
- ◆ SCPI (**S**tandard **C**ommands for **P**rogrammable **I**nstruments) commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

- ◆ VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel (LAN, GPIB...) is selected at initialization time by means of a channel-specific resource string. For more information about VISA refer to its user documentation.

The programming examples for remote control are all written in Microsoft® VISUAL BASIC®. Access to the VISA functions require the declaration of the functions and constants prior to their use in the project. This can be accomplished either by adding the modules `VISA32.BAS` and `VPPTYPE.BAS` or a reference to the `VISA32.DLL` to the project.



The modules `visa32.bas` and `vpptype.bas` can be found in the directory `<VXIpnppath>\WinNT\include` (typically `C:\VXIpnppath\WinNT\include`).

Note: *Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the device status. Therefore, control programs should always define an initial device status (e.g. with the command `*RST`) and then implement the required settings.*

To make remote control operation more comfortable and faster, you can use IVI drivers. They bundle remote control commands, reduce the I/O to the instrument by status caching, check status and parameters and offer simulation modes.

5.2 Getting Started

The short and simple operating sequence below shows how to put the instrument into operation and quickly set its basic functions. The remote control address is factory-set to 10.0.0.10, subnet mask 255.255.255.0 for LAN operation and 20 for operation via GPIB. If you want to change the IP address, see "[Setting the Remote Control \(IP/GPIB\) Address](#)".

Preparations for remote control

1. Connect the instrument to the LAN or directly to the GPIB controller (option GPIB Interface, R&S FSV-B10).
For details refer to the Quick Start Guide, appendix B.
2. Switch on the instruments.
3. Write and start the following program on the controller:

<code>status = viOpenDefaultRM(defaultRM)</code>	' Open default resource manager
<code>Cmd = "*RST;*CLS"</code> <code>status = viWrite(vi, Cmd, Len(Cmd), retCount)</code>	' Reset instrument and clear status registers
<code>Cmd = "FREQ:CENT 100MHz"</code> <code>status = viWrite(vi, Cmd, Len(Cmd), retCount)</code>	' Set center frequency to 100 MHz
<code>Cmd = "FREQ:SPAN 10MHz"</code> <code>status = viWrite(vi, Cmd, Len(Cmd), retCount)</code>	' Set span to 10 MHz
<code>Cmd = "DISP:TRAC:Y:RLEV -10dBm"</code> <code>status = viWrite(vi, Cmd, Len(Cmd), retCount)</code>	' Set reference level to -10 dBm

The instrument now performs a sweep in the frequency range of 95 MHz to 105 MHz.

5.3 Setting the Remote Control (IP/GPIB) Address

In order to operate the instrument via remote control, it must be addressed using the set IP or GPIB address. The remote control address is factory-set (for details refer to "[Getting Started](#)"), but it can be changed if it does not fit in the network environment.

Changing the GPIB address via R&S FSV

For details see Quick Start Guide, chapter 2 "Preparing for Use".

Changing the GPIB address via GPIB

<code>status = viOpenDefaultRM(defaultRM)</code>	' Open default resource manager
<code>status = viOpen(defaultRM, "GPIB:20::INSTR", 0, 5000, vi)</code>	' Open connection to instrument with old address
<code>Cmd = "SYST:COMM:GPIB:ADDR 18"</code> <code>status = viWrite(vi, Cmd, Len(Cmd), retCount)</code>	' Set instrument to new address
<code>status = viClose(vi)</code> <code>status = viOpen(defaultRM, "GPIB:18::INSTR", 0, 5000, vi)</code>	' Close old connection and reopen with new address

Changing the IP address via R&S FSV

For details see Quick Start Guide, chapter 2 "Preparing for Use".

5.4 Starting Remote Control

On power-on, the instrument is always in the manual operating state ("local" state) and can be operated via the front panel.

To start remote control

1. Send an addressed command from a controller to the instrument.
The instrument is switched to remote control ("remote" state). Operation via the front panel is disabled. Only the "Local" softkey is displayed to return to manual operation. The instrument remains in the remote state until it is reset to the manual state via the instrument or via remote control interfaces. Switching from manual operation to remote control and vice versa does not affect the other instrument settings.
2. During program execution, send the `SYSTem:DISPlay:UPDate ON` command to activate the display of results.
The changes in the device settings and the recorded measurement curves are displayed on the instrument screen.

3. To obtain optimum performance during remote control, send the `SYSTem:DISPLay:UPDate OFF` command to hide the display of results and diagrams again (default setting in remote control).
4. To prevent unintentional return to manual operation, disable the keys of the R&S FSV by the universal command LLO.
Then the transition to manual mode is only possible via remote control.
This function is only available for the GPIB interface.
5. To enable the keys of the R&S FSV again, switch the instrument to local mode, i.e. deactivate the REN line of the remote control interface.

Note: *If the instrument is operated exclusively in remote control, it is advisable you switch on the power-save mode for the display. For more details on this mode refer to the Quick Start Guide.*

5.5 Returning to Manual Operation

Before the transition, command processing must be completed. If command processing is not completed, it is not possible to return to manual operation and the instrument will switch back to remote control immediately.

Returning to manual operation via R&S FSV

- ◆ Press the "Local" softkey or the "Preset" key.

Returning to manual operation via GPIB

...	
<code>status = viGpibControlREN(vi, VI_GPIB_REN_ADDRESS_GTL)</code>	' Set instrument to manual operation
...	

5.6 SCPI Command Structure and Syntax

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure.

SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see section "Responses to Queries").

5.6.1 Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

Note: *Not all commands used in the following examples are implemented in the instrument.*

Common commands

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
*ESR?	EVENT STATUS QUERY	Queries the contents of the event status register

Device-specific commands

◆ Hierarchy

Device-specific commands are of hierarchical structure (see [Figure 1](#)). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

Example: `SENSe`

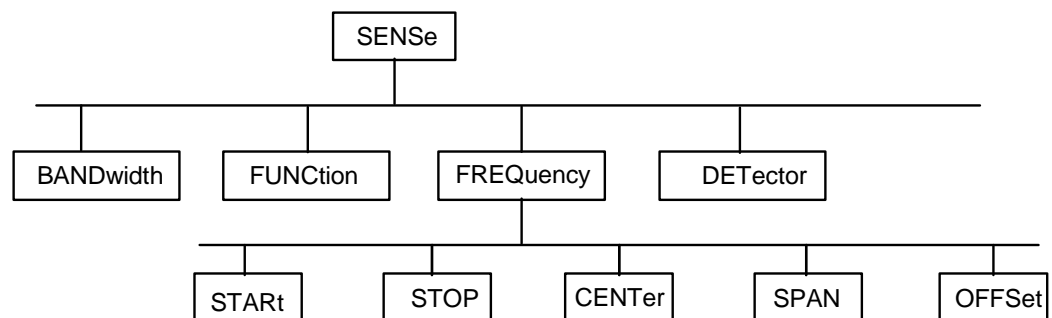
This key word denotes the `SENSe` command system.

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

Example: `SENSe:FREQuency:SPAN 10MHZ`

This command lies in the third level of the `SENSe` system. It sets the frequency span.

Figure 32: Tree structure the SCPI command systems using the `SENSe` system as example



◆ Multiple key words

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, i.e. at which position in the header of a command they are inserted.

Example: `SOURce:FM:POLarity NORMal`

This command contains key word `POLarity` in the third command level. It defines the polarity between modulator and modulation signal.

Example: `SOURce:FM:EXTernal:POLarity NORMal`

This command contains key word `POLarity` in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated. Optional key words

Some command systems permit certain key words to be inserted into the header or omitted. These key words are marked by square brackets in the description.

The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example: [SENSe]:BANDwidth[:RESolution]:AUTO

This command couples the resolution bandwidth of the instrument to other parameters. The following command has the same effect: BANDwidth:AUTO

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

◆ Long and short form

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permitted.

Example: STATus:QUESTionable:ENABle 1= STAT:QUES:ENAB 1

Note: Upper-case and lower-case notation only serves to distinguish the two forms in the manual, the instrument itself does not distinguish upper-case and lower-case letters.

◆ Parameter

The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. For a description of the types of parameter, refer to section "[Parameters](#)".

Example: SENSe:FREQuency:STOP? MAXimum, Response: 3.5E9

This query requests the maximal value for the stop frequency.

◆ Numeric suffix

If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1. Optional keywords must be specified if they select a function with the suffix.

Example: SYSTem:COMMunicate:SERial2:BAUD 9600

This command sets the baud rate of a second serial interface.

Note: In case of remote control, suffix counting may differ from the numbers of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.

Some standards define a fixed numbering, starting with 0. With GSM, for instance, slots are counted from 0 to 7. In the case of remote control, the slots are selected with the suffixes 1 to 8. If the numbering differs in manual operation and remote control, it is indicated with the respective command.

5.6.2 Structure of a Command Line

A command line may consist of one or several commands. It is terminated by an EOI signal together with the last data byte.

Several commands in a command line must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:CENTer 100MHz;:INPut:ATTenuation 10")
```

This command line contains two commands. The first one is part of the SENSE command system and is used to determine the center frequency of the instrument. The second one is part of the INPut command system and sets the input signal attenuation.

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

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START 1E6;:SENSe:FREQuency:STOP 1E9")
```

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 SENSE command system, subsystem FREQuency, i.e. they have two common levels. When abbreviating the command line, the second command begins with the level below SENSE:FREQuency. The colon after the semicolon is omitted. The abbreviated form of the command line reads as follows:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START 1E6;STOP 1E9")
```

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

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START 1E6")
```

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:STOP 1E9")
```

5.6.3 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- ◆ The requested parameter is transmitted without header.
Example: `INPut:COUPling?`, Response: `DC`
- ◆ Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.
Example: `SENSe:FREQuency:STOP? MAX`, Response: `3.5E9`
- ◆ Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.
Example: `SENSe:FREQuency:CENTer?`, Response: `1E6` (for 1 MHz)
- ◆ Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).
Example: `SENSe:BANDwidth:AUTO?`, Response: `1` (for ON)
- ◆ Text (character data) is returned in a short form.
Example: `SYSTem:COMMunicate:SERial:CONTRol:RTS?`, Response `STAN` (for standard)

5.6.4 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 and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description.

Numerical values

Numerical values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example: `SENSe:FREQuency:STOP 1.5GHz = SENSe:FREQuency:STOP 1.5E9`

Special numerical

The texts `MINimum`, `MAXimum`, `DEFault`, `UP` and `DOWN` are interpreted as special numerical values. In the case of a query, the numerical value is provided.

Example:

Setting command: `SENSe:FREQuency:STOP MAXimum`

Query: `SENSe:FREQuency:STOP?`, Response: `3.5E9`

- ◆ `MIN/MAX`
`MINimum` and `MAXimum` denote the minimum and maximum value.
- ◆ `DEF`
`DEFault` denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the `*RST` command
- ◆ `UP/DOWN`
`UP`, `DOWN` increases or reduces the numerical value by one step. The step width can be specified via an allocated step command (see "annex C, List of Commands") for each parameter which can be set via `UP`, `DOWN`.
- ◆ `INF/NINF`
`INFinity`, `Negative INFinity` (`NINF`) `Negative INFinity` (`NINF`) represent the numerical values `-9.9E37` or `9.9E37`, respectively. `INF` and `NINF` are only sent as device responses.
- ◆ `NAN`
`Not A Number` (`NAN`) represents the value `9.91E37`. `NAN` is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Boolean parameters

Boolean parameters represent two states. The "ON" state (logically true) is represented by `ON` or a numerical value unequal to 0. The "OFF" state (logically untrue) is represented by `OFF` or the numerical value 0. The numerical values are provided as response for query.

Example:

Setting command: `DISPlay:WINDow:STATe ON`

Query: `DISPlay:WINDow:STATe?`, Response: `1`

Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example:

Setting command: `INPut:COUPling GROund`

Query: `INPut:COUPling?`, Response: `GRO`

Strings

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

Example:

```
SYSTem:LANGuage "SCPI" OR SYSTem:LANGuage 'SCPI'
```

Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example:

```
HEADer:HEADer #45168xxxxxxxx
```

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted.

5.6.5 Overview of Syntax Elements

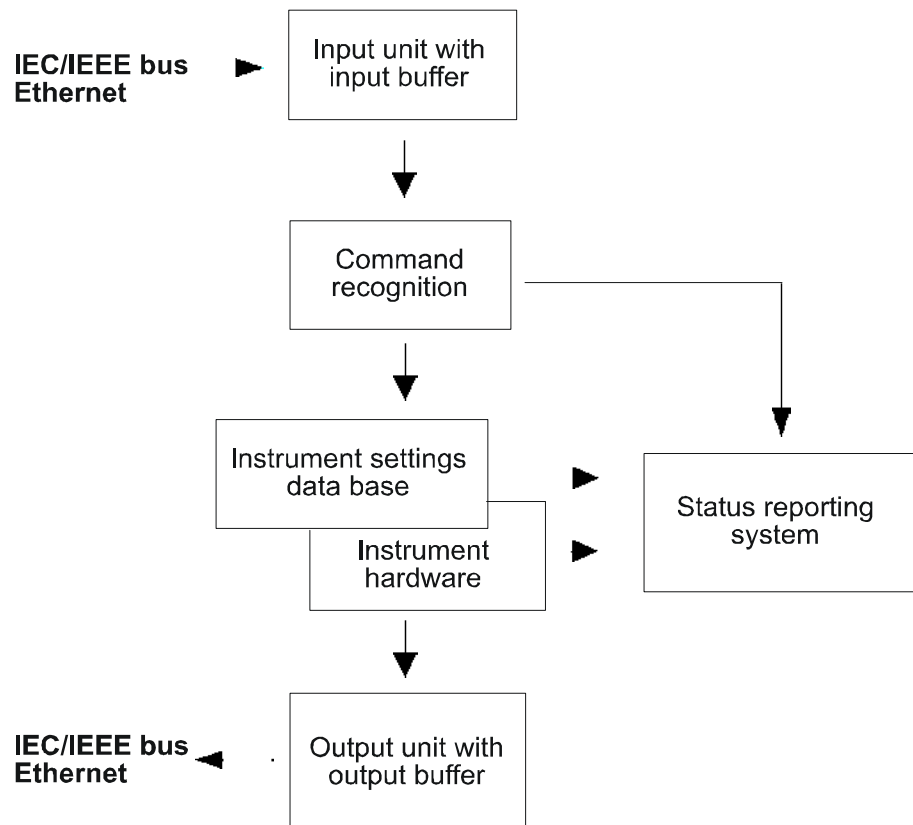
The following table offers an overview of the syntax elements.

:	The colon separates the key words of a command. In a command line 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.
#	The hash symbol # introduces binary, octal, hexadecimal and block data. Binary: #B10110 Octal: #O7612 Hexa: #HF3A7 Block: #21312
	A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

5.7 Instrument Model and Command Processing

The block diagram in [Figure 2](#) shows how SCPI commands are serviced in the instrument. The individual components work independently and simultaneously. They communicate with each other by means of so-called "messages".

Figure 33: Instrument model in the case of remote control



Input unit

The input unit receives commands character by character from the controller and collects them in the input buffer. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the traffic is stopped and the data received up to then are processed. Subsequently the traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of DCL clears the input buffer and immediately resets the command recognition.

Command recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only DCL is serviced with priority, for example GET (Group Execute Trigger) is only executed after the commands received before. Each recognized command is immediately transferred to the internal instrument settings data base but not executed immediately.

The command recognition detects syntax errors in the commands and transfers them to the status reporting system. The rest of a command line after a syntax error is analyzed further if possible and serviced. After the syntax test, the value range of the parameter is checked, if required.

If the command recognition detects a delimiter, it passes the command to an execution unit that performs the instrument settings. In the meantime, the command recognition is ready to process new commands (overlapping execution). A DCL command is processed in the same way.

Data base and instrument hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included. The term "data base" denotes a database that manages all the parameters and associated settings required for setting the instrument hardware.

Setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. This only takes place at the end of a command line.

The data are checked for compatibility with the current instrument settings before they are transmitted to the instrument hardware. If the execution is not possible, an "execution error" is signaled to the status reporting system. The corresponding settings are discarded.

Before passing on the data to the hardware, the settling bit in the STATus:OPERation register is set (refer to section "[STATus:OPERation Register](#)"). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

Queries induce the data set management to send the desired data to the output unit.

Status reporting system

For detailed information refer to section "[Status Reporting System](#)".

Output unit

The output unit collects the information requested by the controller, which it receives from the data base management. It processes it according to the SCPI rules and makes it available in the output buffer.

If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data base management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent on the GPIB or via the Ethernet, the controller waits until it has reached its time limit. This behavior is specified by SCPI.

5.7.1 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. In order to prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the respective action to occur (refer to "[Table 1](#)").

Table 10: Synchronization using *OPC, *OPC? and *WAI

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	- Setting bit 0 in the ESE - Setting bit 5 in the SRE - Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all commands sent before *WAI have been executed.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

An example for command synchronization can be found in chapter 7 "Remote Control - Programming Examples".

For a couple of commands the synchronization to the end of command execution is mandatory in order to obtain the desired result. The affected commands require either more than one measurement in order to accomplish the desired instrument setting (e.g. auto range functions), or they require a longer period of time for execution. If a new command is received during execution of the corresponding function this may either lead to either to an aborted measurement or to incorrect measurement data.

The following list includes the commands, for which a synchronization via *OPC, *OPC? or *WAI is mandatory:

Table 11: Commands with mandatory synchronization (overlapping commands)

Command	Purpose
INIT	start measurement
INIT:CONM	continue measurement
CALC:MARK:FUNC:ZOOM	zoom frequency range around marker 1
CALC:STAT:SCAL:AUTO ONCE	optimize level settings for signal statistic measurement functions
[SENS:]POW:ACH:PRES:RLEV	optimize level settings for adjacent channel power measurements

5.8 Status Reporting System

The status reporting system (refer to "[Figure 4](#)") stores all information on the present operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via GPIB or via the Ethernet.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUESTionable which are defined by SCPI and contain detailed information on the instrument.

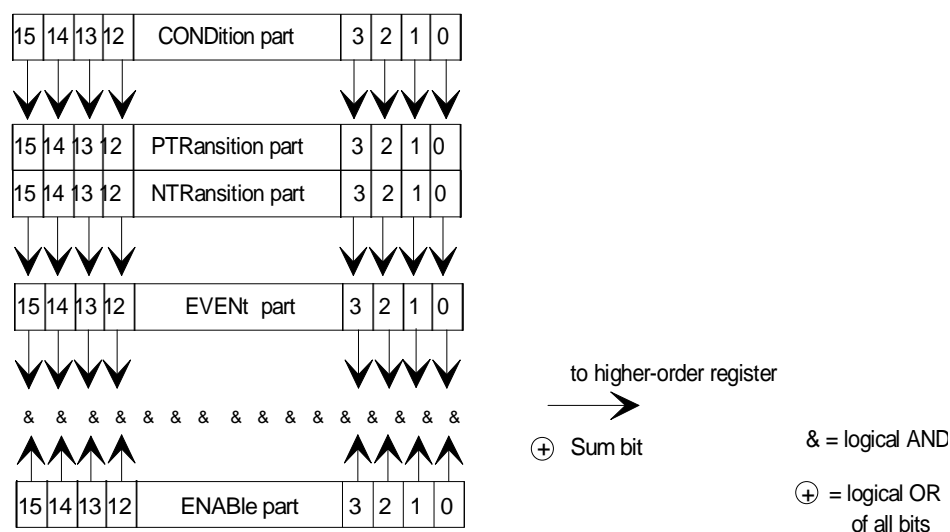
The IST flag ("Individual STATus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills the same function for the IST flag as the SRE for the service request.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB.

5.8.1 Structure of an SCPI Status Register

Each standard SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (refer to "Figure 3"). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number that applies to all five parts. For example, bit 3 of the `STATus:OPERation` register is assigned to the hardware status "wait for trigger" in all five parts. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.

Figure 34: The status-register model



CONDition part

The `CONDition` part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

PTRansition part

The `Positive-TRansition` part acts as an edge detector. When a bit of the `CONDition` part is changed from 0 to 1, the associated `PTR` bit decides whether the `EVENT` bit is set to 1.

`PTR` bit =1: the `EVENT` bit is set.

`PTR` bit =0: the `EVENT` bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

NTRansition part

The `Negative-TRansition` part also acts as an edge detector. When a bit of the `CONDition` part is changed from 1 to 0, the associated `NTR` bit decides whether the `EVENT` bit is set to 1.

NTR-Bit = 1: the `EVENT` bit is set.

NTR-Bit = 0: the `EVENT` bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the `EVENT` part.

EVENT part

The `EVENT` part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.

ENABLE part

The `ENABLE` part determines whether the associated `EVENT` bit contributes to the sum bit (see below). Each bit of the `EVENT` part is "ANDed" with the associated `ENABLE` bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an "OR" function (symbol '+').

`ENABLE`-Bit = 0: the associated `EVENT` bit does not contribute to the sum bit
`ENABLE`-Bit = 1: if the associated `EVENT` bit is "1", the sum bit is set to "1" as well.

This part can be written into and read by the user at will. Its contents is not affected by reading.

Sum bit

As indicated above, the sum bit is obtained from the `EVENT` and `ENABLE` part for each register. The result is then entered into a bit of the `CONDition` part of the higher-order register.

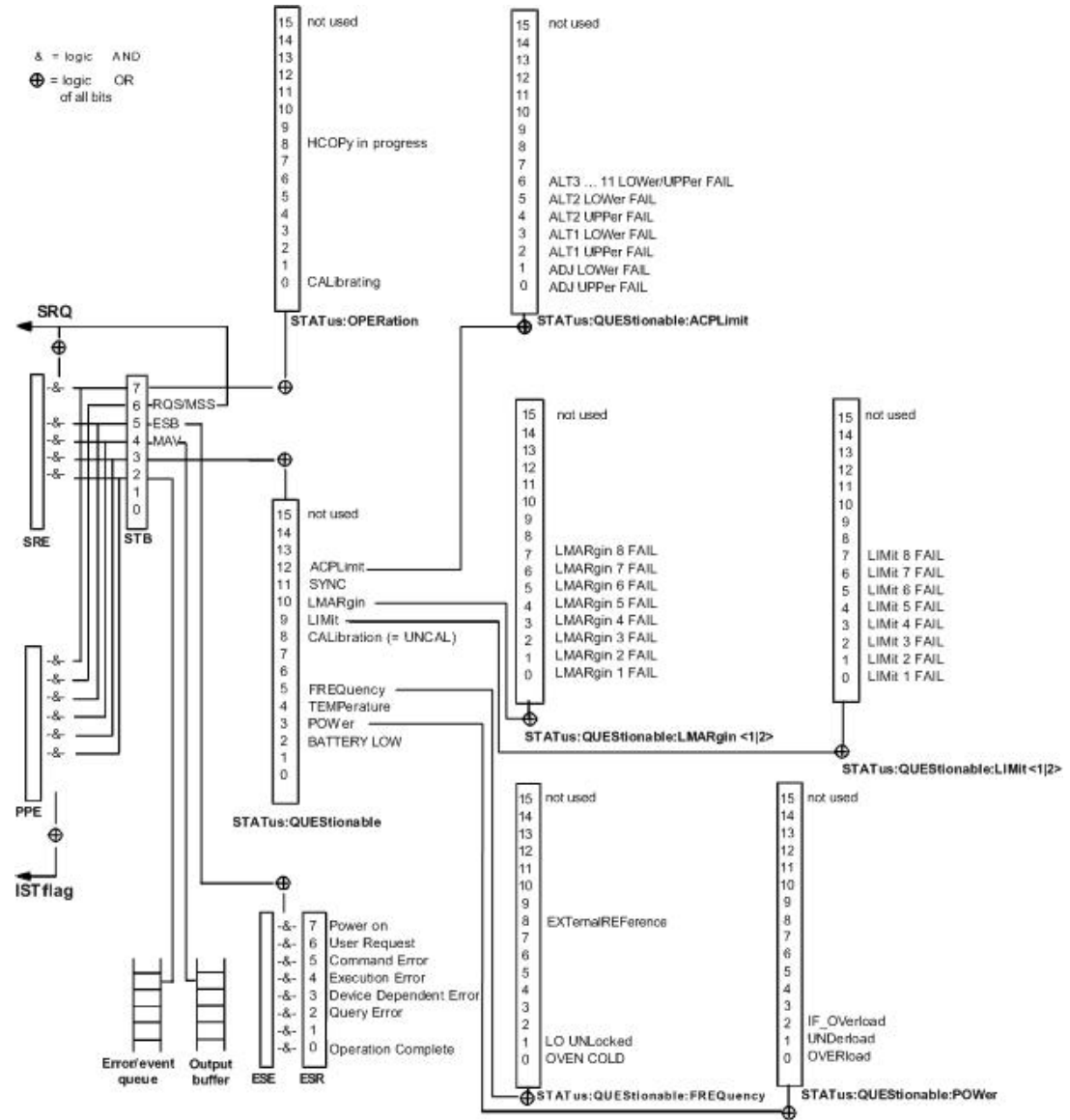
The instrument automatically generates the sum bit for each register. Thus an event, e.g. a `PLL` that has not locked, can lead to a service request throughout all levels of the hierarchy.

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

5.8.2 Overview of the Status Registers

The following figure shows the status registers used by the R&S FSV base unit. The status registers used by the R&S FSV options are described in separate sections at the end of this chapter.

Figure 35: Overview of the status registers (base unit)



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

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDition part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STATUS BYTE is read using the command "*STB?" or a serial poll.

The STB is linked to the SRE. The latter corresponds to the ENABLE part of the SCPI registers in its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated on the GPIB or via the Ethernet, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there.

The SRE can be set using the command "*SRE" and read using the command "*SRE?"

Table 12: Meaning of the bits used in the status byte

Bit No.	Meaning
0...1	Not used
2	Error Queue not empty The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.
3	QUESTionable status sum bit The bit is set if an EVENT bit is set in the QUESTionable: status register and the associated ENABLE bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUESTionable status register.
4	MAV bit (message available) The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.
5	ESB bit Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates 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 instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.
7	OPERation status register sum bit The bit is set if an EVENT bit is set in the OPERation status register and the associated ENABLE bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.

5.8.4 IST Flag and Parallel Poll Enable Register (PPE)

By analogy with the SRQ, the IST flag combines the entire status information in a single bit. It can be read by means of a parallel poll (refer to section "[Parallel Poll](#)") or using the 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, with bit 6 being used as well in contrast to the SRE. The IST flag results from the "ORing" of all results. The PPE can be set using commands *PRE and read using command *PRE?.

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

The ESR is defined in IEEE 488.2. It can be compared with the EVENT part of a SCPI register. The event status register can be read out using command *ESR?.

The ESE is the associated ENABLE part. It can be set using the command *ESE and read using the command *ESE?.

Table 13: Meaning of the bits in the event status register

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	User Request This bit is set on pressing the Local softkey.
7	Power On (supply voltage on) This bit is set on switching on the instrument.

5.8.5.1 STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVENT part, information on which actions the instrument has executed since the last reading. It can be read using the commands STATus:OPERation:CONDition? Or STATus :OPERation[:EVENT]?.

Table 14: Meaning of the bits in the STATus:OPERation register

Bit No.	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 7	Not used
8	HardCOPy in progress This bit is set while the instrument is printing a hardcopy.
9 to 14	Not used
15	This bit is always 0

5.8.5.2 STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands STATus:QUEStionable: CONDition? and STATus:QUEStionable[:EVENT]?.

Table 15: Meaning of bits in STATus:QUEStionable register

Bit No.	Meaning
0 to 1	These bits are not used
2	BATTERY LOW If the instrument is running without any external power supply and the charging level of the internal battery is approximately lower than 5% this bit is set to indicate that the system will be shut down automatically in approx. 5 minutes.
3	POWer This bit is set if a questionable power occurs (refer also to section " STATus:QUEStionable:POWer Register ")
4	TEMPerature This bit is set if a questionable temperature occurs.
5	FREQuency The bit is set if a frequency is questionable (refer to section " STATus:QUEStionable:FREQuency Register ")

Bit No.	Meaning
6 to 7	Not used
8	CALibration The bit is set if a measurement is performed unaligned (label UNCAL)
9	LIMit (device-specific) This bit is set if a limit value is violated (see also section " STATus:QUEStionable:LIMit Register ")
10	LMARgin (device-specific) This bit is set if a margin is violated (see also section " STATus:QUEStionable:LMARgin Register ")
11	SYNC (device-dependent) This bit is set if, in measurements or pre-measurements, synchronization to midamble fails or no burst is found. This bit is also set if, in pre-measurements mode, the result differs too strongly from the expected value.
12	ACPLimit (device-specific) This bit is set if a limit for the adjacent channel power measurement is violated (see also section " STATus:QUEStionable:ACPLimit Register ")
13 to 14	Not used
15	This bit is always 0.

5.8.5.3 STATus:QUEStionable:ACPLimit Register

This register contains information about the observance of limits during adjacent power measurements. It can be read using the commands

'STATus:QUEStionable:ACPLimit :CONDition?' and

'STATus:QUEStionable:ACPLimit[:EVENT]?'

Table 16: Meaning of bits in STATus:QUEStionable:ACPLimit register

Bit No.	Meaning
0	ADJ UPPer FAIL This bit is set if the limit is exceeded in the upper adjacent channel
1	ADJ LOWer FAIL This bit is set if the limit is exceeded in the lower adjacent channel.
2	ALT1 UPPer FAIL This bit is set if the limit is exceeded in the upper 1st alternate channel.
3	ALT1 LOWer FAIL This bit is set if the limit is exceeded in the lower 1st alternate channel.
4	ALT2 UPPer FAIL This bit is set if the limit is exceeded in the upper 2nd alternate channel.
5	ALT2 LOWer FAIL This bit is set if the limit is exceeded in the lower 2nd alternate channel.
6	ALT3 ... 11 LOWer/UPPer FAIL This bit is set if the limit is exceeded in one off the lower or upper alternate channels 3 ... 11
7 to 14	Not used
15	This bit is always set to 0.

5.8.5.4 STATus:QUEStionable:FREQuency Register

This register contains information about the reference and local oscillator.

It can be read using the commands

STATus:QUEStionable:FREQuency:CONDition? and STATus:QUEStionable:FREQuency[:EVENT]?.

Table 17: Meaning of bits in STATus:QUEStionable:FREQuency register

Bit No.	Meaning
0	OVEN COLD This bit is set if the reference oscillator has not yet attained its operating temperature. OCXO is displayed.
1	LO UNLocked This bit is set if the local oscillator no longer locks. LOUNL is displayed.
2 to 7	Not used
8	EXTErnalREFerence Bit 8 indicates that the external reference oscillator is selected and no useable external reference source is connected to the instrument. Therefore the synthesizer can not lock and the frequency accuracy is not guaranteed.
9 to 14	Not used
15	This bit is always 0.

5.8.5.5 STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read

using the commands STATus:QUEStionable:LIMit:CONDition? and

STATus:QUEStionable:LIMit[:EVENT]?.

Table 18: Meaning of bits in STATus:QUEStionable:LIMit register

Bit No.	Meaning
0	LIMit 1 FAIL This bit is set if limit line 1 is violated.
1	LIMit 2 FAIL This bit is set if limit line 2 is violated.
2	LIMit 3 FAIL This bit is set if limit line 3 is violated.
3	LIMit 4 FAIL This bit is set if limit line 4 is violated.
4	LIMit 5 FAIL This bit is set if limit line 5 is violated.
5	LIMit 6 FAIL This bit is set if limit line 6 is violated.
6	LIMit 7 FAIL This bit is set if limit line 7 is violated.
7	LIMit 8 FAIL This bit is set if limit line 8 is violated.
8 to 14	Not used
15	This bit is always 0.

5.8.5.6 STATus:QUEStionable:LMARgin Register

This register contains information about the observance of limit margins. It can be read using the commands `STATus:QUEStionable:LMARgin:CONDition?` and `STATus:QUEStionable:LMARgin[:EVENT]?`.

Table 19: Meaning of bits in STATus:QUEStionable:LMARgin register

Bit No.	Meaning
0	LMARgin 1 FAIL This bit is set if limit margin 1 is violated.
1	LMARgin 2 FAIL This bit is set if limit margin 2 is violated.
2	LMARgin 3 FAIL This bit is set if limit margin 3 is violated.
3	LMARgin 4 FAIL This bit is set if limit margin 4 is violated.
4	LMARgin 5 FAIL This bit is set if limit margin 5 is violated.
5	LMARgin 6 FAIL This bit is set if limit margin 1 is violated.
6	LMARgin 7 FAIL This bit is set if limit margin 7 is violated.
7	LMARgin 8 FAIL This bit is set if limit margin 8 is violated.
8 to 14	Not used
15	This bit is always 0.

5.8.5.7 STATus:QUEStionable:POWER Register

This register contains all information about possible overloads of the unit. It can be read using the commands `STATus:QUEStionable:POWER:CONDition?` and `STATus:QUEStionable:POWER[:EVENT]?`.

Table 20: Meaning of bits in STATus:QUEStionable:POWER register

Bit No.	Meaning
0	OVERload This bit is set if the RF input is overloaded. OVLD is displayed.
1	UNDERload This bit is set if the RF input is underloaded. UNLD is displayed.
2	IF_OVERload This bit is set if the IF path is overloaded. IFOVL is displayed.
3 to 14	Not used
15	This bit is always 0.

5.8.6 Application of the Status Reporting Systems

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following. For detailed program examples refer to chapter 7 "Remote Control - Programming Examples".

5.8.6.1 Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from [Figure 4](#), an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The ENABLE parts of the status registers can be set so that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

Example: Use of the command *OPC to generate an SRQ at the end of a sweep

1. CALL InstrWrite(analyzer, "*ESE 1") 'Set bit 0 in the ESE (Operation Complete)
2. CALL InstrWrite(analyzer, "*SRE 32") 'Set bit 5 in the SRE (ESB)?
After its settings have been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument in a way that a service request is initiated in the case of malfunction. The program should react appropriately to the service request. A detailed example for a service request routine is to be found in chapter 7 "Remote Control - Programming Examples".

5.8.6.2 Serial Poll

In a serial poll, just as with command *STB, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is `IBRSP()`. Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

5.8.6.3 Parallel Poll

In a parallel poll, the controller uses a single command to request up to eight instruments to transmit one bit of information each on the data lines, i.e., to set the data line allocated to each instrument to a logical "0" or "1". In addition to the `SRE` register, which determines the conditions under which an `SRQ` is generated, there is a parallel poll enable register (`PPE`). This register is ANDed with the `STB` bit by bit, considering bit 6 as well. The results are ORed, the result is possibly inverted and then sent as a response to the parallel poll of the controller. The result can also be queried without parallel poll by means of the command `*IST?`.

The instrument first has to be set for the parallel poll using the VISUAL BASIC command `IBPPC()`. This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using `IBRPP()`.

The parallel poll method is mainly used to find out quickly which one of the instruments connected to the controller has sent a service request. To this effect, `SRE` and `PPE` must be set to the same value.

5.8.6.4 Query by Means of Commands

Each part of any status register can be read by means of queries. The individual commands are listed in the description of the `STATUS` Subsystem. The returned value is always a number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an `SRQ` in order to obtain more detailed information on the cause of the `SRQ`.

5.8.6.5 Error Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages that can be displayed via manual operation using the setup menu or queried via remote control using the command `SYSTEM:ERROR?`. Each call of `SYSTEM:ERROR?` provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every `SRQ` in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

5.8.7 Reset Values of the Status Reporting System

[Table 12](#) contains the different commands and events causing the status reporting system to be reset. None of the commands, except `*RST` and `SYSTEM:PRESet`, influences the functional instrument settings. In particular, `DCL` does not change the instrument settings.

Table 21: Resetting the status reporting system

Event	Switching on supply voltage		DCL,SDC (Device Clear, Selected Device Clear)	*RST or SYSTEM:PRESet	STATUS:PRESet	*CLS
	Power-On-Status-Clear					
Effect	0	1				
Clear <code>STB,ESR</code>	—	yes	—	—	—	yes
Clear <code>SRE,ESE</code>	—	yes	—	—	—	—
Clear <code>PPE</code>	—	yes	—	—	—	—
Clear <code>EVENT</code> parts of the registers	—	yes	—	—	—	yes
Clear <code>ENABLE</code> parts of all <code>OPERation</code> and <code>QUESTIONable</code> registers; Fill <code>ENABLE</code> parts of all other registers with "1".	—	yes	—	—	yes	—
Fill <code>PTRansition</code> parts with "1"; Clear <code>NTRansition</code> parts	—	yes	—	—	yes	—
Clear error queue	yes	yes	—	—	—	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	—	—	—

1) Every command being the first in a command line, i.e., immediately following a `<PROGRAM MESSAGE TERMINATOR>` clears the output buffer.

5.9 Interfaces and Protocols

The standard instrument is accessed via LAN or GPIB in order to operate via remote control.

5.9.1 LAN Interface

To be integrated in a LAN, the instrument is equipped with a LAN interface, consisting of a connector, a network interface card and protocols (VXI-11 and RSIB). For details on the connector and its use refer to the Quick Start Guide, chapter 1 "Front and Rear Panel".

Instrument access via VXI11 or RSIB is usually achieved from high level programming platforms by using VISA as an intermediate abstraction layer. VISA encapsulates the low level VXI, RSIB or even GPIB function calls and thus makes the transport interface transparent for the user. The necessary VISA library is available as a separate product. For details contact your local R&S sales representative.

5.9.1.1 VXI Basics

The VXI-11 standard is based on the RPC protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Remote control of an instrument via a network is based on standardized protocols which follow the OSI reference model (see [Figure 5](#) below).

Figure 36: Example for LAN remote control based on the OSI reference model

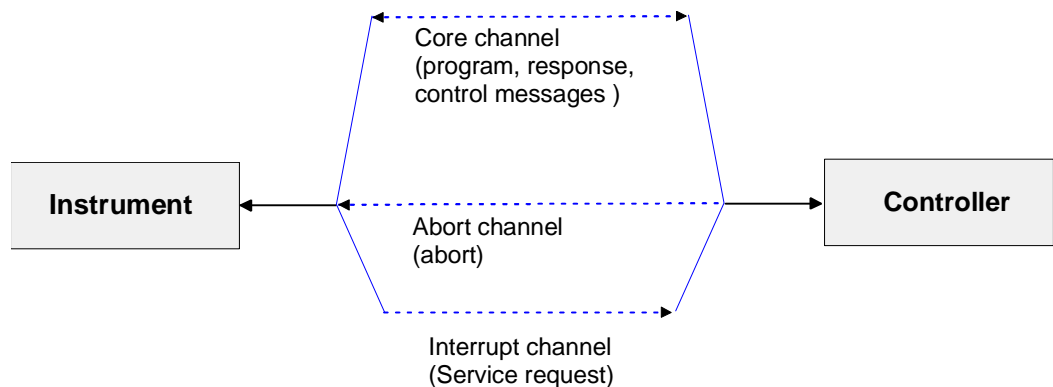
Application	SCPI
Presentation	XDR (VXI-11)
Session	ONC-RPC
Transport	TCP / UDP
Network	IP
Data Link	Ethernet/802.3
Physical	802.3/10BASE-T

Based on TCP/UDP, messages between the controller and the instrument are exchanged via open network computing (ONC) - remote procedure calls (RPC). With XDR (VXI-11), legal RPC messages are known as VXI-11 standard. Based on this standard, messages are exchanged between the controller and the instrument. The messages are identical with SCPI commands. They can be organized in four groups:

- ◆ program messages (control command to the instrument)
- ◆ response messages (values returned by the instrument)
- ◆ service request (spontaneous queries of the instrument)
- ◆ low-level control messages (interface messages).

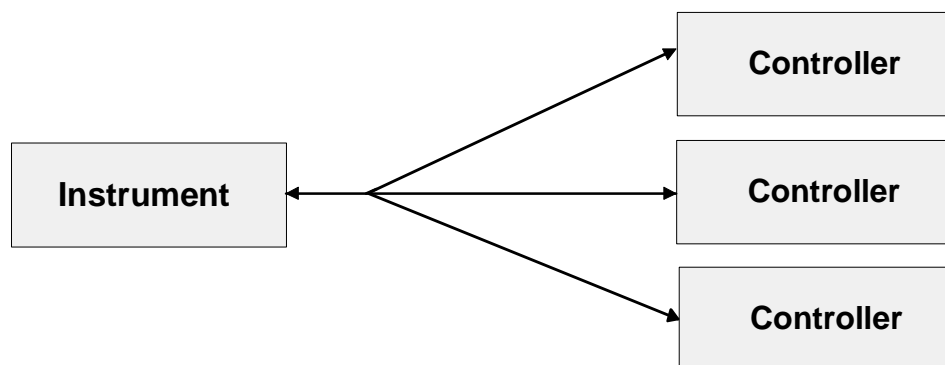
A VXI-11 link between a controller and an instrument uses three channels: core, abort and interrupt channel. Instrument control is mainly performed on the core channel (program, response and low-level control messages). The abort channel is used for immediate abort of the core channel; the interrupt channel transmits spontaneous service requests of the instrument. Link setup itself is very complex. For more details refer to the VXI-11 specification.

Figure 37: VXI-11 channels between instrument and controller



The number of controllers that can address an instrument is practically unlimited in the network. In the instrument, the individual controllers are clearly distinguished. This distinction continues up to the application level in the controller, i.e. two applications on a computer are identified by the instrument as two different controllers.

Figure 38: Remote control via LAN from several controllers



The controllers can lock and unlock the instrument for exclusive access. This regulates access to the instrument of several controllers.

5.9.1.2 VXI-11 Interface Messages

On the Ethernet link, the interface messages are called low-level control messages. These messages can be used to emulate interface messages of the GPIB.

Table 22: VXI-11 Interface Messages

Command	Description	Effect on the instrument
&ABO	(Abort)	Aborts the processing of the commands just received.
&DCL	(Device Clear)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
>L	(Go to Local)	Transition to the "Local" state (manual operation)
>R	(Go to Remote)	Transition to the "Remote" state (remote control)
&GET	(Group Execute Trigger)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
&LLO	(Local Lockout)	Disables switchover from remote control to manual operation by means of the front panel keys
&POL	(Serial Poll)	Starts a serial poll
&NREN	(Not Remote Enable)	Enables switchover from remote control to manual operation by means of the front panel keys

5.9.1.3 RSIB Protocol Basics

The R&S defined RSIB protocol uses the TCP/IP protocol for communication with the instrument. Remote control over RSIB is done on a message level basis using the SCPI command set of the instrument. The RSIB protocol allows you to control the instrument not only via Visual C++- and Visual Basic programs but also via the two Windows applications WinWord and Excel as well as via National Instruments LabView, LabWindows/CVI and Agilent VEE. The control applications run on an external computer in the network.

A UNIX operating system can be installed on an external computer in addition to a Windows operating system. In this case, the control applications are created either in C or C++. The supported UNIX operating systems include:

- ◆ Sun Solaris 2.6 Sparc Station
- ◆ Sun Solaris 2.6 Intel Platform
- ◆ Red Hat Linux 6.2 x86 Processors

5.9.1.4 RSIB Interface Functions

The library functions are adapted to the interface functions of National Instruments for GPIB programming. The functions supported by the libraries are listed in the following table.

Function	Description
RSDLLibfind()	Provides a handle for access to a device.
RSDLLibwrt()	Sends a zero-terminated string to a device.
RSDLLilwrt()	Sends a certain number of bytes to a device.
RSDLLibwrtf()	Sends the contents of a file to a device.
RSDLLibrd()	Reads data from a device into a string.
RSDLLilrd()	Reads a certain number of bytes from a device.
RSDLLibrdf()	Reads data from a device into a file.
RSDLLibtmo()	Sets timeout for RSIB functions.
RSDLLibsre()	Switches a device to the local or remote state.
RSDLLibloc()	Temporarily switches a device to the local state.
RSDLLibeot()	Enables/disables the END message for write operations.
RSDLLibrsp()	Performs a serial poll and provides the status byte.
RSDLLibonl()	Sets the device online/offline.
RSDLLTestSrq()	Checks whether a device has generated an SRQ.
RSDLLWaitSrq()	Waits until a device generates an SRQ.
RSDLLSwapBytes	Swaps the byte sequence for binary numeric display (only required for non-Intel platforms).

As with the National Instrument interface, the successful execution of a command can be checked by means of the variables `ibsta`, `iberr` and `ibcntl`. For this purpose, all RSIB functions are assigned references to these three variables.

Status word - `ibsta`

The status word `ibsta` provides information on the status of the RSIB interface. The following bits are defined:

Bit designation	Bit	Hex code	Description
ERR	15	8000	Is set when an error has occurred on calling a function. If this bit is set, <code>iberr</code> contains an error code that specifies the error in greater detail.
TIMO	14	4000	Is set when a timeout has occurred on calling a function.
CMPL	8	0100	Is set if the response of the GPIB parser has been read out completely. If a parser response is read out with the function <code>RSDLLilrd()</code> and the length of the buffer is insufficient for the answer, the bit will be cleared.

Error variable - `iberr`

If the ERR bit (8000h) is set in the status word, `iberr` contains an error code which allows the error to be specified in greater detail. Extra error codes are defined for the RSIB protocol, independent of the National Instruments interface.

Error	Error code	Description
IBERR_CONNECT	2	Setup of the connection to the measuring instrument has failed.
IBERR_NO_DEVICE	3	A function of the interface has been called with an illegal device handle.
IBERR_MEM	4	No empty memory available.
IBERR_TIMEOUT	5	Timeout has occurred.
IBERR_BUSY	6	The RSIB protocol is blocked by a function that is still running.
IBERR_FILE	7	Error when reading or writing to a file.
IBERR_SEMA	8	Error upon creating or assigning a semaphore (only under UNIX).

Count variable - `ibcntl`

The variable `ibcntl` is updated with the number of transferred bytes each time a read or write function is called.

5.9.2 GPIB Interface

The standard instrument is equipped with a GPIB connector. For details on the connector and its use refer to the Quick Start Guide, chapter 1 "Front and Rear Panel".

5.9.2.1 GPIB Basics

The GPIB interface is described by the following characteristics:

- ◆ 8-bit parallel data transfer
- ◆ bi-directional data transfer
- ◆ three-line handshake
- ◆ data transfer rate of max. 700 Kbytes/s
- ◆ up to 15 instruments can be connected
- ◆ maximal length of the interconnecting cables 15 m (single connection, 2m)
- ◆ wired-OR connection if several instruments are connected in parallel.

Depending on the bus type the following bus lines are used:

Data bus with 8 lines D0 to D7

The transmission is bit-parallel and byte-serial in the ASCII/ISO code. D0 is the least significant bit, D7 the most significant bit.

Control bus with 5 lines

IFC (Interface Clear)	active LOW resets the interfaces of the instruments connected to the default setting.
ATN (Attention)	active LOW signals the transmission of interface messages. inactive HIGH signals the transmission of device messages.
SRQ (Service Request)	active LOW enables the connected device to send a service request to the controller.
REN (Remote Enable)	active LOW permits switchover to remote control.
EOI (End or Identify)	has two functions in connection with ATN: <ul style="list-style-type: none"> – ATN = HIGH active LOW marks the end of data transmission. – ATN = LOW active LOW triggers a parallel poll.

Handshake bus with three lines

DAV (Data Valid)	active LOW signals a valid data byte on the data bus.
NRFD (Not Ready For Data)	active LOW signals that one of the connected devices is not ready for data transfer.
NDAC (Not Data Accepted)	active LOW signals that the instrument connected is accepting the data on the data bus.

5.9.2.2 GPIB Interface Functions

Instruments which can be remote controlled via the GPIB can be equipped with various interface functions. [Table 14](#) lists the interface functions appropriate for the instrument.

Table 23: Interface functions

Control character	Interface function
SH1	Handshake source function (source handshake), full capability
AH1	Handshake sink function (acceptor handshake), full capability
L4	Listener function, full capability, unaddressed if MTA.
T6	Talker function, full capability, ability to respond to serial poll, unaddressed if MLA
SR1	Service request function (Service Request), full capability
PP1	Parallel poll function, full capability
RL1	Remote/Local switch over function, full capability
DC1	Reset function (Device Clear), full capability
DT1	Trigger function (Device Trigger), full capability
C0	No controller function

5.9.2.3 GPIB Interface Messages

The messages transferred via the data lines of the GPIB can be divided into two groups: interface messages and device messages

Interface messages are transferred on the data lines of the GPIB if the "ATN" control line is active (LOW). They are used for communication between controller and instruments and can only be sent by the controller which currently has control of the GPIB.

Universal Commands

The universal commands are encoded 10 - 1F hex. They affect all instruments connected to the bus without addressing.

Table 24: Universal Commands

Command	QuickBASIC command	Effect on the instrument
DCL (Device Clear)	IBCMD (controller%, CHR\$(20))	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument settings.
IFC (Interface Clear)	IBSIC (controller%)	Resets the interfaces to the default setting.
LLO (Local Lockout)	IBCMD (controller%, CHR\$(17))	The LOC/IEC ADDR key is disabled.
SPE (Serial Poll Enable)	IBCMD (controller%, CHR\$(24))	Ready for serial poll.
SPD (Serial Poll Disable)	IBCMD (controller%, CHR\$(25))	End of serial poll.
PPU (Parallel Poll Unconfigure)	IBCMD (controller%, CHR\$(21))	End of the parallel-poll state.

Addressed Commands

The addressed commands are encoded 00 - 0F hex. They are only effective for instruments addressed as listeners.

Table 25: Addressed Commands

Command	QuickBASIC command	Effect on the instrument
SDC (Selected Device Clear)	IBCLR (device%)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
GET (Group Execute Trigger)	IBTRG (device%)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
GTL (Go to Local)	IBLOC (device%)	Transition to the "Local" state (manual operation).
PPC (Parallel Poll Configure)	IBPPC (device%, data%)	Configure instrument for parallel poll. Additionally, the QuickBASIC command executes PPE/PPD.

5.9.2.4 Instrument Messages

For different interfaces, device messages are more or less alike. They are divided into two groups, depending on the direction they are sent: commands and device responses.

Commands

Commands (program messages) are messages the controller sends to the instrument. They operate the device functions and request information. The commands are subdivided according to two criteria:

- ◆ According to the effect they have on the instrument:
 - *Setting commands* cause instrument settings such as a reset of the instrument or setting the frequency.
 - *Queries* cause data to be provided for remote control, e.g. for identification of the device or polling a parameter value. Queries are formed by directly appending a question mark to the header.
- ◆ According to their definition in standard:
 - *Common commands* are exactly defined as to their function and notation in standard IEEE 488.2. They refer to functions such as management of the standardized status registers, reset and self test.
 - *Device-specific commands* refer to functions depending on the features of the instrument such as frequency setting. A majority of these commands has also been standardized by the SCPI committee. Device-specific extensions following the SCPI rules are permitted by the standard.

Device responses

Device responses (response messages and service request) are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status (refer to section "Responses to Queries").

6 Remote Control - Commands

This chapter describes all remote control commands for the analyzer functions, firmware options (see list below) and the basic settings functions of the R&S FSV in detail. Commands that are used both for analyzer functions and firmware options are described in the analyzer commands section. The mode information is provided for each command.

Each subsystem starts with a list of commands, which provides quick access to all commands of the subsystem. Be aware, that for one subsystem more than one SCPI command lists can exist, depending on the functionality (analyzer and basic settings, options). For details on the notation refer to "[Notation](#)".

Remote commands of the basic firmware

- ◆ "[Remote Control - Description of Analyzer Commands](#)" on page "313"
- ◆ Remote Control - Description of Basic Settings Commands

6.1 Notation

In the following sections, all commands implemented in the instrument are first listed and then described in detail, arranged according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Individual Description

The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well. The options and operating modes for which a command can be used are indicated by the following abbreviations:

Abbreviation	Description
A	signal analysis
A-F	signal analysis - span > 0 only (frequency mode)
A-T	signal analysis - zero span only (time mode)
ADEM0D	analog demodulation (option R&S FSV-K7)
OFDM	WiMAX IEEE 802.16 OFDM measurements (options R&S FSV-K92/K93)
OFDMA/WiBro	WiMAX IEEE 802.16e OFDMA/WiBro measurements (option R&S FSV-K93)
PSM	power sensor measurements (option R&S FSV-K9)
WCDMA	3GPP Base Station measurements (option R&S FSV-K72)
WLAN	WLAN TX measurements (option R&S FSV-K91)

Note: The signal analysis (spectrum) mode is implemented in the basic unit. For the other modes, the corresponding options are required.

Upper/Lower Case Notation

Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see chapter 5 "Remote Control - Basics"). The instrument itself does not distinguish between upper and lower case letters.

Special Characters

- | A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example:

```
SENSe:FREQuency:CW|:FIXed
```

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

```
SENSe:FREQuency:CW 1E3
```

```
SENSe:FREQuency:FIXed 1E3
```

A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example: Selection of the parameters for the command

```
[SENSe<1|2>:]AVERAge:TYPE VIDEo | LINear
```

If parameter `SINGLE` is selected, full screen is displayed, in the case of `SPLIT`, split screen is displayed.

- [] Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards. Parameters in square brackets can be incorporated optionally in the command or omitted as well.
- { } Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

Description of Parameters

Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following (see also chapter 5 "Remote Control - Basics", section "Parameters").

<Boolean>

This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword OFF or by the numeric value 0, the "on" state is indicated by ON or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value> <num>

These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data). The following keywords given below are permitted:

- ◆ MAXimum: This keyword sets the parameter to the largest possible value.
- ◆ MINimum: This keyword sets the parameter to the smallest possible value.
- ◆ DEFault: This keyword is used to reset the parameter to its default value.
- ◆ UP: This keyword increments the parameter value.
- ◆ DOWN: This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example:

```
SENSe:FREQuency:CENTer? MAXimum
```

Returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

6.2 Remote Control - Description of Analyzer Commands

In this section all remote control commands for analyzer functions are described in detail. For details on basic settings commands refer to section "[Remote Control - Description of Basic Settings Commands](#)".

Subsystems of the analyzer

- ◆ ["ABORt Subsystem"](#) on page "314"
- ◆ ["CALCulate Subsystem"](#) on page "315"
- ◆ ["DISPlay Subsystem"](#) on page "434"
- ◆ ["FORMat Subsystem"](#) on page "439"
- ◆ ["INITiate Subsystem"](#) on page "440"
- ◆ ["INPut Subsystem"](#) on page "443"
- ◆ ["MMEMory Subsystem"](#) on page "451"
- ◆ ["SENSe Subsystem"](#) on page "451"
- ◆ ["STATus Subsystem"](#) on page "523"
- ◆ ["SYSTem Subsystem"](#) on page "536"
- ◆ ["TRACe Subsystem"](#) on page "536"
- ◆ ["TRACe:IQ Subsystem"](#) on page "538"
- ◆ ["UNIT Subsystem"](#) on page "553"

6.2.1 ABORt Subsystem

The ABORt subsystem contains the commands for aborting triggered actions. An action can be triggered again immediately after being aborted. All commands trigger events, and therefore they have no *RST value.

Commands of the ABORt Subsystem

- ◆ ["ABORt"](#)

ABORt

This command aborts a current measurement and resets the trigger system.

Example

```
ABOR ; INIT : IMM
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

6.2.2 CALCulate Subsystem

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the SENSE subsystem.

The following subsystems are included:

- ◆ "[CALCulate:DELTamarker Subsystem](#)" on page "315"
- ◆ "[CALCulate:DLINe Subsystem](#)" on page "328"
- ◆ "[CALCulate:ESPectrum Subsystem](#)" on page "329"
- ◆ "[CALCulate:FEED Subsystem](#)" on page "331"
- ◆ "[CALCulate:FLINe Subsystem](#)" on page "331"
- ◆ "[CALCulate:LIMit Subsystem](#)" on page "332"
- ◆ "[CALCulate:MARKer Subsystem](#)" on page "332"
- ◆ "[CALCulate:MATH Subsystem](#)" on page "422"
- ◆ "[CALCulate:PSEarch|PEAKsearch Subsystem](#)" on page "424"
- ◆ "[CALCulate:STATistics Subsystem](#)" on page "425"
- ◆ "[CALCulate:THReshold Subsystem](#)" on page "431"
- ◆ "[CALCulate:TLINE Subsystem](#)" on page "432"
- ◆ "[CALCulate:UNIT Subsystem](#)" on page "433"

6.2.2.1 CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem controls the delta marker functions of the instrument.

Commands of the CALCulate:DELTamarker Subsystem

- ◆ "[CALCulate<1|2>:DELTamarker<1...16>\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:LINK](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MODE](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:AOFF](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:FIXed\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:FIXed:RPOint:MAXimum\[:PEAK\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:FIXed:RPOint:X](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:FIXed:RPOint:Y](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:FIXed:RPOint:Y:OFFSet](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:PNOise\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:FUNctIon:PNOise:RESult?](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MAXimum\[:PEAK\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MAXimum:LEFT](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MAXimum:NEXT](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MAXimum:RIGHT](#)"

- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MINimum\[:PEAK\]](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MINimum:LEFT](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MINimum:NEXT](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:MINimum:RIGHT](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:TRACe](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:X](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:X:RELative?](#)"
- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:Y?](#)"

CALCulate<1|2>:DELTamarker<1...16>[:STATe]

This command switches on and off the delta marker when delta marker 1 is selected. The corresponding marker becomes the delta marker when delta marker 2 to 4 is selected. If the corresponding marker is not activated, it will be activated and positioned on the maximum of the measurement curve.

If no numeric suffix with DELTmarker is indicated, delta marker 1 is selected automatically.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:DELT1 ON
```

Switches marker 1 to delta marker mode.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

All

CALCulate<1|2>:DELTamarker<1...16>:LINK

This command links the delta marker 1 to marker 1, so if the x-axis value of the marker 1 is changed, the delta marker 1 will follow on the same x-position.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:DELT3:LINK ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

All

CALCulate<1|2>:DELTamarker<1...16>:MODE

This command switches between relative and absolute frequency input of the delta marker (or time with span = 0).

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ABSolute | RELative

Example

```
CALC:DELT:MODE ABS
```

Switches the frequency/time indication for all delta markers to absolute values.

```
CALC:DELT:MODE REL
```

Switches the frequency/time indication for all delta markers to relative to marker 1.

Characteristics

*RST value: REL

SCPI: device-specific

Mode

All

CALCulate<1|2>:DELTamarker<1...16>:AOFF

This command switches off all active delta markers.

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
CALC:DELT:AOFF
```

Switches off all delta markers.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed[:STATe]

This command switches the relative measurement to a fixed reference value on or off. Marker 1 will be activated previously and a peak search will be performed, if necessary. If marker 1 is activated, its position becomes the reference point for the measurement. The reference point can then be modified with the "[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:X](#)" commands and "[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:Y](#)" independently of the position of marker 1 and of a trace. It applies to all delta markers as long as the function is active.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:DELT:FUNC:FIX ON
```

Switches on the measurement with fixed reference value for all delta markers.

```
CALC:DELT:FUNC:FIX:RPO:X 128 MHZ
```

Sets the frequency reference to 128 MHz.

```
CALC:DELT:FUNC:FIX:RPO:Y 30 DBM
```

Sets the reference level to +30 dBm.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:MAXimum[:PEAK]

This command sets the reference point level for all delta markers for a measurement with fixed reference point ("[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed\[:STATe\]](#)") to the peak of the selected trace.

For phase-noise measurements

("[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOise\[:STATe\]](#)"), the command defines a new reference point level for delta marker 2.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<numeric_value>

Example

```
CALC:DELT:FUNC:FIX:RPO:MAX
```

Sets the reference point level for delta markers to the peak of the selected trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:X

This command defines a new frequency reference (span > 0) or time (span = 0) for all delta markers for a measurement with fixed reference value

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed[:STATe]").

For phase-noise measurements

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOise[:STATe]"), the

command defines a new frequency reference or time for delta marker 2.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:DELT:FUNC:FIX:RPO:X 128MHz
```

Sets the frequency reference to 128 MHz.

Characteristics

*RST value: - ("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed[:STATe]" is set to OFF)

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:Y

This command defines a new reference point level for all delta markers for a measurement with fixed reference point

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed[:STATe]").

For phase-noise measurements

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOise[:STATe]"), the

command defines a new reference point level for delta marker 2.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:DELT:FUNC:FIX:RPO:Y -10dBm
```

Sets the reference point level for delta markers to -10 dBm.

Characteristics

*RST value: - ("[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXedf:STATe](#)") is set to OFF)

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:Y:OFFSet

This command defines an additional level offset for the measurement with fixed reference value (CALCulate:DELTamarker:FUNCTion:FIXed:STATe ON). For this measurement, the offset is included in the display of all delta markers.

For phase-noise measurements

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOisef:STATe"), the command defines an additional level offset which is included in the display of delta marker 2.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:DELT:FUNC:FIX:RPO:Y:OFFS 10dB
```

Sets the level offset for the measurement with fixed reference value or the phase-noise measurement to 10 dB.

Characteristics

*RST value: 0 dB

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOise[:STATe]

This command switches on or off the phase-noise measurement with all active delta markers. The correction values for the bandwidth and the log amplifier are taken into account in the measurement.

Marker 1 will be activated, if necessary, and a peak search will be performed. If marker 1 is activated, its position becomes the reference point for the measurement.

The reference point can then be modified with the

"[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:X](#)" and

"[CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:FIXed:RPOint:Y](#)" commands independently of the position of marker 1 and of a trace (the same commands used for the measurement with fixed reference point).

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:DELT:FUNC:PNO ON
```

Switches on the phase-noise measurement with all delta markers.

```
CALC:DELT:FUNC:FIX:RPO:X 128 MHZ
```

Sets the frequency reference to 128 MHz.

```
CALC:DELT:FUNC:FIX:RPO:Y 30 DBM
```

Sets the reference level to +30 dBm

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:FUNCTion:PNOise:RESult?

This command queries the result of the phase-noise measurement. The measurement will be switched on, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
CALC:DELT:FUNC:PNO:RES?
```

Outputs the result of phase-noise measurement of the selected delta marker.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:DELTamarker<1...16>:MAXimum[:PEAK]

This command positions the delta marker to the current maximum value on the measured curve. If necessary, the corresponding delta marker will be activated first.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT3:MAX
```

Sets delta marker 3 to the maximum value of the associated trace.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MAXimum:LEFT

This command positions the delta marker to the next smaller maximum value to the left of the current value (i.e. descending X values). The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT:MAX:LEFT
```

Sets delta marker 1 to the next smaller maximum value to the left of the current value.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MAXimum:NEXT

This command positions the delta marker to the next smaller maximum value on the measured curve. The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT2:MAX:NEXT
```

Sets delta marker 2 to the next smaller maximum value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MAXimum:RIGHT

This command positions the delta marker to the next smaller maximum value to the right of the current value (i.e. ascending X values). The corresponding delta marker is activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT:MAX:RIGH
```

Sets delta marker 1 to the next smaller maximum value to the right of the current value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MINimum[:PEAK]

This command positions the delta marker to the current minimum value on the measured curve. The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT3:MIN
```

Sets delta marker 3 to the minimum value of the associated trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MINimum:LEFT

This command positions the delta marker to the next higher minimum value to the left of the current value (i.e. descending X values). The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT:MIN:LEFT
```

Sets delta marker 1 to the next higher minimum to the left of the current value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MINimum:NEXT

This command positions the delta marker to the next higher minimum value of the measured curve. The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT2:MIN:NEXT
```

Sets delta marker 2 to the next higher minimum value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:MINimum:RIGHT

This command positions the delta marker to the next higher minimum value to the right of the current value (i.e. ascending X values). The corresponding delta marker will be activated first, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT:MIN:RIGH
```

Sets delta marker 1 to the next higher minimum value to the right of the current value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:TRACe

This command assigns the selected delta marker to the indicated trace. The selected trace must be active, i.e. its state must be different from "BLANK".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

1 to 6

Example

```
CALC:DELT3:TRAC 2
```

Assigns delta marker 3 to trace 2.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:DELTamarker<1...16>:X

This command positions the selected delta marker to the indicated frequency (span > 0), time (span = 0) or level (APD measurement = ON or CCDF measurement = ON). The input is in absolute values or relative to marker 1 depending on the command "[CALCulate<1|2>:DELTamarker<1...16>:MODE](#)". If reference fixed measurement

("CALCulate<1|2>:DELTamarker<1...16>:FUNCTION:FIXed[:STATe]" is ON) is active, relative values refer to the reference position are entered. The query always returns absolute values.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

0 to MAX (frequency | sweep time)

Example

```
CALC:DELT:MOD REL
```

Switches the input for all delta markers to relative to marker 1.

```
CALC:DELT2:X 10.7MHz
```

Positions delta marker 2 10.7 MHz to the right of marker 1.

```
CALC:DELT:X?
```

Outputs the absolute frequency/time of delta marker 1.

```
CALC:DELT:X:REL?
```

Outputs the relative frequency/time/level of delta marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:X:RELative?

This command queries the frequency (span > 0) or time (span = 0) of the selected delta marker relative to marker 1 or to the reference position (for "[CALCulate<1|2>:DELTamarker<1...16>:FUNCTION:FIXed\[:STATe\]](#)" is ON). The command activates the corresponding delta marker, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
CALC:DELT3:X:REL?
```

Outputs the frequency of delta marker 3 relative to marker 1 or relative to the reference position.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:DELTamarker<1...16>:Y?

This command queries the measured value of the selected delta marker. The corresponding delta marker will be activated, if necessary. The output is always a relative value referred to marker 1 or to the reference position (reference fixed active).

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Depending on the unit defined with "[CALCulate<1|2>:UNIT:POWer](#)" or on the activated measuring functions, the query result is output in the units below:

Parameter or measuring functions	Output unit
DBM DBPW DBUV DBMV DBUA	dB (lin/log)
WATT VOLT AMPere	dB (lin), % (log)
statistics function (APD or CCDF) on	dimensionless output

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:DELT2 ON
Switches on delta marker 2.
INIT;*WAI
Starts a sweep and waits for its end.
CALC:DELT2:Y?
Outputs measurement value of delta marker 2.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD, WCDMA

6.2.2.2 CALCulate:DLINe Subsystem

The CALCulate:DLINe subsystem defines the position of the display lines.

Commands of the CALCulate:DLINe Subsystem

- ◆ "[CALCulate<1|2>:DLINe<1|2>](#)"
- ◆ "[CALCulate<1|2>:DLINe<1|2>:STATe](#)"

CALCulate<1|2>:DLINe<1|2>

This command defines the position of display line 1 or 2. These lines enable the user to mark any levels in the diagram. The unit depends on the setting made with "[CALCulate<1|2>:UNIT:POWer](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

MINimum to MAXimum (depending on current unit)

Example

```
CALC:DLIN -20dBm
```

Characteristics

*RST value: - (STATe to OFF)

SCPI: device-specific

Mode

A

CALCulate<1|2>:DLINe<1|2>:STATe

This command switches display line 1 or 2 (level lines) on or off.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:DLIN2:STAT OFF
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

6.2.2.3 CALCulate:ESpectrum Subsystem

The CALCulate:ESpectrum subsystem contains the remote commands for Spectrum Emission Mask (SEM) measurements. Both groups of commands (PSEarch and PEAKsearch) perform the same functions.

Commands of the CALCulate:ESpectrum Subsystem

- ◆ "[CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:AUTO](#)"
- ◆ "[CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:\[IMMEDIATE\]](#)"
- ◆ "[CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:MARGIN](#)"
- ◆ "[CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:PSHOW](#)"

CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:AUTO

This command activates or deactivates the list evaluation.
The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:ESP:PSE:AUTO OFF
```

Deactivates the list evaluation.

Characteristics

*RST value: ON
SCPI: device-specific

Mode

A

CALCulate<1|2>:ESpectrum:PSEarch|PEAKsearch:[IMMEDIATE]

This command starts the list evaluation.
The numeric suffixes <1|2> are not relevant.
This command is an event and therefore has no *RST value and no query.

Characteristics

*RST value: -
SCPI: device-specific

Example

```
CALC:ESP:PSE
```

Characteristics

SCPI: device-specific

Mode

A

CALCulate<1|2>:ESPectrum:PSEarch|:PEAKsearch:MARGin

This command sets the margin used for the limit check/peak search.
The numeric suffixes <1|2> are not relevant.

Parameters

-200 to 200 dB

Example

```
CALC:ESP:PSE:MARG 100
```

Sets the margin to 100 dB.

Characteristics

*RST value: 200 dB

SCPI: device-specific

Mode

A

CALCulate<1|2>:ESPectrum:PSEarch|:PEAKsearch:PSHow

This command marks all peaks with blue squares in the diagram.
The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:ESP:PSE:PSH ON
```

Marks all peaks with blue squares.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

6.2.2.4 CALCulate:FEED Subsystem

The CALCulate:FEED subsystem defines the position of the frequency lines that mark the frequencies.

CALCulate<1|2>:FEED

This command defines the position of the frequency lines that mark the frequencies.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<string>

Example

```
CALC:FEED
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

6.2.2.5 CALCulate:FLINE Subsystem

The CALCulate:FLINE subsystem defines the position of the frequency lines.

Commands of the CALCulate:FLINE Subsystem

- ◆ "[CALCulate<1|2>:FLINE<1|2>](#)"
- ◆ "[CALCulate<1|2>:FLINE<1|2>:STATE](#)"

CALCulate<1|2>:FLINE<1|2>

This command defines the position of the frequency lines that mark the frequencies.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

0 to f_{max}

Example

```
CALC:FLIN2 120MHz
```

Characteristics

*RST value: - (STATe to OFF)

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:FLINe<1|2>:STATe

This command switches the frequency line on or off.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:FLIN2:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

6.2.2.6 CALCulate:LIMit Subsystem

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks. Limit lines can be defined as upper or lower limit lines. The individual Y values of the limit lines correspond to the values of the x-axis (CONTrol). The number of X and Y values must be identical. For details on limit lines refer to chapter "Instrument Functions", section ["Using Limit Lines and Display Lines - LINES Key"](#).

The following subsystems are included:

- ◆ ["CALCulate:LIMit:ACPower Subsystem"](#) on page "339"
- ◆ ["CALCulate:LIMit:CONTrol Subsystem"](#) on page "339"
- ◆ ["CALCulate:LIMit:LOWer Subsystem"](#) on page "352"
- ◆ ["CALCulate:LIMit:UPPer Subsystem"](#) on page "357"

Commands of the CALCulate:LIMit Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACTive?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CLEar\[:IMMediate\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:COMMeNt](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:COpy](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:DELeT](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:NAME](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:TRACe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UNIT](#)"

Further information

- ◆ "[Example \(Spectrum Analyzer mode\)](#)"
- ◆ "[Definition of the Limit Line](#)"
- ◆ "[Switching on and Evaluating the Line](#)"

6.2.2.7 Example (Spectrum Analyzer Mode)

Definition and use of a new limit line 5 for trace 2 with the following features:

- ◆ upper limit line
- ◆ absolute x-axis with span > 0.
- ◆ 5 ref. values: 126 MHz/-40 dB, 127 MHz/-40 dB, 128 MHz/-20 dB, 129 MHz/-40 dB, 130 MHz/-40 dB
- ◆ relative y-axis with unit dB
- ◆ absolute threshold value at -35 dBm
- ◆ no safety margin

6.2.2.8 Definition of the Limit Line

1. Defining the name:
CALC:LIM5:NAME 'TEST1'
2. Entering the comment:
CALC:LIM5:COMM 'Upper limit line'
3. Associated trace:
CALC:LIM5:TRAC 2
4. Defining the x-axis range:
CALC:LIM5:CONT:DOM FREQ
5. Defining the x-axis scaling:
CALC:LIM5:CONT:MODE ABS
6. Defining the y-axis unit:
CALC:LIM5:UNIT DB

7. Defining the y-axis scaling:
CALC:LIM5:UPP:MODE REL
8. Defining the x-axis values:
CALC:LIM5:CONT 126MHZ, 127MHZ, 128MHZ, 129 MHZ, 130MHZ
9. Defining the y values:
CALC:LIM5:UPP -40, -40, -30, -40, -40
10. Defining the y threshold value:
CALC:LIM5:UPP:THR -35DBM
The definition of the safety margin and shifting in X and/or Y direction can take place as from here (see commands below).

6.2.2.9 Switching on and Evaluating the Line

1. Switching on the line:
CALC:LIM5:UPP:STAT ON
2. Switching on the limit check:
CALC:LIM5:STAT ON
3. Starting a new measurement with synchronization:
INIT;*WAI
4. Querying the limit check result:
CALC:LIM5:FAIL?

CALCulate<1|2>:LIMit<1...8>:ACTive?

This command queries the names of all active limit lines.
The numeric suffixes <1|2> and <1...8> are irrelevant for this command.
This command is only a query and therefore has no *RST value.

Example

```
CALC:LIM:ACT?
```

Queries the names of all active limit lines.

Return values

```
' 3GBAA , 3GBBA , 3GBCR '
```

Returns the names of the active limit lines in alphabetical order, separated by commas.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:CLEar[:IMMediate]

This command deletes the result of the current limit check for all limit lines. The numeric suffixes <1|2> and <1...8> are irrelevant for this command. This command is an event and therefore has no *RST value.

Example

```
CALC:LIM:CLE
```

Deletes the result of the limit check.

Characteristics

*RST value: -

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:COMMENT

This command defines a comment for the limit line selected (max. 40 characters). The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<string>, max. 40 alphanumeric characters

Example

```
CALC:LIM5:COMM 'Upper limit for spectrum'
```

Defines the comment for limit line 5.

Characteristics

*RST value: blank comment

SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:COPY

This command copies one limit line onto another one
The numeric suffixes <1|2> are irrelevant for this command.
This command is an event and therefore has no *RST value and no query.

Parameter

1 to 8 number of the new limit line
<name> name of the new limit line given as a string

Example

```
CALC:LIM1:COPY 2  
Copies limit line 1 to line 2.  
CALC:LIM1:COPY 'FM2'  
Copies limit line 1 to a new line named FM2.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:DELeTe

This command deletes the selected limit line.
The numeric suffixes <1|2> are irrelevant for this command.
This command is an event and therefore has no *RST value and no query.

Example

```
CALC:LIM1:DEL  
Deletes limit line 1.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:FAIL?

This command queries the result of the limit check of the indicated limit line. It should be noted that a complete sweep must have been performed for obtaining a correct result. A synchronization with *OPC, *OPC? or *WAI should therefore be provided. The result of the limit check is given with 0 for PASS, 1 for FAIL, and 2 for MARGIN.

The numeric suffixes <1|2> are irrelevant for this command.

Return values

0 for pass, 1 for fail

Example

```
INIT; *WAI
```

Starts a new sweep and waits for its end.

```
CALC:LIM3:FAIL?
```

Queries the result of the check for limit line 3.

Characteristics

*RST value: -

SCPI: conform

Mode

A, ADEMOD, NF, WLAN

CALCulate<1|2>:LIMit<1...8>:NAME

This command assigns a name to a limit line numbered 1 to 8. If it does not exist already, a limit line with this name is created.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<name of limit line>

Example

```
CALC:LIM1:NAME 'FM1'
```

Assigns the name FM1 to limit line 1.

Characteristics

*RST value: REM1 to REM8 for lines 1 to 8

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:STATe

This command switches on or off the limit check for the selected limit line.

The result of the limit check can be queried with

"[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM:STAT ON
```

Switches on the limit check for limit line 1.

Characteristics

*RST value: OFF

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:TRACe

This command assigns a limit line to a trace.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

1 to 6

Example

```
CALC:LIM2:TRAC 3
```

Assigns limit line 2 to trace 3.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:UNIT

This command defines the unit of the selected limit line.

Upon selection of the unit DB the limit line is automatically switched to the relative mode. For units different from DB the limit line is automatically switched to absolute mode.

The units DEG, RAD, S, HZ, PCT are not available in Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | DB | DEG | RAD
| HZ | PCT

Example

```
CALC:LIM4:UNIT DBUV
```

Sets the unit of limit line 4 to dB μ V.

Characteristics

*RST value: DBM

SCPI: device-specific

Mode

A, ADEMOD

6.2.2.10 CALCulate:LIMit:ACPower Subsystem

The CALCulate:LIMit:ACPower subsystem defines the limit check for adjacent channel power measurement.

Commands of the CALCulate:LIMit:ACPower Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel\[:RELative\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel\[:RELative\]:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel:ABSolute](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel:ABSolute:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ALTernate<1...11>\[:RELative\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ALTernate<1...11>\[:RELative\]:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ALTernate<1...11>:ABSolute](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ALTernate<1...11>:ABSolute:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:ACPower:ALTernate<1...11>:RESult?](#)"

CALCulate<1|2>:LIMit<1...8>:ACPowEr[:STATe]

This command switches on and off the limit check for adjacent-channel power measurements. The commands "[CALCulate<1|2>:LIMit<1...8>:ACPowEr:ACHannel\[:RELative\]:STATe](#)" or "[CALCulate<1|2>:LIMit<1...8>:ACPowEr:ALternate<1...11>\[:RELative\]:STATe](#)" must be used in addition to specify whether the limit check is to be performed for the upper/lower adjacent channel or for the alternate adjacent channels. The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM:ACP ON
```

Switches on the ACLR limit check.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPowEr:ACHannel[:RELative]

This command defines the relative limit of the upper/lower adjacent channel for adjacent-channel power measurements. The reference value for the relative limit value is the measured channel power.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit value defined with the "[CALCulate<1|2>:LIMit<1...8>:ACPowEr:ACHannel:ABSolute](#)" command. This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

Parameters

first value: 0 to 100dB; limit for the upper (lower) adjacent channel

Example

```
CALC:LIM:ACP:ACH 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

Characteristics

*RST value: 0 dB

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel[:RELative]:STATe

This command activates the limit check for the relative limit value of the adjacent channel when adjacent-channel power measurement is performed. Before the command, the limit check must be activated using

"[CALCulate<1|2>:LIMit<1...8>:ACPpower\[:STATe\]](#)".

The result can be queried with

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:RESult?](#)". It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM:ACP:ACH 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent channel measurement.

```
CALC:LIM:ACP:ACH:STAT ON
```

Switches on the check of the relative limit values for adjacent channels.

```
CALC:LIM:ACP:ACH:ABS:STAT ON
```

Switches on the check of absolute limit values for the adjacent channels.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ACH:RES?
```

Queries the limit check result in the adjacent channels.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:ABSolute

This command defines the absolute limit value for the lower/upper adjacent channel during adjacent-channel power measurement (Adjacent Channel Power). It should be noted that the absolute limit value has no effect on the limit check as soon as it is below the relative limit value defined with "[CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:RELative](#)". This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

Parameters

first value: -200DBM to 200DBM; limit for the lower and the upper adjacent channel

Example

```
CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.

Characteristics

*RST value: -200DBM

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:ABSolute:STATe

This command activates the limit check for the adjacent channel when adjacent-channel power measurement (Adjacent Channel Power) is performed. Before the command, the limit check for the channel/adjacent-channel measurement must be globally switched on using "[CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:STATe](#)".

The result can be queried with

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:RESult?](#)". It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM:ACP:ACH 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dBm.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent-channel measurement.

```
CALC:LIM:ACP:ACH:REL:STAT ON
```

Switches on the check of the relative limit values for adjacent channels.

```
CALC:LIM:ACP:ACH:ABS:STAT ON
```

Switches on the check of absolute limit values for the adjacent channels.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ACH:RES?
```

Queries the limit check result in the adjacent channels.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPower:ACHannel:RESult?

This command queries the result of the limit check for the upper/lower adjacent channel when adjacent channel power measurement is performed.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

The numeric suffixes <1|2> and <1...8> are irrelevant for this command.

This command is a query and therefore has no *RST value.

Parameters

The result is returned in the form <result>, <result> where <result> = PASSED | FAILED, and where the first returned value denotes the lower, the second denotes the upper adjacent channel.

Example

```
CALC:LIM:ACP:ACH 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper adjacent channel to -35 dB.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent channel measurement.

```
CALC:LIM:ACP:ACH:STAT ON
```

Switches on the limit check for the adjacent channels.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ACH:RES?
```

Queries the limit check result in the adjacent channels.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, WLAN

CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTernate<1...11>[:RELative]

This command defines the limit for the alternate adjacent channels for adjacent channel power measurements. The reference value for the relative limit value is the measured channel power.

The numeric suffix after `ALTernate` denotes the alternate channel. The numeric suffixes `<1|2>` with `CALCulate` and `<1...8>` with `LIMit` are irrelevant for this command.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit defined with

["CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTernate<1...11>:ABSolute"](#). This mechanism allows automatic checking of the absolute basic values of adjacent-channel power as defined in mobile radio standards.

Parameters

first value: 0 to 100dB; limit for the lower and the upper alternate adjacent channel

Example

```
CALC:LIM:ACP:ALT2 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

Characteristics

*RST value: 0 DB

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTErnate<1...11>[:RELative]:STATe

This command activates the limit check for the alternate adjacent channels for adjacent channel power measurements. Before the command, the limit check must be activated using "[CALCulate<1|2>:LIMit<1...8>:ACPpower\[:STATe\]](#)".

The numeric suffix after ALTErnate denotes the alternate channel. The numeric suffixes <1|2> with CALCulate and <1...8> with LIMit are irrelevant for this command.

The result can be queried with

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTErnate<1...11>:RESult?](#)". It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are obtained.

Parameters

ON | OFF

Example

```
CALC:LIM:ACP:ALT2 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent channel measurement.

```
CALC:LIM:ACP:ALT2:STAT ON
```

Switches on the check of the relative limit values for the lower and upper second alternate adjacent channel.

```
CALC:LIM:ACP:ALT2:ABS:STAT ON
```

Switches on the check of absolute limit values for the lower and upper second alternate adjacent channel.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ALT2:RES?
```

Queries the limit check result in the second alternate adjacent channels.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTErnate<1...11>:ABSolute

This command defines the absolute limit value for the lower/upper alternate adjacent-channel power measurement (Adjacent Channel Power).

The numeric suffix after ALTErnate denotes the alternate channel. The numeric suffixes <1|2> with CALCulate and <1...8> with LIMit are irrelevant for this command.

It should be noted that the absolute limit value for the limit check has no effect as soon as it is below the relative limit value defined with

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTErnate<1...11>\[:RELative\]](#)". This mechanism allows automatic checking of the absolute basic values defined in mobile radio standards for the power in adjacent channels.

Parameters

first value: -200DBM to 200DBM; limit for the lower and the upper alternate adjacent channel

Example

```
CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

Characteristics

*RST value: -200DBM

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTernate<1...11>:ABSolute:STATe

This command activates the limit check for the alternate adjacent channels for adjacent-channel power measurement (Adjacent Channel Power).

Before the command, the limit check must be globally switched on for the channel/adjacent-channel power with the

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:STATe1](#)" command.

The numeric suffix after ALTernate denotes the alternate channel. The numeric suffixes <1|2> with CALCulate and <1...8> with LIMit are irrelevant for this command.

The result can be queried with

"[CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTernate<1...11>:RESult?](#)". It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no correct results are available.

Parameters

ON | OFF

Example

```
CALC:LIM:ACP:ALT2 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent channel measurement.

```
CALC:LIM:ACP:ALT2:STAT ON
```

Switches on the check of the relative limit values for the lower and upper second alternative adjacent channels.

```
CALC:LIM:ACP:ALT2:ABS:STAT ON
```

Switches on the check of absolute limit values for the lower and upper second alternative adjacent channels.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ALT2:RES?
```

Queries the limit check result in the second alternate adjacent channels.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:ACPpower:ALTErnate<1...11>:RESult?

This command queries the result of the limit check for the alternate adjacent channels for adjacent channel power measurements.

The numeric suffix after ALTErnate denotes the alternate channel. The numeric suffixes <1|2> with CALCulate and <1...8> with LIMit are irrelevant for this command.

If the power measurement of the adjacent channel is switched off, the command produces a query error.

This command is a query and therefore has no *RST value.

Parameters

The result is returned in the form <result>, <result> where <result> = PASSED | FAILED and where the first (second) returned value denotes the lower (upper) alternate adjacent channel.

Example

```
CALC:LIM:ACP:ALT2 30DB, 30DB
```

Sets the relative limit value for the power in the lower and upper second alternate adjacent channel to 30 dB below the channel power.

```
CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM
```

Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

```
CALC:LIM:ACP ON
```

Switches on globally the limit check for the channel/adjacent channel measurement.

```
CALC:LIM:ACP:ALT2:STAT ON
```

Switches on the limit check for the lower and upper second adjacent channel.

```
INIT;*WAI
```

Starts a new measurement and waits for the sweep end.

```
CALC:LIM:ACP:ALT2:RES?
```

Queries the limit check result in the second alternate adjacent channels.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, WLAN

6.2.2.11 CALCulate:LIMit:CONTRol Subsystem

The CALCulate:LIMit:CONTRol subsystem defines the x-axis (CONTRol axis).

Commands of the CALCulate:LIMit:CONTRol Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol\[:DATA\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol:DOMain](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol:MODE](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol:OFFSet](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol:SHIFt](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:CONTRol:SPACing](#)"

CALCulate<1|2>:LIMit<1...8>:CONTRol[:DATA]

This command defines the x-axis values (frequencies or times) of the upper or lower limit lines.

The number of values for the CONTRol axis and for the corresponding UPPER and/or LOWER limit lines has to be identical. Otherwise default values are entered for missing values or not required values are deleted.

In Spectrum Analyzer mode, the unit of values depends on the span setting of the x-axis. For details refer to "[CALCulate<1|2>:LIMit<1...8>:CONTRol:DOMain](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>,<numeric_value>

Example

```
CALC:LIM2:CONT 1MHz,30MHz,100MHz,300MHz,1GHz
```

Defines 5 reference values for the x-axis of limit line 2.

```
CALC:LIM2:CONT?
```

Outputs the reference values for the x-axis of limit line 2 separated by a comma.

Characteristics

*RST value: - ("[CALCulate<1|2>:LIMit<1...8>:STATe](#)" is set to OFF)

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:CONTrol:DOMain

This command defines the span setting for the x-axis values.
The numeric suffixes <1|2> are irrelevant for this command.

Parameters

FREQuency | TIME

Example

```
CALC:LIM2:CONT:DOM TIME
```

Defines zero span for the x-axis of limit line 2.

Characteristics

*RST value: FREQuency

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:CONTrol:MODE

This command selects the relative or absolute scaling for the x-axis of the selected limit line.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

RELative | ABSolute

Example

```
CALC:LIM2:CONT:MODE REL
```

Defines the x-axis of limit line 2 as relatively scaled.

Characteristics

*RST value: ABSolute

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:CONTrol:OFFSet

This command defines an offset for the x-axis value of the selected relative limit line for span > 0 or zero span.

In Spectrum Analyzer mode, the unit of values depends on the span setting of the x-axis. For details refer to "[CALCulate<1|2>:LIMit<1...8>:CONTrol:DOMain](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:CONT:OFFS 100us
```

Sets the X offset for limit line 2 (defined in zero span) to 100µs.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:CONTrol:SHIFt

This command moves a limit line by the indicated value in x direction. In contrast to "[CALCulate<1|2>:LIMit<1...8>:CONTrol:OFFSet](#)", the line is shifted by modifying the individual x values and not by means of an additive offset.

In Spectrum Analyzer mode, the unit of values depends on the span setting of the x-axis. For details refer to "[CALCulate<1|2>:LIMit<1...8>:CONTrol:DOMain](#)".

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<numeric_value>

Example

```
CALC:LIM2:CONT:SHIF 50KHZ
```

Shifts all reference values of limit line 2 by 50 kHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:CONTrol:SPACing

This command selects linear or logarithmic interpolation for the calculation of limit lines from frequency points.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

LINear | LOGarithmic

Example

```
CALC:LIM:CONT:SPAC LIN
```

Characteristics

*RST value: LIN

SCPI: device-specific

Mode

A

6.2.2.12 CALCulate:LIMit:LOWer Subsystem

The CALCulate:LIMit:LOWer subsystem defines the lower limit line.

Commands of the CALCulate:LIMit:LOWer Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer\[:DATA\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:OFFSet](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:MARGin](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:MODE](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:SHIFt](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:SPACing](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:LOWer:THReshold](#)"

CALCulate<1|2>:LIMit<1...8>:LOWer[:DATA]

This command defines the values for the selected lower limit line.

The number of values for the CONTROL axis and for the corresponding LOWER limit line has to be identical. Otherwise default values are entered for missing values or not necessary values are deleted.

The unit must be identical with the unit selected by

"[CALCulate<1|2>:LIMit<1...8>:UNIT](#)". If no unit is indicated, the unit defined with "[CALCulate<1|2>:LIMit<1...8>:UNIT](#)" is automatically used.

If the measured values are smaller than the LOWER limit line, the limit check signals errors.

The units DEG, RAD, S, HZ, PCT are not available in the Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>,<numeric_value>

Example

```
CALC:LIM2:LOW -30,-40,-10,-40,-30
```

Defines 5 lower limit values for limit line 2 in the preset unit.

```
CALC:LIM2:LOW?
```

Outputs the lower limit values of limit line 2 separated by a comma.

Characteristics

*RST value: - (LIMit:STATe is set to OFF)

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:LOWer:STATe

This command switches on or off the indicated limit line. The limit check is activated separately with "[CALCulate<1|2>:LIMit<1...8>:STATe](#)".

In Spectrum Analyzer mode, the result of the limit check can be queried with "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM4:LOW:STAT ON
```

Switches on limit line 4 (lower limit).

Characteristics

*RST value: OFF

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:LOWer:OFFSet

This command defines an offset for the y-axis of the selected relative lower limit line. In contrast to "[CALCulate<1|2>:LIMit<1...8>:LOWer:SHIFt](#)", the line is not shifted by modifying the individual Y values but by means of an additive offset. The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:LOW:OFFS 3dB
```

Shifts limit line 2 by 3 dB upwards.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:LOWer:MARGin

This command defines a margin to a lower limit line, at which out-of-limit values are signaled (if the limit check is active), but not handled as a violation of the limit value.

Only the unit dB is available in Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM:LOW:MARG 10dB
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:LOWer:MODE

This command selects the relative or absolute scaling for the y-axis of the selected lower limit line.

Selecting RELative causes the unit to be switched to DB.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

RELative | ABSolute

Example

```
CALC:LIM:LOW:MODE REL
```

Defines the y-axis of limit line 2 as relative scaled.

Characteristics

*RST value: ABSolute

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:LOWer:SHIFt

This command shifts a limit line by the indicated value in Y direction. In contrast to "[CALCulate<1|2>:LIMit<1...8>:LOWer:OFFSet](#)", the line is shifted by modifying the individual Y values but not by means of an additive offset.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<numeric_value>

Example

```
CALC:LIM3:LOW:SHIF 20DB
```

Shifts all Y values of limit line 3 by 20 dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:LOWer:SPACing

This command selects linear or logarithmic interpolation for the lower limit line. The numeric suffixes <1|2> are irrelevant for this command.

Parameters

LINear | LOGarithmic

Example

```
CALC:LIM:LOW:SPAC LIN
```

Characteristics

*RST value: LIN

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:LOWer:THReshold

This command defines an absolute threshold value for limit lines with relative y-axis scaling. The absolute threshold value is used in the limit check as soon as it exceeds the relative limit value.

The unit must correspond to the unit selected with

"[CALCulate<1|2>:LIMit<1...8>:UNIT](#)" (except dB which is not allowed). If no unit is indicated, the unit defined with "[CALCulate<1|2>:LIMit<1...8>:UNIT](#)" is automatically used (exception: dBm instead of dB).

The units DEG, RAD, S, HZ, PCT are not available in the Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:LOW:THR -35DBM
```

Defines an absolute threshold value for limit line 2.

Characteristics

*RST value: -200 dBm

SCPI: device-specific

Mode

A, ADEMOD

6.2.2.13 CALCulate:LIMit:UPPer Subsystem

The CALCulate:LIMit:UPPer subsystem defines the upper limit line.

Commands of the CALCulate:LIMit:UPPer Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer\[:DATA\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:MARGin](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:MODE](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:OFFSet](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:SHIFt](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:SPACing](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:STATe](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:UPPer:THReshold](#)"

CALCulate<1|2>:LIMit<1...8>:UPPer[:DATA]

This command defines the values for the upper limit lines

The number of values for the CONTROL axis and for the corresponding UPPer and/or LOWEr limit line has to be identical. Otherwise default values are entered for missing values or not necessary values are deleted.

The unit must be identical with the unit selected by

["CALCulate<1|2>:LIMit<1...8>:UNIT"](#). If no unit is indicated, the unit defined with ["CALCulate<1|2>:LIMit<1...8>:UNIT"](#) is automatically used.

In Spectrum Analyzer mode, the limit check indicates errors if the measured values exceed the UPPer limit line. The units DEG, RAD, S, HZ, PCT are not available in Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>,<numeric_value>

Example

```
CALC:LIM2:UPP -10,0,0,-10,-5
```

Defines 5 upper limit values for limit line 2 in the preset unit.

```
CALC:LIM2:UPP?
```

Outputs the upper limit values for limit line 2 separated by a comma.

Characteristics

*RST value: - ("[CALCulate<1|2>:LIMit<1...8>:STATe](#)" is set to OFF)

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:UPPer:MARGin

This command defines a margin to an upper limit line, at which out-of-limit values are signaled (if the limit check is active), but not handled as a violation of the limit value.

Only the unit dB is available in Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:UPP:MARG 10dB
```

Defines the margin of limit line 2 to 10 dB below the limit value.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:UPPer:MODE

This command selects the relative or absolute scaling for the y-axis of the selected upper limit line.

Selecting RELative causes the unit to be switched to DB.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

RELative | ABSolute

Example

```
CALC:LIM2:UPP:MODE REL
```

Defines the y-axis of limit line 2 as relative scaled.

Characteristics

*RST value: ABSolute

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:UPPer:OFFSet

This command defines an offset for the y-axis of the selected relative upper limit line. In contrast to "[CALCulate<1|2>:LIMit<1...8>:UPPer:SHIFt](#)", the line is not shifted by modifying the individual Y values but by means of an additive offset. Only the unit dB is available in the Spectrum Analyzer mode. The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:UPP:OFFS 3dB
```

Shifts limit line 2 by 3 dB upwards.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:LIMit<1...8>:UPPer:SHIFt

This command moves a limit line by the indicated value in Y direction. In contrast to "[CALCulate<1|2>:LIMit<1...8>:UPPer:OFFSet](#)", the line is shifted by modifying the individual Y values and not by means of an additive offset. The numeric suffixes <1|2> are irrelevant for this command. This command is an event and therefore has no *RST value and no query.

Parameters

<numeric_value>

Example

```
CALC:LIM3:UPP:SHIF 20
```

Shifts all Y values of limit line 3 by 20 limit line units, e.g. dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:UPPer:SPACing

This command selects linear or logarithmic interpolation for the upper limit line. The numeric suffixes <1|2> are irrelevant for this command.

Parameters

LINear | LOGarithmic

Example

```
CALC:LIM:UPP:SPAC LIN
```

Characteristics

*RST value: LIN

SCPI: device-specific

Mode

A

CALCulate<1|2>:LIMit<1...8>:UPPer:STATe

This command switches on or off the indicated limit line. The limit check is activated separately with "[CALCulate<1|2>:LIMit<1...8>:STATe](#)".

In Spectrum Analyzer mode, the result of the limit check can be queried with

"[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:LIM4:UPP:STAT ON
```

Switches on limit line 4 (upper limit).

Characteristics

*RST value: OFF

SCPI: conform

Mode

A, ADEMOD, NF

CALCulate<1|2>:LIMit<1...8>:UPPer:THReshold

This command defines an absolute threshold value for limit lines with relative y-axis scaling. The absolute threshold value is used in the limit check as soon as it exceeds the relative limit value.

The unit must correspond to the unit selected with

"[CALCulate<1|2>:LIMit<1...8>:UNIT](#)" (except dB which is not possible). If no unit is indicated, the unit defined with "[CALCulate<1|2>:LIMit<1...8>:UNIT](#)" is automatically used (exception: dBm instead of dB).

The units DEG, RAD, S, HZ, PCT are not available in the Spectrum Analyzer mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:LIM2:UPP:THR -35DBM
```

Defines an absolute threshold value for limit line 2.

Characteristics

*RST value: -200 dBm

SCPI: device-specific

Mode

A, ADEMOD

6.2.2.14 CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem checks the marker functions of the instrument. The following subsystem is included:

- ◆ "[CALCulate:MARKer:FUNCTION Subsystem](#)" on page "377"

Commands of the CALCulate:MARKer Subsystem

- ◆ "[CALCulate<1|2>:MARKer<1...16>:STATe](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:AOFF](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:COUNT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:COUNT:FREQuency?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:COUNT:RESolution](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:LOEXclude](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MAXimum\[:PEAK\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MAXimum:AUTO](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MAXimum:LEFT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MAXimum:NEXT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MAXimum:RIGHT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MINimum\[:PEAK\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MINimum:AUTO](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MINimum:LEFT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MINimum:NEXT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:MINimum:RIGHT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:TRACe](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:X](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:X:SLIMits\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:X:SLIMits:LEFT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:X:SLIMits:RIGHT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:X:SSIZE](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:Y?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:Y:PERCent](#)"

CALCulate<1|2>:MARKer<1...16>[:STATe]

This command switches on or off the currently selected marker. If no indication is made, marker 1 is selected automatically. If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK3 ON
```

Switches on marker 3 or switches to marker mode.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:AOFF

This command switches off all active markers and all delta markers and active marker/delta marker measurement functions.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK:AOFF
```

Switches off all markers.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:COUNT

This command switches on or off the frequency counter at the marker position.

The count result is queried with

"CALCulate<1|2>:MARKer<1...16>:COUNT:FREQUENCY?".

Frequency counting is possible only for one marker at a time. If it is activated for another marker, it is automatically deactivated for the previous marker.

It should be noted that a complete sweep must be performed after switching on the frequency counter to ensure that the frequency to be measured is actually reached. The synchronization to the sweep end required for this is only possible in single sweep mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK ON
```

Switches on marker 1.

```
CALC:MARK:COUNT ON
```

Switches on the frequency counter for marker 1.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:COUNT:FREQ?
```

Outputs the measured value.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:COUNT:FREQUENCY?

This command queries the result of the frequency counter for the indicated marker. Before the command, the frequency counter should be switched on and a complete measurement performed to obtain a correct count result. Therefore, a single sweep with synchronization must be performed between switching on the frequency counter and querying the count result.

The numeric suffixes <1|2> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK2 ON
Switches on marker 2.
CALC:MARK2:COUN ON
Switches the frequency counter for marker 2.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK2:COUN:FREQ?
Outputs the measured value of marker 2.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:COUNt:RESolution

This command specifies the resolution of the frequency counter.
 The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

0.1 | 1 | 10 | 100 | 1000 | 10000 Hz

Example

```
CALC:MARK:COUN:RES 1kHz
Sets the resolution of the frequency counter to 1 kHz.
```

Characteristics

*RST value: 1kHz
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:LOEXclude

This command switches the local oscillator suppression for peak search on or off.
 This setting applies to all markers and delta markers.
 The numeric suffixes 1|2 and 1 to 4 are irrelevant.

Parameters

ON | OFF

Example

```
CALC:MARK:LOEX ON
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A-F, ADEMOD

CALCulate<1|2>:MARKer<1...16>:MAXimum[:PEAK]

This command positions the marker to the current maximum value of the corresponding trace. The corresponding marker is activated first or switched to the marker mode.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MAX
```

Positions marker 2 to the maximum value of the trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MAXimum:AUTO

Activates the automatic peak search function for marker 1 at the end of each particular sweep. This function may be used during adjustments of a device under test to keep track of the actual peak marker position and level.

The numeric suffixes <1|2> are irrelevant for this command.

Note: If no maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Parameters

ON | OFF

Example

```
CALC:MARK:MAX:AUTO ON
```

Activates the automatic peak search function for marker 1 at the end of each particular sweep.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:MAXimum:LEFT

This command positions the marker to the next smaller maximum value to the left of the current value (i.e. in descending X values) on the trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MAX:LEFT
```

Positions marker 2 to the next lower maximum value to the left of the current value.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MAXimum:NEXT

This command positions the marker to the next smaller maximum value of the corresponding trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MAX:NEXT
```

Positions marker 2 to the next lower maximum value.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MAXimum:RIGHT

This command positions the marker to the next smaller maximum value to the right of the current value (i.e. in ascending X values) on the corresponding trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next smaller maximum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MAX:RIGHT
```

Positions marker 2 to the next lower maximum value to the right of the current value.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MINimum[:PEAK]

This command positions the marker to the current minimum value of the corresponding trace. The corresponding marker is activated first or switched to marker mode, if necessary.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MIN
```

Positions marker 2 to the minimum value of the trace.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MINimum:AUTO

Activates the automatic minimum value search function for marker 1 at the end of each particular sweep. This function may be used during adjustments of a device under test to keep track of the actual peak marker position and level.

The numeric suffixes <1|2> are irrelevant for this command.

Note: If no minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Parameters

ON | OFF

Example

CALC:MARK:MIN:AUTO ON

Activates the automatic minimum value search function for marker 1 at the end of each particular sweep.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:MINimum:LEFT

This command positions the marker to the next higher minimum value to the left of the current value (i.e. in descending X direction) on the corresponding trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

CALC:MARK2:MIN

Positions marker 2 to the minimum value of the trace.

CALC:MARK2:MIN:LEFT

Positions marker 2 to the next higher minimum value to the left of the current value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MINimum:NEXT

This command positions the marker to the next higher minimum value of the corresponding trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MIN
```

Positions marker 2 to the minimum value of the trace.

```
CALC:MARK2:MIN:NEXT
```

Positions marker 2 to the next higher maximum value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:MINimum:RIGHT

This command positions the marker to the next higher minimum value to the right of the current value (i.e. in ascending X direction) on the corresponding trace.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Note: If no next higher minimum value is found on the trace (level spacing to adjacent values < peak excursion), an execution error (error code: -200) is produced.

Example

```
CALC:MARK2:MIN
```

Positions marker 2 to the minimum value of the trace.

```
CALC:MARK2:MIN:RIGH
```

Positions marker 2 to the next higher minimum value to the right of the current value.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:PEXCursion

This command defines the peak excursion, i.e. the spacing below a trace maximum which must be attained before a new maximum is recognized, or the spacing above a trace minimum which must be attained before a new minimum is recognized. The set value applies to all markers and delta markers. The unit depends on the selected operating mode.

The numeric suffixes >1<2> and <1...16> are irrelevant.

Parameters

<numeric_value>

Example

```
CALC:MARK:PEXC 10dB
```

Defines peak excursion 10 dB in spectrum **Spectrum Analyzer mode**.

Characteristics

*RST value: 6dB in **Spectrum Analyzer mode**
SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:MARKer<1...16>:TRACe

This command assigns the selected marker (1 to 4) to the indicated measurement curve. The corresponding trace must be active, i.e. its status must be different from "BLANK".

If necessary the corresponding marker is switched on prior to the assignment.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

1 to 6

Example

```
CALC:MARK3:TRAC 2
```

Assigns marker 3 to trace 2.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:MARKer<1...16>:X

This command positions the selected marker to the indicated frequency (span > 0), time (span = 0) or level (APD measurement or CCDF measurement ON).
 If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

0 to MAX (frequency | sweep time)

Example

```
CALC:MARK2:X 10.7MHz
```

Positions marker 2 to frequency 10.7 MHz.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:X:SLIMits[:STATe]

This command switches between a limited (ON) and unlimited (OFF) search range.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK:X:SLIM ON
```

Switches on search limitation.

Characteristics

*RST value: OFF
 SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:MARKer<1...16>:X:SLIMits:LEFT

This command sets the left limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on ("[CALCulate<1|2>:MARKer<1...16>:X:SLIMits:STATe](#)").

Parameters

0 to MAX (frequency | sweep time)

Example

```
CALC:MARK:X:SLIM ON
```

Switches the search limit function on.

```
CALC:MARK:X:SLIM:LEFT 10MHz
```

Sets the left limit of the search range to 10 MHz.

Characteristics

*RST value: - (is set to the left diagram border when switching on search limits)

SCPI: device-specific

Mode

A, ADEM0D

CALCulate<1|2>:MARKer<1...16>:X:SLIMits:RIGHT

This command sets the right limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

Note: The function is only available if the search limit for marker and delta marker is switched on ("[CALCulate<1|2>:MARKer<1...16>:X:SLIMits:STATe](#)").

Parameters

0 to MAX (frequency | sweep time)

Example

```
CALC:MARK:X:SLIM ON
```

Switches the search limit function on.

```
CALC:MARK:X:SLIM:RIGHT 20MHz
```

Sets the right limit of the search range to 20 MHz.

Characteristics

*RST value: - (is set to the right diagram border when switching on search limits)
 SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:MARKer<1...16>:X:SSIZe

This command defines the step size of the rotary knob for marker or delta marker value changes. It takes only effect in manual operation. It is available for all base unit measurements with the exception of statistics.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameter

STANdard	measurement point step size
POINts	measured value step size (number of measured values is defined via the " SENSe<1 2>: SWEEp:POINts " command)

Example

```
CALC:MARK:X:SSIZ POIN
```

Sets the measured value step size.

Characteristics

*RST value: STANdard
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:Y?

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

The query result is output in the unit determined with "[CALCulate<1|2>:UNIT:POWer](#)".

In the default setting, the output is made depending on the unit determined with "[CALCulate<1|2>:UNIT:POWer](#)"; only with linear level scaling is the output in %.

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK2 ON
Switches marker 2.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK2:Y?
Outputs the measured value of marker 2.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A, ADEMOD, WCDMA

CALCulate<1|2>:MARKer<1...16>:Y:PERCent

This command positions the selected marker to the given probability. If marker 2, 3 or 4 is selected and used as a delta marker, it is switched to marker mode. The numeric suffixes <1|2> are irrelevant for this command.

Note: The command is only available with the CCDF measurement switched on. The associated level value can be determined with the "[CALCulate<1|2>:MARKer<1...16>:X](#)" command.

Parameters

0 to 100%

Example

```
CALC1:MARK:Y:PERC 95PCT
Positions marker 1 to a probability of 95%.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A

6.2.2.15 CALCulate:MARKer:FUNCTion Subsystem

The CALCulate:MARKer:FUNCTion subsystem checks the marker functions in the instrument.

The following subsystems are included:

- ◆ "[CALCulate:MARKer:FUNCTion:HARMonics Subsystem](#)" on page "393"
- ◆ "[CALCulate:MARKer:FUNCTion:POWEr Subsystem](#)" on page "393"
- ◆ "[CALCulate:MARKer:FUNCTion:STRack Subsystem](#)" on page "404"
- ◆ "[CALCulate:MARKer:FUNCTion:SUMMary Subsystem](#)" on page "407"

Commands of the CALCulate:MARKer:FUNCTion Subsystem

- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation:CONTinuous](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation:HOLDoff](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation:SElect](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:CENTer](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:CSTep](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks\[:IMMEDIATE\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks:COUNT?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks:SORT](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks:X?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks:Y?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:MDEPth\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:MDEPth:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:MDEPth:SEARChsignal](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown:FREQUency?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown:QFACTOR?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown:STATe](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NDBDown:TIME?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NOISe\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:NOISe:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:REFerence](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:TOI\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:TOI:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:TOI:SEARChsignal](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:ZOOM](#)"

CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation[:STATe]

This command switches on or off the audio demodulator when the indicated marker is reached. With span > 0 the hold time can be defined at the corresponding marker position with "[CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation:HOLDoff](#)". In zero span the demodulation is permanently active. The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

CALC:MARK3:FUNC:DEM ON

Switches on the demodulation for marker 3.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCTion:DEModulation:CONTinuous

This command switches on or off the continuous demodulation for span >0. Thus acoustic monitoring of the signals can be performed. The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

CALC2:MARK3:FUNC:DEM:CONT ON

Switches on the continuous demodulation.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:DEModulation:HOLDoff

This command defines the hold time at the marker position for the demodulation with span > 0. The setting is independent of the selected marker, the suffixes <1|2> and <1...16> are irrelevant.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

10ms to 1000s

Example:

```
CALC:MARK:FUNC:DEM:HOLD 3s
```

Characteristics:

*RST value: - (DEModulation is set to OFF)

SCPI: device-specific

Mode:

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:DEModulation:SElect

This command selects the demodulation type for the audio demodulator. The command is independent of the selected marker, the suffixes 1|2 and 1 to 4 are irrelevant.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

AM | FM

Example

```
CALC:MARK:FUNC:DEM:SEL FM
```

Characteristics

*RST value: AM

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:CENTer

This command sets the center frequency equal to the frequency of the indicated marker.

If marker 2, 3 or 4 is selected and used as delta marker, the marker is switched to the marker mode.

The numeric suffix <1|2> are irrelevant for this command.

This command is an "event" and therefore has no *RST value and no query.

Example

```
CALC:MARK2:FUNC:CENT
```

Sets the center frequency to the frequency of marker 2.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer<1...16>:FUNCTION:CSTep

This command sets the step size of the center frequency to the X value of the current marker. If marker 2, 3 or 4 is selected and used as delta marker, it is switched to the marker mode.

The numeric suffix <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK3:FUNC:CST
```

Sets the center frequency to the same value as the frequency of marker 3.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer<1...16>:FUNCTION:FPEaks[:IMMEDIATE]

This command searches the selected trace for the indicated number of maxima.

The results are entered in a list and can be queried with the

"[CALCulate<1|2>:MARKer<1...16>:FUNCTION:FPEaks:X?](#)" and

"[CALCulate<1|2>:MARKer<1...16>:FUNCTION:FPEaks:Y?](#)" commands. The

number of maxima found can be queried with

"[CALCulate<1|2>:MARKer<1...16>:FUNCTION:FPEaks:COUNT?](#)". The trace to be examined is selected with "[CALCulate<1|2>:MARKer<1...16>:TRACe](#)". The order

of the results in the list can be defined with

"[CALCulate<1|2>:MARKer<1...16>:FUNCTION:FPEaks:SORT](#)".

The numeric suffixes <1|2> are irrelevant for this command.

Note: The number of maxima found depends on the waveform and value set for the Peak Excursion parameter ("[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)"), however, a maximum number of 200 maxima are determined. Only the signals which exceed their surrounding values at least by the value indicated by the peak excursion parameter will be recognized as maxima. Therefore, the number of maxima found is not automatically the same as the number of maxima desired.

Parameters

1 to 200

Example

INIT:CONT OFF

Switches to single sweep mode

INIT;*WAI

Starts measurement and synchronizes to end

CALC:MARK:TRAC 1

Sets marker 1 to trace 1

CALC:MARK:FUNC:FPE:SORT X

Sets the sort mode to increasing X values

CALC:MARK:FUNC:FPE 3

Searches the 3 highest maxima for trace 1

CALC:MARK:FUNC:COUN?

Queries the number of maxima found

CALC:MARK:FUNC:Y?

Queries the level of maxima found

CALC:MARK:FUNC:X?

Queries the frequencies (span <> 0) or time (span = 0) of maxima found.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCTion:FPEaks:COUNt?

This query reads out the number of maxima found during the search. If no search for maxima has been performed, 0 is returned.

The numeric suffixes <1|2> are irrelevant for this command.

Example

CALC:MARK:FUNC:FPE 3

Searches the 3 highest maxima for trace 1

CALC:MARK:FUNC:FPE:COUN?

Queries the number of maxima found

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:FPEaks:SORT

This command sets the sort mode for the search for maxima:

X: the maxima are sorted in the list of responses according to increasing X values

Y: the maxima are sorted in the list of responses according to decreasing Y values

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

X | Y

Example

```
CALC:MARK:FUNC:FPE:SORT Y
```

Sets the sort mode to decreasing y values

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:FPEaks:X?

This query reads out the list of X values of the maxima found. The number of available values can be queried with

"[CALCulate<1|2>:MARKer<1...16>:FUNCtion:FPEaks:COUNT?](#)".

With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values.

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
CALC:MARK:FUNC:FPE:SORT Y
```

Sets the sort mode to decreasing y values

```
CALC:MARK:FUNC:FPE 3
```

Searches the 3 highest maxima for trace 1

```
CALC:MARK:FUNC:FPE:COUN?
```

Queries the number of maxima found

```
CALC:MARK:FPE:FUNC:X?
```

Queries the frequencies (span <> 0) or. time (span = 0) of the maxima found

Return values

107.5E6, 153.8E6, 187.9E6
 frequencies in increasing order
 2.05E-3, 2.37E-3, 3.71e-3
 times in increasing order

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:FPEaks:Y?

This query reads out the list of X values of the maxima found. The number of available values can be queried with ["CALCulate<1|2>:MARKer<1...16>:FUNCtion:FPEaks:COUNT?"](#). With sort mode X, the X values are in increasing order; with sort mode Y the order corresponds to the decreasing order of the Y values. The numeric suffixes <1|2> are irrelevant for this command.

Example

```
CALC:MARK:FUNC:FPE:SORT Y
Sets the sort mode to decreasing y values
CALC:MARK:FUNC:FPE 3
Searches the 3 highest maxima for trace 1
CALC:MARK:FUNC:FPE:COUNT?
Queries the number of maxima found
CALC:MARK:FUNC:FPE:Y?
Queries the levels of the maxima found
```

Return values

-37.5, -58.3, -59.6
 level in decreasing order

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:MDEPth[:STATe]

This command switches on the measurement of the AM modulation depth. An AM-modulated carrier is required on the screen for correct operation. If necessary, marker 1 is previously activated and set to the largest signal available.

The level value of marker 1 is regarded as the carrier level. On activating the function, marker 2 and marker 3 are automatically set as delta markers symmetrically to the carrier to the adjacent maxima of the trace.

If the position of delta marker 2 is changed, delta marker 3 is moved symmetrically with respect to the reference marker (marker 1). If the position of delta marker 3 is changed, fine adjustment can be performed independently of delta marker 2.

The power at the marker positions is calculated from the measured levels.

The AM modulation depth is calculated from the ratio of power values at the reference marker and the delta markers. If the two AM sidebands differ in power, the average value of the two power values is used for calculating the AM modulation depth.

The numeric suffix <1|2> and <1...16> are irrelevant for this command.

Example

```
CALC:MARK:X 10MHZ
```

Sets the reference marker (marker 1) to the carrier signal at 10 MHz.

```
CALC:MARK:FUNC:MDEP ON
```

Switches on the modulation depth measurement.

```
CALC:DELT2:X 10KHZ
```

Sets delta markers 2 and 3 to the signals at 10 kHz from the carrier signal.

```
CALC:DELT3:X 9.999KHZ
```

Corrects the position of delta marker 3 relative to delta marker 2.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:MDEPth:RESult?

This command queries the AM modulation depth.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffix <1|2> and <1...16> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:X 10MHZ
```

Sets the reference marker (marker 1) to the carrier signal at 10 MHz.

```
CALC:MARK:FUNC:MDEP ON
```

Switches on the modulation depth measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:MDEP:RES?
```

Outputs the measured value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:MDEPth:SEARChsignal

This command starts the search of the signals required for the modulation depth measurement.

The numeric suffix <1|2> are irrelevant for this command.

Note: No new measurement is done. Only the currently available trace selected for the modulation depth measurement is used

Parameters

ONCE

Example

```
CALC:MARK:FUNC:MDEP:SEAR ONCE
```

Executes the search of an AM modulated signal at the currently available trace.

Characteristics

*RST value: -

SCPI: conform

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCTION:NDBDown

This command defines the level spacing of the two temporary markers to the right and left of marker 1.

The temporary markers T1 and T2 are positioned by n dB below the active reference marker. The value measured by these markers can be queried with "[CALCulate<1|2>:MARKer<1...16>:FUNCTION:NDBDown:RESult?](#)".

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

<numeric_value>

Example

```
CALC:MARK:FUNC:NDBD 3dB
```

Sets the level spacing to 3 dB.

Characteristics

*RST value: 6dB

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCTION:NDBDown:FREQUENCY?

This command queries the values of the two temporary markers for span>0. The frequency values are separated by comma and output in ascending order.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:NDBD ON
```

Switches on the n dB down function.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:NDBD:FREQ?
```

Outputs the frequencies of the temporary markers.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NDBDown:QFACTOR?

This command queries the Q factor (quality) of the measured bandwidth for span>0.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:NDBD ON
Switches on the n dB down function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:NDBD:QFAC?
Queries the Q factor of the measured bandwidth.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NDBDown:RESult?

This command queries the measured value. The value depends on the span setting:

- ◆ span > 0: frequency spacing of the two temporary markers (in Hz)
- ◆ span = 0: pulse width between the two temporary markers (in s)

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:NDBD ON
Switches on the n dB down function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:NDBD:RES?
Outputs the measured value.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NDBDown:STATe

This command switches the "N dB Down" function on or off. Marker 1 is activated first, if necessary.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:NDBD:STAT ON
Switches on the "N dB Down" function.
```

Characteristics

*RST value: OFF
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NDBDown:TIME?

This command queries the values of the two temporary markers in zero span. The time values are separated by comma and output in ascending order.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode
CALC:MARK:FUNC:NDBD ON
Switches on the n dB down function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:NDBD:TIME?
Outputs the time values of the temporary markers.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NOISe[:STATe]

This command switches the noise measurement on or off for all markers. The noise power density is measured at the position of the markers. The result can be queried with "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:NOISe:RESult?](#)". The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:NOIS ON
Switches on the noise measurement.
```

Characteristics

*RST value: OFF
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:NOISe:RESult?

This command queries the result of the noise measurement. A complete sweep with synchronization to the sweep end must be performed between switching on the function and querying the measured value in order to obtain a correct query result. This is only possible in single sweep mode. The numeric suffixes <1|2> are irrelevant for this command. This command is an event and therefore has no *RST value and no query.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK2 ON
Switches on marker 2.
CALC:MARK:FUNC:NOIS ON
Switches on noise measurement.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK2:NOIS:RES?
Outputs the noise result of marker 2.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:REFerence

This command sets the reference level to the power measured by the indicated marker. If marker 2, 3 or 4 is selected and used as delta marker, it is switched to marker mode.

The numeric suffix <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK2:FUNC:REF
Sets the reference level to the level of marker 2.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:TOI[:STATe]

This command initiates the measurement of the third-order intercept point. A two-tone signal with equal carrier levels is expected at the RF input of the instrument. Marker 1 and marker 2 (both normal markers) are set to the maximum of the two signals. Delta marker 3 and delta marker 4 are positioned to the intermodulation products. The delta markers can be modified separately afterwards with the "[CALCulate<1|2>:DELTAmarker<1...16>:X](#)" command.

The third-order intercept is calculated from the level spacing between the normal markers and the delta markers.

The numeric suffix <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:TOI ON
```

Switches on the measurement of the third-order intercept.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:TOI:RESult?

This command queries the third-order intercept point measurement.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffix <1|2> and <1...16> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:TOI ON
```

Switches the intercept measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:TOI:RES?
```

Outputs the measured value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:TOI:SEARChsignal

This command starts the search of the signals required for the third order intercept measurement.

The numeric suffix <1|2> are irrelevant for this command.

Note: No new measurement is done. Only the currently available trace selected for the TOI measurement is used

Parameters

ONCE

Example

```
CALC:MARK:FUNC:TOI:SEAR ONCE
```

Executes the search for 2 signals and their intermodulation product at the currently available trace.

Characteristics

*RST value: -

SCPI: conform

Mode

A

CALCulate<1|2>:MARKer<1...16>:FUNCtion:ZOOM

This command defines the range to be zoomed around marker 1. Marker 1 is activated first, if necessary.

The subsequent frequency sweep is stopped at the marker position and the frequency of the signal is counted. This frequency becomes the new center frequency, and the zoomed span is set. In order to recognize the end of the operation the synchronization to the sweep end should be activated. This is only possible in single sweep mode.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<numeric_value>

Example

```
INIT:CONT OFF
Switches to single sweep mode
CALC:MARK:FUNC:ZOOM 1kHz;*WAI
Activates zooming and waits for its end.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-F

6.2.2.16 CALCulate:MARKer:FUNCtion:HARMonics Subsystem

The CALCulate:MARKer:FUNCtion:POWER subsystem contains the commands to define the settings for harmonics measurement.

Commands of the CALCulate:MARKer:FUNCtion:HARMonics Subsystem

- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:BANDwidth:AUTO](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:DISTortion?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:LIST?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:NHARMonics](#)"
- ◆ "[CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:PRESet](#)"

CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics[:STATe]

This command activates/deactivates the harmonic distortion measurement. If the measurement is started in span > 0, the last span defines the search range for the first harmonic. The level is determined for the first harmonic. If the measurement is started in zero span, center frequency and level are used unchanged. The numeric suffix <1|2> and <1...16> are irrelevant for this command.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:HARM ON
Activates the harmonic distortion measurement.
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F, A-T

CALCulate<1|2>:MARKer<1...16>:FUNction:HARMonics:BANDwidth:AUTO

This command defines the resolution bandwidth of the harmonic in respect to the bandwidth of the first harmonic. For details refer to chapter "Instrument Functions", section "[Harmonic RBW Auto](#)".

The numeric suffix <1|2> are irrelevant for this command.

Parameter

OFF identical

ON a multiple

Example

```
CALC:MARK:FUNC:HARM:BAND:AUTO OFF
```

Deactivates the automatic bandwidth enlargement.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A-F, A-T

CALCulate<1|2>:MARKer<1...16>:FUNction:HARMonics:DISToRTion?

This command queries the distortion results (THD: total harmonic distortion). Two values separated by a comma are returned: <THD in %>, <THD in dB>.

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

The numeric suffix <1|2> and <1...16> are irrelevant for this command.

Parameters

TOTAL

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:HARM:NHARM 3
```

Sets the number of harmonics to be measured to 3.

```
CALC:MARK:FUNC:HARM ON
```

Activates the harmonic distortion measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end of the sweep.

```
CALC:MARK:FUNC:HARM:DIST? TOT
```

Returns the total distortion in % and dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F, A-T

CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:LIST?

This command reads out the list of the harmonics. The first value is the absolute power of the first harmonic (the unit is set via the `CALCulate<1|2>:UNIT:POWER` command). The following values are relative to the carrier signal and have the unit dB. They are separated by commas and correspond to the harmonics to be measured (set via the ["`CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:NHARmonics`"](#) command).

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

The numeric suffixes <1|2> are not relevant.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:HARM:NHARM 3
```

Sets the number of harmonics to be measured to 3.

```
CALC:MARK:FUNC:HARM ON
```

Activates the harmonic distortion measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end of the sweep.

```
CALC:MARK:FUNC:HARM:LIST?
```

Returns the values for the 3 measured harmonics.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-F, A-T

CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:NHARmonics

This command sets the number of harmonics to be measured.
 The numeric suffix <1|2> and <1...16> are irrelevant for this command.

Parameters

1...26

Example

```
CALC:MARK:FUNC:HARM:NHARM 3
```

Sets the number of harmonics to be measured to 3.

Characteristics

*RST value: 10
 SCPI: device-specific

Mode

A-F, A-T

CALCulate<1|2>:MARKer<1...16>:FUNCtion:HARMonics:PRESet

This command optimizes the device settings depending on the span setting:

span > 0	Frequency and level of the first harmonic are determined and used for the measurement list.
zero span	The level of the first harmonic is determined. The frequency remains unchanged.

The numeric suffixes <1|2> and <1...16> are irrelevant.
 This command is an event and therefore has no *RST value.

Example

```
CALC:MARK:FUNC:HARM:PRES
```

Optimizes the device settings for the harmonic measurement.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-F, A-T

6.2.2.17 CALCulate:MARKer:FUNCTION:POWER Subsystem

The CALCulate:MARKer:FUNCTION:POWER subsystem contains the commands for control of power measurement.

Commands of the CALCulate:MARKer:FUNCTION:POWER Subsystem

- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER:MODE](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER:PRESet](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER:RESult:PHZ](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:POWER:SElect](#)"

Further information

- ◆ "[Predefined CP / ACLR Standards](#)" on page "398"

6.2.2.18 Predefined CP / ACLR Standards

Parameter	Standard
W-CDMA 3GPP FWD	W-CDMA 3.84 MHz forward
W-CDMA 3GPP REV	W-CDMA 3.84 MHz reverse
CDMA IS95A FWD	CDMA IS95A forward
CDMA IS95A REV	CDMA IS95A reverse
CDMA IS95C Class 0 FWD	CDMA IS95C Class 0 forward
CDMA IS95C Class 0 REV	CDMA IS95C Class 0 reverse
CDMA J-STD008 FWD	CDMA J-STD008 forward
CDMA J-STD008 REV	CDMA J-STD008 reverse
CDMA IS95C Class 1 FWD	CDMA IS95C Class 1 forward
CDMA IS95C Class 1 REV	CDMA IS95C Class 1 reverse
CDMA 2000	CDMA 2000
TD SCDMA FWD	TD-SCDMA forward
TD SCDMA REV	TD-SCDMA reverse
WLAN 802.11A	WLAN 802.11A
WLAN 802.11B	WLAN 802.11B
WiMAX	WiMAX
WIBRO	WIBRO
RFID 14443	RFID 14443
EUTRa	EUTRA/LTE Square
REUTRa	EUTRA/LTE Square/RRC
TETRA	TETRA
PDC	PDC
PHS	PHS
CDPD	CDPD

CALCulate<1|2>:MARKer:FUNCtion:POWER[:STATe]

This command switches off the power measurement.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value.

Parameters

OFF

Example

```
CALC:MARK:FUNC:POW OFF
```

Switches off the power measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:POWER:MODE

This commands defines the method by which the channel power values are calculated from the current trace.

The numeric suffixes <1|2> are not relevant.

Parameter

WRITe	The channel power and the adjacent channel powers are calculated directly from the current trace
MAXHold	The power values are calculated from the current trace and compared with the previous power value using a maximum algorithm.

Example

```
CALC:MARK:FUNC:POW:MODE MAXH
Sets the Maxhold channel power mode.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:POWER:PRESet

This command selects the power measurement setting for a standard and previously switches on the corresponding measurement, if required.

The configuration for a standard comprises of the parameters weighting filter, channel bandwidth and spacing, resolution and video bandwidth, as well as detector and sweep time.

The numeric suffixes <1|2> are not relevant.

Note: The settings for standards IS95A and C differ as far as the calculation method of channel spacings is concerned. For IS95A and J-STD008 the spacing is calculated from the center of the main channel to the center of the corresponding adjacent channel, for IS95C from the center of the main channel to the nearest border of the adjacent channel.

Parameters

EUTRa | REUTra | TETRA | PDC | PHS | CDPD | FWCDma | RWCDma |
FW3Gppcdma | RW3Gppcdma | FIS95A | RIS95A | FIS95C0 | RIS95C0
| FIS95C1 | RIS95C1 | FJ008 | RJ008 | TCDMa | FTCDMa | RTCDMa
| AWLan | BWLan | WIMax | WIBRo | RFID14443 | NONE

For further details refer to "[Predefined CP / ACLR Standards](#)" on page "398".

Example

```
CALC:MARK:FUNC:POW:PRES TETRA
```

Selects the standard setting for TETRA

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:POWER:RESult?

This command queries the result of the performed power measurement. If necessary, the measurement is switched on prior to the query.

The channel spacings and channel bandwidths are configured in the "[SENSe:POWer Subsystem](#)" on page "501".

To obtain a correct result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is a query and therefore has no *RST value.

Parameter

ACPower	<p>Adjacent-channel power measurement</p> <p>Results are output in the following sequence, separated by commas:</p> <ul style="list-style-type: none"> Power of transmission channel Power of lower adjacent channel Power of upper adjacent channel Power of lower alternate channel 1 Power of upper alternate channel 1 Power of lower alternate channel 2 Power of upper alternate channel 2 <p>The number of measured values returned depends on the number of adjacent/alternate channels selected with "[SENSe<1 2>]:[POWer:ACHannel:ACPairs]".</p> <p>With logarithmic scaling (RANGE LOG), the power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If "[SENSe<1 2>]:[POWer:ACHannel:MODE]" is set to REL, the adjacent/alternate-channel power is output in dB.</p>
CN	<p>Measurement of carrier-to-noise ratio</p> <p>The carrier-to-noise ratio in dB is returned.</p>
CNO	<p>Measurement of carrier-to-noise ratio referenced to 1 Hz bandwidth.</p> <p>The carrier-to-noise ratio in dB/Hz is returned.</p>
CPOWer	<p>Channel power measurement</p>

Remote Control - Description of Analyzer Commands

	In a Spectrum Emission Mask measurement, the query returns the power result for the reference range, if this power reference type is selected.
	With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.
MCACpower	<p>Channel/adjacent-channel power measurement with several carrier signals</p> <p>Results are output in the following sequence, separated by commas:</p> <ul style="list-style-type: none"> Power of carrier signal 1 to 12 in ascending order Total power of all carrier signals Power of lower adjacent channel Power of upper adjacent channel Power of lower alternate channel 1 Power of upper alternate channel 1 Power of lower alternate channel 2 Power of upper alternate channel 2 <p>The number of measured values returned depends on the number of carrier signals and adjacent/alternate channels selected with "[SENSe<1 2>:]POWer:ACHannel:TXChannel:COUNT" and "[SENSe<1 2>:]POWer:ACHannel:ACPairs".</p> <p>If only one carrier signal is measured, the total value of all carrier signals will not be output.</p> <p>With logarithmic scaling (RANGE LOG), the power is output in dBm; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If "[SENSe<1 2>:]POWer:ACHannel:MODE" is set to REL, the adjacent/alternate-channel power is output in dB.</p>
OBANdwidth	Measurement of occupied bandwidth
OBWidth	The occupied bandwidth in Hz is returned.
PPOWer	<p>Power of the highest peak</p> <p>In a Spectrum Emission Mask measurement, the query returns the power result for the reference range, if this power reference type is selected.</p>

Example of channel/adjacent-channel power measurement

```
POW:ACH:ACP 3
```

Sets the number of adjacent/alternate channels to 3.

```
POW:ACH:BAND 30KHZ
```

Sets the bandwidth of the transmission channel to 30 kHz.

```
POW:ACH:BAND:ACH 40KHZ
```

Sets the bandwidth of each adjacent channel to 40 kHz.

```
POW:ACH:BAND:ALT1 50KHZ
```

Sets the bandwidth of each alternate channel to 50 kHz.

```
POW:ACH:BAND:ALT2 60KHZ
```

Sets the bandwidth of alternate channel 2 to 60 kHz.

POW:ACH:SPAC 30KHZ

Sets the spacing between the transmission channel and the adjacent channel to 30 kHz, the spacing between the transmission channel and alternate channel 1 to 60 kHz, and the spacing between the transmission channel and alternate channel 2 to 90 kHz.

POW:ACH:SPAC:ALT1 100KHZ

Sets the spacing between the alternate adjacent channels and the TX channel. For details refer to the

"[\[SENSe<1|2>:\]POWer:ACHannel:SPACing:ALTErnate<1...11>](#)" command.

POW:ACH:SPAC:ALT2 140KHZ

Sets the spacing between the transmission channel and alternate channel 2 to 140 kHz.

POW:ACH:MODE ABS

Switches on absolute power measurement.

CALC:MARK:FUNC:POW:SEL ACP

Switches on the adjacent-channel power measurement.

INIT:CONT OFF

Switches over to single sweep mode.

INIT;*WAI

Starts a sweep and waits for the end of the sweep.

CALC:MARK:FUNC:POW:RES? ACP

Queries the result of adjacent-channel power measurement.

POW:ACH:REF:AUTO ONCE

Defines the measured channel power as the reference value for relative power measurements.

Note: If the channel power only is to be measured, all commands relating to adjacent/alternate channel bandwidth and channel spacings are omitted. The number of adjacent/alternate channels is set to 0 with "[\[SENSe<1|2>:\]POWer:ACHannel:ACPairs](#)".

Example of occupied bandwidth measurement

POW:BAND 90PCT

Defines 90% as the percentage of the power to be contained in the bandwidth range to be measured.

INIT:CONT OFF

Switches over to single sweep mode.

INIT;*WAI

Starts a sweep and waits for the end of the sweep.

CALC:MARK:FUNC:POW:RES? OBW

Queries the occupied bandwidth measured.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-F, WCDMA

CALCulate<1|2>:MARKer:FUNCtion:POWer:RESult:PHZ

This command switches the query response of the power measurement results between output of absolute values and output referred to the measurement bandwidth.

The measurement results are output with the "[CALCulate<1|2>:MARKer:FUNCtion:POWer:RESult?](#)" command. The numeric suffixes <1|2> are not relevant.

Parameter

ON Results output: channel power density in dBm/Hz
 OFF Results output: channel power is displayed in dBm

Example

```
CALC:MARK:FUNC:POW:RES:PHZ ON
```

Output of results referred to the channel bandwidth.

For details on a complete measurement example refer to "[Example of channel/adjacent-channel power measurement](#)".

Characteristics

*RST value: OFF
 SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:POWer:SELEct

This command selects - and switches on - specified power measurement type. The channel spacings and channel bandwidths are configured in the "[SENSe:POWer Subsystem](#)" on page "501". The numeric suffixes <1|2> are not relevant.

Note: If CPOWer is selected, the number of adjacent channels ("[\[SENSe<1|2>:\]POWer:ACHannel:ACPairs](#)") is set to 0. If ACPOWer is selected, the number of adjacent channels is set to 1, unless adjacent-channel power measurement is switched on already.

The channel/adjacent-channel power measurement is performed for the trace selected with "[\[SENSe<1|2>:\]POWer:TRACe](#)".

The occupied bandwidth measurement is performed for the trace on which marker 1 is positioned. To select another trace for the measurement, marker 1 is to be positioned on the desired trace by means of "[CALCulate<1|2>:MARKer<1...16>:TRACe](#)".

Parameter

ACPower	Adjacent-channel power measurement with a single carrier signal
CPOWer	Channel power measurement with a single carrier signal (equivalent to adjacent-channel power measurement with <i>NO. OF ADJ CHAN = 0</i>)
MCACpower	Channel/adjacent-channel power measurement with several carrier signals
OBANdwidth OBWidth	Measurement of occupied bandwidth
CN	Measurement of carrier-to-noise ratio
CNO	Measurement of carrier-to-noise ratio referenced to 1 Hz bandwidth

Example

```
CALC:MARK:FUNC:POW:SEL ACP
```

Switches on adjacent-channel power measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

6.2.2.19 CALCulate:MARKer:FUNCtion:STRack Subsystem

The CALCulate:MARKer:FUNCtion:STRack subsystem defines the settings of the signal track.

Commands of the CALCulate:MARKer:FUNCtion:STRack Subsystem

- ◆ "[CALCulate<1|2>:MARKer:FUNCtion:STRack\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCtion:STRack:BANDwidth|BWIDth](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCtion:STRack:THReshold](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCtion:STRack:TRACe](#)"

CALCulate<1|2>:MARKer:FUNCtion:STRack[:STATe]

This command switches the signal-track function on or off.
 With signal track activated, the maximum signal is determined after each frequency sweep and the center frequency is set to the frequency of this signal.
 Thus with drifting signals the center frequency follows the signal.
 The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:STR ON
```

Switches on the signal track function.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:STRack:BANDwidth|BWIDth

These commands have the same function. They define the bandwidth around the center frequency within which the largest signal is searched.
 The numeric suffixes <1|2> are not relevant.

Note: The entry of the search bandwidth is only possible if the Signal Track function is switched on ("[CALCulate<1|2>:MARKer:FUNCtion:STRack\[:STATe\]](#)").

Parameters

10Hz to MAX (span)

Example

```
CALC:MARK:FUNC:STR:BAND 1MHZ
```

Sets the search bandwidth to 1 MHz.

```
CALC:MARK:FUNC:STR:BWID 1MHZ
```

Alternative command for the same function.

Characteristics

*RST value: - (= span/10 on activating the function)

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:STRack:THReshold

This command defines the threshold above which the largest signal is searched for.

The response unit depends on the settings defined with "[CALCulate<1|2>:UNIT:POWer](#)".

The numeric suffixes <1|2> are not relevant.

Note: The entry of the search bandwidth is only possible if the Signal Track function is switched on ("[CALCulate<1|2>:MARKer:FUNCtion:STRack\[:STATe\]](#)").

Parameters

-330dBm to +30dBm

Example

```
CALC:MARK:FUNC:STR:THR -50DBM
```

Sets the threshold for signal tracking to -50 dBm.

Characteristics

*RST value: -120 dBm

SCPI: device-specific

Mode

A-F

CALCulate<1|2>:MARKer:FUNCtion:STRack:TRACe

This command defines the trace on which the largest signal is searched for.

The numeric suffixes <1|2> are not relevant.

Parameters

1 to 6

Example

```
CALC:MARK:FUNC:STR:TRAC 3
```

Defines trace 3 as the trace for signal tracking.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

A-F

6.2.2.20 CALCulate:MARKer:FUNCTION:SUMMARY Subsystem

This subsystem contains the control commands for the power functions in zero span.

Commands of the CALCulate:MARKer:FUNCTION:SUMMARY Subsystem

- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:MSUMmary?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:AOff](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:AVERage](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:MEAN\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:MEAN:AVERage:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:MEAN:PHOLd:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:MEAN:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:MODE](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:PHOLd](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:PPEak\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:PPEak:AVERage:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:PPEak:PHOLd:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:PPEak:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:REFerence:AUTO](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:RMS\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:RMS:AVERage:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:RMS:PHOLd:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:RMS:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:SDEVIation\[:STATe\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:SDEVIation:AVERage:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:SDEVIation:PHOLd:RESult?](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:SUMMARY:SDEVIation:RESult?](#)"

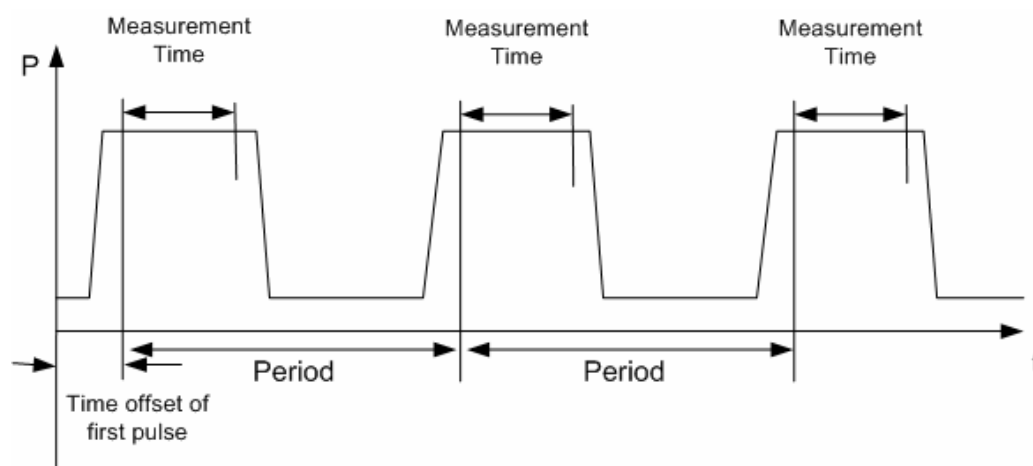
CALCulate<1|2>:MARKer:FUNCTION:MSUMmary?

The commands of this subsystem are used to determine the power of a sequence of signal pulses having the same interval, as are typical for the slots of a GSM signal, for example. The number of pulses to be measured as well as the measurement time and the period can be set. To define the position of the first pulse in the trace, a suitable offset can be entered.

The evaluation is performed on the measurement data of a previously recorded trace. The data recorded during the set measurement time is combined to a measured value for each pulse according to the detector specified and the indicated number of results is output as a list.

Trace 1 is always used by the function.

The numeric suffixes <1|2> are not relevant.



Trace start

Parameters

<time offset of first pulse>, <measurement time>, <period>, < # of pulses to measure>

Example

```
DISP:WIND:TRAC:Y:RLEV -10dBm
```

Sets the reference level to 10 dB

```
INP:ATT 30 dB
```

Sets the input attenuation to 30 dB

```
FREQ:CENT 935.2MHz;SPAN 0Hz
```

Sets the receive frequency to 935.2 MHz and the span to 0 Hz

```
BAND:RES 1MHz;VID 3MHz
```

Sets the resolution bandwidth to 1 MHz and the video bandwidth to 3 MHz

```
DET RMS
```

Sets the RMS detector

```
TRIG:SOUR VID;LEV:VID 50 PCT
```

Selects the trigger source VIDEo and sets the level of the video trigger source to 50 PCT

```
SWE:TIME 50ms
```

Sets the sweep time to 50 ms

```
INIT;*WAI
```

Starts the measurement with synchronization

```
CALC:MARK:FUNC:MSUM? 50US,450US,576.9US,8
```

Queries 8 bursts with an offset of 50 μ s, a test time of 450 μ s and a period of 576.9 μ s

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary[:STATe]

This command switches on or off the previously selected power measurements in zero span. Thus one or several measurements can be first selected and then switched on and off together with

"[CALCulate<1|2>:MARKer:FUNCtion:SUMMary\[:STATe\]](#)".

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:SUMM:STAT ON
```

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AOFF

This command switches off all measurements in zero span.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK:FUNC:SUMM:AOFF
```

Switches off the functions for power measurement in zero span.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AVERage

This command switches on or off averaging for the active power measurement in zero span.

Averaging is reset by switching it off and on again.

The number of results required for the calculation of average is defined with "[\[SENSe<1|2>:\]AVERage:COUNt](#)".

Synchronization to the end of averaging is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:AVER ON
```

Switches on the calculation of average.

```
AVER:COUN 200
```

Sets the measurement counter to 200.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:MEAN[:STATe]

This command switches on or off the measurement of the mean value.

The numeric suffixes <1|2> are not relevant.

Note: The measurement is performed on the trace on which marker 1 is positioned. In order to evaluate another trace, marker 1 must be positioned on another trace with "[CALCulate<1|2>:MARKer<1...16>:TRACe](#)".

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:SUMM:MEAN ON
```

Switches on the function.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:MEAN:AVERage:RESult?

This command queries the result of the measurement of the averaged mean value. The query is only possible if averaging has been activated previously using "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AVERage](#)".

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:MEAN ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:AVER ON
```

Switches on the average value calculation.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:MEAN:AVER:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMery:MEAN:PHOLd:RESult?

This command queries the result of the measurement of the mean value with active peak hold. The query is only possible if the peak hold function has been switched on previously using

"[CALCulate<1|2>:MARKer:FUNCtion:SUMMery:PHOLd](#)".

The query is possible only if the peak hold function is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:MEAN ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:PHOL ON
```

Switches on the peak value measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:MEAN:PHOL:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMery:MEAN:RESult?

This command queries the result of the measurement of the mean value.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:SUMM:MEAN ON
Switches on the function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:SUMM:MEAN:RES?
Outputs the result.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:MODE

This command selects absolute or relative power measurement in zero span. The reference power for relative measurement is defined with "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:REFerence:AUTO](#)". If the reference power is not defined, the value 0 dBm is used. The numeric suffixes <1|2> and <1...16> are irrelevant for this command.

Parameters

ABSolute | RELative

Example

```
CALC:MARK:FUNC:SUMM:MODE REL
Switches the power measurement in zero span to relative.
```

Characteristics

*RST value: ABSolute
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PHOLd

This command switches on or off the peak-hold function for the active power measurement in zero span. The peak-hold function is reset by switching it off and on again. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:SUMM:PHOL ON
```

Switches on the function.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PPEak[:STATe]

This command switches on or off the measurement of the positive peak value.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:SUMM:PPE ON
```

Switches on the function.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PPEak:AVERage:RESult?

This command is used to query the result of the measurement of the averaged positive peak value. The query is only possible if averaging has been activated previously using "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AVERage](#)".

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:PPE ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:AVER ON
```

Switches on the calculation of average.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:PPE:AVER:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PPEak:PHOLd:RESult?

This command is used to query the result of the measurement of the positive peak value with active peak hold function. The query is only possible if the peak hold function has been activated previously using

["CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PHOLd"](#).

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:PPE ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:PHOL ON
```

Switches on the measurement of the peak value.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:PPE:PHOL:RES?
```

Outputs the result.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PPEak:RESult?

This command is used to query the result of the measurement of the positive peak value. The measurement may have to be switched on previously. A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode. The numeric suffixes <1|2> are not relevant. This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:SUMM:PPE ON
Switches on the function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:SUMM:PPE:RES?
Outputs the result.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:REFerence:AUTO

This command sets the currently measured average value ("[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:MEAN\[:STATe\]](#)") and RMS value ("[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:RMS\[:STATe\]](#)") as reference values for relative measurements in zero span. If the measurement of RMS value and average is not activated, the reference value 0 dBm is used. If the function "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AVERage](#)" or "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PHOLd](#)" is switched on, the current value is the accumulated measurement value at the time considered. The numeric suffixes <1|2> and <1...16> are irrelevant for this command. This command is an event and therefore has no *RST value and no query.

Parameters

ONCE

Example

CALC:MARK:FUNC:SUMM:REF:AUTO ONCE

Takes the currently measured power as reference value for the relative power measurement in zero span.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:RMS[:STATe]

This command switches on or off the measurement of the effective (RMS) power. If necessary the function is switched on previously. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

CALC:MARK:FUNC:SUM:RMS ON

Switches on the function.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:RMS:AVERAge:RESult?

This command queries the result of the measurement of the averaged RMS value. The query is only possible if averaging has been activated previously using "[CALCulate<1|2>:MARKer:FUNCtion:SUMMary:AVERAge](#)".

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:SUMM:RMS ON
Switches on the function.
CALC:MARK:FUNC:SUMM:AVER ON
Switches on the average value calculation.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:SUMM:RMS:AVER:RES?
Outputs the result.
```

Characteristics

*RST- value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:RMS:PHOLd:RESult?

This command queries the result of the measurement of the RMS value with active peak hold. The query is only possible only if the peak hold function has been activated previously using

["CALCulate<1|2>:MARKer:FUNCtion:SUMMary:PHOLd"](#).

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:SUMM:RMS ON
Switches on the function.
CALC:MARK:FUNC:SUMM:PHOL ON
Switches on the peak value measurement.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:SUMM:RMS:PHOL:RES?
Outputs the result.
```

Characteristics

*RST- value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:RMS:RESult?

This command queries the result of the measurement of the RMS power value. A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode. The numeric suffixes <1|2> are not relevant. This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
Switches to single sweep mode.
CALC:MARK:FUNC:SUMM:RMS ON
Switches on the function.
INIT;*WAI
Starts a sweep and waits for the end.
CALC:MARK:FUNC:SUMM:RMS:RES?
Outputs the result.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:SDEViation[:STATe]

This command switches on or off the measurement of the standard deviation. On switching on the measurement, the mean power measurement is switched on as well. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:MARK:FUNC:SUMM:SDEV ON
Switches on the measurement of the standard deviation.
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:SDEViation:AVERage:RESult?

This command queries the result of the averaged standard deviation determined in several sweeps. The query is possible only if averaging is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:SDEV ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:AVER ON
```

Switches on the calculation of average.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:MEAN:SDEV:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:SDEViation:PHOLd:RESult?

This command queries the maximum standard deviation value determined in several sweeps. The query is possible only if the peak hold function is active.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:SDEV ON
```

Switches on the function.

```
CALC:MARK:FUNC:SUMM:PHOL ON
```

Switches on the peak value measurement.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:SDEV:PHOL:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:MARKer:FUNCtion:SUMMary:SDEViation:RESult?

This command queries the results of the standard deviation measurement.

A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a correct query result. This is only possible in single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK:FUNC:SUMM:SDEV ON
```

Switches on the function.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK:FUNC:SUMM:SDEV:RES?
```

Outputs the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-T

6.2.2.21 CALCulate:MATH Subsystem

The CALCulate:MATH subsystem allows data from the SENSE-subsystem to be processed in numeric expressions.

Commands of the CALCulate:MATH Subsystem

- ◆ "[CALCulate<1|2>:MATH:EXpression\]:DEFine\]](#)"
- ◆ "[CALCulate<1|2>:MATH:POSition](#)"
- ◆ "[CALCulate<1|2>:MATH:STATe](#)"

CALCulate<1|2>:MATH[:EXpression]][:DEFine]

This command defines the mathematical expression for relating traces to trace1.

Parameter

(TRACE1-TRACE2)	Subtracts trace 2 from trace 1.
(TRACE1-TRACE3)	Subtracts trace 3 from trace 1.
(TRACE1-TRACE4)	Subtracts trace 4 from trace 1.
(TRACE1-TRACE5)	Subtracts trace 5 from trace 1.
(TRACE1-TRACE6)	Subtracts trace 6 from trace 1.

Example

```
CALC1:MATH (TRACE1 - TRACE2)
```

Selects the subtraction of trace 2 from trace 1.

Characteristics

*RST value: -
SCPI: conform

Mode

A

CALCulate<1|2>:MATH:POSition

This command defines the position of the result of the trace mathematics. The indication is in % of the screen height, with 100% corresponding to the upper diagram border.

Parameters

-100PCT to 200PCT

Example

```
CALC:MATH:POS 50PCT
```

Sets the position to the horizontal diagram center.

Characteristics

*RST value: 50PCT

SCPI: device-specific

Mode

A

CALCulate<1|2>:MATH:STATe

This command switches the mathematical relation of traces on or off.

Parameters

ON | OFF

Example

```
CALC:MATH:STAT ON
```

Switches on the trace mathematics.

Characteristics

*RST value: OFF

SCPI: conform

Mode

A

CALCulate<1|2>:MATH:MODE

This command selects the averaging method for the average trace mode.

The numeric suffixes <1|2> are irrelevant.

For details see the "[Average Mode](#)" softkey.

Parameters

LINear | LOGarithmic | POWer

Example

```
CALC:MATH:MODE LIN
```

Selects linear averaging for average trace mode.

Characteristics

*RST value: LOG

SCPI: device-specific

Mode

A

6.2.2.22 CALCulate:PSEarch|PEAKsearch Subsystem

The CALCulate:PSEarch|PEAKsearch subsystem contains the remote commands for Spurious Emissions measurements. Both groups of commands (PSEarch and PEAKsearch) perform the same functions.

Commands of the CALCulate:PSEarch|PEAKsearch Subsystem

- ◆ "[CALCulate<1|2>:PSEarch|PEAKsearch\[:IMMediate\]](#)"
- ◆ "[CALCulate<1|2>:PSEarch|PEAKsearch:AUTO](#)"
- ◆ "[CALCulate<1|2>:PSEarch|PEAKsearch:MARGin](#)"
- ◆ "[CALCulate<1|2>:PSEarch|PEAKsearch:PSHow](#)"
- ◆ "[CALCulate<1|2>:PSEarch|PEAKsearch:SUBRanges](#)"

CALCulate<1|2>:PSEarch|PEAKsearch[:IMMediate]

This command determines the list of the subrange maximums from the existing sweep results.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:PSE
```

Starts to determine the list.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate<1|2>:PSEarch|PEAKsearch:AUTO

For details refer to "[CALCulate<1|2>:ESPectrum:PSEarch|PEAKsearch:AUTO](#)" on page "329".

CALCulate<1|2>:PSEarch|PEAKsearch:MARGin

For details refer to "[CALCulate<1|2>:ESPectrum:PSEarch|PEAKsearch:PSHow](#)" on page "330".

CALCulate<1|2>:PSEarch|PEAKsearch:PSHow

For details refer to "[CALCulate<1|2>:ESPectrum:PSEarch|PEAKsearch:MARGin](#)" on page "330".

CALCulate<1|2>:PSEarch|PEAKsearch:SUBRanges

This command sets the number of peaks per range that are stored in the list. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range.

The numeric suffixes <1|2> are not relevant.

Parameters

1 to 50

Example

```
CALC:PSE:SUBR 10
```

Sets 10 peaks per range to be stored in the list.

Characteristics

*RST value: 25

SCPI: device-specific

Mode

A

6.2.2.23 CALCulate:STATistics Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the instrument.

Commands of the CALCulate:STATistics Subsystem

- ◆ "[CALCulate:STATistics:APD\[:STATe\]](#)"
- ◆ "[CALCulate:STATistics:CCDF\[:STATe\]](#)"
- ◆ "[CALCulate:STATistics:CCDF:X<1..6>?](#)"
- ◆ "[CALCulate:STATistics:NSAMples](#)"
- ◆ "[CALCulate:STATistics:PRESet](#)"
- ◆ "[CALCulate:STATistics:RESult<1..6>?](#)"
- ◆ "[CALCulate:STATistics:SCALE:AUTO](#)"
- ◆ "[CALCulate:STATistics:SCALE:X:RANGe](#)"
- ◆ "[CALCulate:STATistics:SCALE:X:RLEVel](#)"
- ◆ "[CALCulate:STATistics:SCALE:Y:LOWer](#)"
- ◆ "[CALCulate:STATistics:SCALE:Y:UNIT](#)"
- ◆ "[CALCulate:STATistics:SCALE:Y:UPPer](#)"

CALCulate:STATistics:APD[:STATe]

This command switches on or off the measurement of amplitude distribution (APD). On activating this function, the CCDF measurement is switched off.

Parameters

ON | OFF

Example

```
CALC:STAT:APD ON
```

Switches on the APD measurement.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate:STATistics:CCDF[:STATe]

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF). On activating this function, the APD measurement is switched off.

Parameters

ON | OFF

Example

```
CALC:STAT:CCDF ON
```

Switches on the CCDF measurement.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

CALCulate:STATistics:CCDF:X<1..6>?

This command queries the results of the complementary cumulative distribution function (CCDF) for the specified probability (corresponding to the [Percent Marker](#) in the display). The suffix of X defines the trace number.

Parameters

P0_01: Level value for 0.01% probability

P0_1: Level value for 0.1% probability

P1: Level value for 1% probability

P10: Level value for 10% probability

Example

```
CALC:STAT:CCDF:X1? P10
```

Returns the level values that are over 10% above the mean value.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate:STATistics:NSAMples

This command sets the number of measurement points to be acquired for the statistical measurement functions.

Parameters

100 to 1E9

Example

```
CALC:STAT:NSAM 500
```

Sets the number of measurement points to be acquired to 500.

Characteristics

*RST value: 100000

SCPI: device-specific

Mode

A

CALCulate:STATistics:PRESet

This command resets the scaling of the X and Y axes in a statistical measurement.

The following values are set:

x-axis ref level: -20 dBm

x-axis range APD: 100 dB

x-axis range CCDF: 20 dB

y-axis upper limit: 1.0

y-axis lower limit: 1E-6

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:STAT:PRES
```

Resets the scaling for statistical functions

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate:STATistics:RESult<1...6>?

This command reads out the results of statistical measurements of a recorded trace. The trace is selected with the numeric suffix <1...6> attached to RESult.

Parameters

The required result is selected via the following parameters:

MEAN	Average (=RMS) power in dBm measured during the measurement time.
PEAK	Peak power in dBm measured during the measurement time.
CFACtor	Determined CREST factor (= ratio of peak power to average power) in dB.
ALL	Results of all three measurements mentioned before, separated by commas: <mean power>,<peak power>,<crest factor>

Example

```
CALC:STAT:RES2? ALL
```

Reads out the three measurement results of trace 2. Example of answer string: 5.56,19.25,13.69 i.e. mean power: 5.56 dBm, peak power 19.25 dBm, CREST factor 13.69 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:AUTO

This command optimizes the level setting of the instrument depending on the measured peak power, in order to obtain maximum instrument sensitivity.

To obtain maximum resolution, the level range is set as a function of the measured spacing between peak power and the minimum power for the APD measurement and of the spacing between peak power and mean power for the CCDF measurement. In addition, the probability scale for the number of test points is adapted.

This command is an event and therefore has no *RST value and no query.

Note: Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.

Parameters

ONCE

Example

```
CALC:STAT:SCALE:AUTO ONCE;*WAI
```

Adapts the level setting for statistical measurements.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:X:RANGE

This command defines the level range for the x-axis of the measurement diagram.

The setting is identical to the level range setting defined with the "[DISPlay:WINDow<1|2>:TRACe<1...6>:Y:SCALE](#)" command.

Parameters

10dB to 200dB

Example

```
CALC:STAT:SCALE:X:RANG 20dB
```

Characteristics

*RST value: 100dB

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:X:RLEVel

This command defines the reference level for the x-axis of the measurement diagram. The setting is identical to the reference level setting using the

"[DISPlay:WINDow<1|2>:TRACe<1...6>:Y:SCALE:RLEVel](#)" command.

With the reference level offset <> 0 the indicated value range of the reference level is modified by the offset.

The unit depends on the setting performed with "[CALCulate<1|2>:UNIT:POWer](#)".

Parameters

-120dBm to 20dBm

Example

```
CALC:STAT:SCAL:X:RLEV -60dBm
```

Characteristics

*RST value: -20dBm

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:Y:LOWer

This command defines the lower limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Parameters

1E-9 to 0.1

Example

```
CALC:STAT:SCAL:Y:LOW 0.001
```

Characteristics

*RST value: 1E-6

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:Y:UNIT

This command defines the scaling type of the y-axis.

Parameters

PCT | ABS

Example

```
CALC:STAT:SCAL:Y:UNIT PCT
```

Sets the percentage scale.

Characteristics

*RST value: ABS

SCPI: device-specific

Mode

A

CALCulate:STATistics:SCALE:Y:UPPer

This command defines the upper limit for the y-axis of the diagram in statistical measurements. Since probabilities are specified on the y-axis, the entered numeric values are dimensionless.

Parameters

1E-8 to 1.0

Example

CALC:STAT:Y:UPP 0.01

Characteristics

*RST value: 1.0

SCPI: device-specific

Mode

A

6.2.2.24 CALCulate:THReshold Subsystem

The CALCulate:THReshold subsystem controls the threshold value for the maximum/minimum search of markers.

Commands of the CALCulate:THReshold Subsystem

- ◆ "[CALCulate<1|2>:THReshold](#)"
- ◆ "[CALCulate<1|2>:THReshold:STATe](#)"

CALCulate<1|2>:THReshold

This command defines the threshold value for the maximum/minimum search of markers with marker search functions. The associated display line is automatically switched on.

The numeric suffixes <1|2> are not relevant.

Parameters

MINimum to MAXimum (depending on current unit)

Example

CALC:THR -82DBM

Sets the threshold value to -82 dBm.

Characteristics

*RST value: - (STATe to OFF)

SCPI: device-specific

Mode

A, ADEMOD

CALCulate<1|2>:THReshold:STATe

This command switches on or off the threshold line. The unit depends on the setting performed with "[CALCulate<1|2>:UNIT:POWer](#)".

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:THR:STAT ON
```

Switches on the threshold line.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A, ADEMOD

6.2.2.25 CALCulate:TLINe Subsystem

The CALCulate:TLINe subsystem defines the position of the time lines.

Commands of the CALCulate:TLINe Subsystem

- ◆ "[CALCulate<1|2>:TLINe<1|2>](#)"
- ◆ "[CALCulate<1|2>:TLINe<1|2>:STATe](#)"

CALCulate<1|2>:TLINe<1|2>

This command defines the position of the time lines that mark the times.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to 1000s

Example

```
CALC:TLIN 10ms
```


Characteristics

*RST value: - (STATe to OFF)

SCPI: device-specific

Mode

A-T

CALCulate<1|2>:TLINe<1|2>:STATe

This command switches the time line on or off.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CALC:TLIN2:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

6.2.2.26 CALCulate:UNIT Subsystem

The CALCulate:UNIT subsystem defines the units for the parameters that can be set and the measurement results.

Commands of the CALCulate:UNIT Subsystem

- ◆ "[CALCulate<1|2>:UNIT:POWER](#)"

CALCulate<1|2>:UNIT:POWER

This command selects the unit for power.

The numeric suffixes <1|2> are not relevant.

Parameters

DBM | V | A | W | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere

Example

```
CALC:UNIT:POW DBM
```

Sets the power unit to dBm.

Characteristics

*RST value: dBm
 SCPI: device-specific

Mode

A

6.2.3 DISPlay Subsystem

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

Commands of the DISPlay Subsystem

- ◆ ["DISPlay\[:WINDow<1|2>\]:SIZE"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:X:SPACing"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:STATe\]"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:MODE"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:MODE:HCONtinuous"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SPACing"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SCALE\]"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SCALE:MODE"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SCALE:RLEVel"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SCALE:RLEVel:OFFSet"](#)

DISPlay[:WINDow<1|2>]:SIZE

This command configures the measurement display.

Channel and adjacent-channel power measurements: Only "1" is allowed as a numeric suffix.

Spectrum Emission Mask and Spurious Emissions measurements: The numeric suffix <1|2> selects the item that is displayed in full size; 1 for measurement diagram, 2 for list

Parameter

LARGE	Channel and adjacent-channel power measurements: diagram in full screen. Spectrum Emission Mask and Spurious Emissions measurements: diagram or list in full screen, depending on the value of the numeric suffix.
SMALI	split screen (diagram and list)

Example

```
DISP:SIZE LARG
```

Displays the measurement diagram in full screen size.

```
DISP:WIND2:SIZE LARG
```

Displays the list in full screen size.

Characteristics

*RST value: SMALI
 SCPI: device-specific

Mode

A, ADEMOD

DISPlay[:WINDow<1|2>]:TRACe<1...6>:X:SPACing

This command toggles between linear and logarithmic display of the x-axis.

The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameter

LOGarithmic Selects logarithmic scaling.
 LINear Selects linear scaling.

Example

```
DISP:TRAC:X:SPAC LIN
```

Characteristics

*RST value: LOGarithmic
 SCPI: conform

Mode

A, ADEMOD

DISPlay[:WINDow<1|2>]:TRACe<1...6>[:STATe]

This command switches on or off the display of the corresponding trace.
 The numeric suffixes <1|2> are irrelevant.

Parameters

ON | OFF

Example

```
DISP:TRAC3 ON
```

Characteristics

*RST value: ON for TRACe1, OFF for TRACe2 to 6
 SCPI: conform

Mode

all

DISPlay[:WINDow<1|2>]:TRACe<1...6>:MODE

This command defines the type of display and the evaluation of the traces. WRITE corresponds to the Clr/Write mode of manual operation. The trace is switched off (= BLANK in manual operation) with

"[DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:STATe](#)".

The number of measurements for AVERage, MAXHold and MINHold is defined with the "[\[SENSe<1|2>:\]AVERage:COUNt](#)" or "[\[SENSe<1|2>:\]SWEEp:COUNt](#)" commands. It should be noted that synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

If calculation of average values is active, selection between logarithmic and linear averaging is possible. For more detail see "[\[SENSe<1|2>:\]AVERage:TYPE](#)" command.

The numeric suffixes <1|2> are irrelevant.

Parameters

WRITE | VIEW | AVERage | MAXHold | MINHold |RMS

For details on trace modes refer to chapter "Instrument Functions", section "[Trace mode overview](#)".

Example

```
SWE:CONT OFF
```

Switching to single sweep mode.

```
SWE:COUN 16
```

Sets the number of measurements to 16.

```
DISP:TRAC3:MODE MAXH
```

Switches on the calculation of the for trace 3.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the 16 sweeps.

Characteristics

*RST value: WRITE for TRACe1, STATe OFF for TRACe2/3/4/5/6

SCPI: device-specific

Mode

all

DISPlay[:WINDow<1|2>]:TRACe<1...6>:MODE:HCONtinuous

This command defines, whether traces in Min Hold, Max Hold and Average mode are reset after parameter change or not.

Normally, the measurement is started anew after parameter changes, before the measurement results are evaluated (e.g. using a marker). In all cases that require a new measurement after parameter changes, the trace is reset automatically to avoid false results (e.g. with span changes). For applications that require no reset after parameter changes, the automatic reset can be switched off.

The numeric suffixes <1|2> are irrelevant.

Parameter

OFF After certain parameter changes the traces are reset.
ON The automatic reset is switched off.

Example

```
DISP:WIND:TRAC3:MODE:HCON ON
```

Switches off the reset function.

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

A

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y:SPACing

This command selects the scaling for the level display range.
The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameter

LOGarithmic	Selects logarithmic scaling.
LINear	Selects linear scaling in %.
LDB	Selects linear scaling in dB.

Example

```
DISP:TRAC:Y:SPAC LIN
```

Characteristics

*RST value: LOGarithmic
SCPI: conform

Mode

A, ADEMOD

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALE]

This command defines the display range of the y-axis (level axis) with logarithmic scaling ("[DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SPACing](#)").

For linear scaling, the display range is fixed and cannot be modified.

The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameters

10 dB to 200 dB or value in Hz

Example

```
DISP:TRAC:Y 110dB
```

Characteristics

*RST value: 100dB

SCPI: device-specific

Mode

all

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALE]:MODE

This command defines the scale type of the y-axis (absolute or relative).

When `SYSTEM:DISPlay:UPDate` is set to OFF, this command has no immediate effect on the screen. The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameters

ABSolute | RELative

Example

```
DISP:TRAC:Y:MODE REL
```

Characteristics

*RST value: ABS

SCPI: device-specific

Mode

all

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALE]:RLEVel

This command defines the reference level.

With the reference level offset <> 0, the indicated value range of the reference level is modified by the offset.

The unit depends on the setting defined with "[CALCulate<1|2>:UNIT:POWer](#)".

The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameters

<numeric_value>, range specified in data sheet

Example

```
DISP:TRAC:Y:RLEV -60dBm
```

Characteristics

*RST value: -10dBm

SCPI: conform

Mode

A, WCDMA

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALe]:RLEVel:OFFSet

This command defines the offset of the reference level.

The numeric suffixes <1|2> and <1...6> are irrelevant.

Parameters

-200dB to 200dB

Example

```
DISP:TRAC:Y:RLEV:OFFS -10dB
```

Characteristics

*RST value: 0dB

SCPI: conform

Mode

A, PSM, WCDMA, WLAN

6.2.4 FORMat Subsystem

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

Commands of the FORMat Subsystem

- ◆ "[FORMat:DEXPort:DSEParator](#)"

FORMat:DEXPort:DSEParator

This command defines which decimal separator (decimal point or comma) is to be used for outputting measurement data to the file in ASCII format. Different languages of evaluation programs (e.g. MS-Excel) can thus be supported.

Parameters

POINT | COMMA

Example

```
FORM:DEXP:DSEP POIN
```

Sets the decimal point as separator.

Characteristics

*RST value: - (factory setting is POINT; *RST does not affect setting)

SCPI: device-specific

Mode

all

6.2.5 INITiate Subsystem

The INITiate subsystem is used to control the init-measurement function.

Commands of the INITiate Subsystem

- ◆ "[INITiate<1|2>\[:IMMediate\]](#)"
- ◆ "[INITiate<1|2>:CONMeas](#)"
- ◆ "[INITiate<1|2>:CONTinuous](#)"
- ◆ "[INITiate<1|2>:DISPlay](#)"
- ◆ "[INITiate<1|2>:ESpectrum](#)"
- ◆ "[INITiate<1|2>:SPURious](#)"

INITiate<1|2>[:IMMediate]

The command initiates a new measurement sequence.

With sweep count > 0 or average count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

In single sweep mode, synchronization to the end of the indicated number of measurements can be achieved with the command *OPC, *OPC? or *WAI. In continuous-sweep mode, synchronization to the sweep end is not possible since the overall measurement never ends.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
DISP:WIND:TRAC:MODE AVER
```

Switches on trace averaging.

```
SWE:COUN 20
```

Setting the sweep counter to 20 sweeps.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the 20 sweeps.

Characteristics

*RST value: -
 SCPI: conform

Mode

all

INITiate<1|2>:CONMeas

This command continues a stopped measurement at the current position in single sweep mode. The function is useful especially for trace functions MAXHold, MINHold and AVERage, if the previous results are not to be cleared with sweep count > 0 or average count > 0 on restarting the measurement (INIT:IMMediate resets the previous results on restarting the measurement).

The single sweep mode is automatically switched on. Synchronization to the end of the indicated number of measurements can then be performed with the commands *OPC, *OPC? or *WAI. In the continuous sweep mode, synchronization to the sweep end is not possible since the overall measurement "never" ends. The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
DISP:WIND:TRAC:MODE AVER
```

Switches on trace averaging.

```
SWE:COUN 20
```

Setting the sweep counter to 20 sweeps.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the 20 sweeps.

```
INIT:CONM;*WAI
```

Continues the measurement (next 20 sequences) and waits for the end.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

INITiate<1|2>:CONTinuous

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

In the **Spectrum Analyzer mode**, this setting refers to the sweep sequence (switching between continuous/single sweep).

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

INIT:CONT OFF

Switches the sequence single sweep.

INIT:CONT ON

Switches the sequence to continuous sweep.

Characteristics

*RST value: ON

SCPI: conform

Mode

all

INITiate<1|2>:DISPlay

This command switches the display during a single sweep measurement on (ON) or off (OFF).

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

INIT:CONT OFF

Switches to single sweep mode

INIT:DISP OFF

Sets the display behavior to OFF

INIT;*WAI

Starts the measurement with display switched off.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A

INITiate<1|2>:ESpectrum

This command starts a Spectrum Emission Mask measurement.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

INIT:ESP

Starts a Spectrum Emission Mask measurement.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

INITiate<1|2>:SPURious

This command starts a Spurious Emissions measurement.
 The numeric suffixes <1|2> are not relevant.
 This command is an event and therefore has no *RST value and no query.

Example

```
INIT:SPUR
Starts a Spurious Emissions measurement.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

6.2.6 INPut Subsystem

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

Commands of the INPut Subsystem

- ◆ "[INPut<1|2>:ATTenuation](#)"
- ◆ "[INPut<1|2>:ATTenuation:AUTO](#)"
- ◆ "[INPut<1|2>:GAIN:STATe \(option RF Preamplifier, B22\)](#)"
- ◆ "[INPut<1|2>:IMPedance](#)"
- ◆ "[INPut<1|2>:UPORt\[:VALue\]?](#)"
- ◆ "[INPut<1|2>:UPORt:STATe](#)"
- ◆ "[INPut<1|2>:EATT](#)"
- ◆ "[INPut<1|2>:EATT:AUTO](#)"
- ◆ "[INPut<1|2>:EATT:STATe](#)"
- ◆ "[INPut<1|2>:COUPling](#)"

INPut<1|2>:ATTenuation

This command programs the input attenuator. To protect the input mixer against damage from overloads, the setting 0 dB can be obtained by entering numerals, not by using the `DEC` command.

The attenuation can be set in 5 dB steps (with option R&S FSV-B25: 1 dB steps). If the defined reference level cannot be set for the set RF attenuation, the reference level is adjusted accordingly.

In the default state with **Spectrum Analyzer mode**, the attenuation set on the step attenuator is coupled to the reference level of the instrument. If the attenuation is programmed directly, the coupling to the reference level is switched off.

Parameters

<numeric_value> in dB; range specified in data sheet

Example

```
INP:ATT 30dB
```

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Characteristics

*RST value: 0 dB (AUTO is set to ON)

SCPI: conform

Mode

all

INPut<1|2>:ATTenuation:AUTO

This command automatically couples the input attenuation to the reference level (state ON) or switches the input attenuation to manual entry (state OFF).

Parameters

ON | OFF

Example

```
INP:ATT:AUTO ON
```

Couples the attenuation set on the attenuator to the reference level.

Characteristics

*RST value: ON

SCPI: conform

Mode

All

INPut<1|2>:GAIN:STATe (option RF PreampIifier, B22)

This command switches the preamplifier on or off. The preamplifier has only an effect below 6 GHz.

Parameters

ON | OFF

Example

```
INP:GAIN:STAT ON
```

Switches on 20 dB preamplification.

Characteristics

*RST value: OFF

SCPI: conform

Mode

A, NF, WCDMA

INPut<1|2>:IMPedance

This command sets the nominal input impedance of the instrument. The set impedance is taken into account in all level indications of results.

The setting 75 Ω should be selected, if the 50 Ω input impedance is transformed to a higher impedance using a 75 Ω adapter of the RAZ type (= 25 Ω in series to the input impedance of the instrument). The correction value in this case is 1.76 dB = $10 \log (75\Omega / 50\Omega)$.

Parameters

50 | 75

Example

```
INP:IMP 75
```

Characteristics

*RST value: 50 Ω

SCPI: conform

Mode

all

INPut<1|2>:UPORt[:VALue]?

This command queries the control lines of the user ports.
This command is a query and therefore has no *RST value.

Example

```
INP : UPOR ?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

INPut<1|2>:UPORt:STATe

This command toggles the control lines of the user ports between INPut and OUTPut. With ON, the user port is switched to INPut, with OFF to OUTPut.

Parameters

ON | OFF

Example

```
INP : UPOR : STAT ON
```

Characteristics

*RST value: ON
SCPI: device-specific

Mode

all

INPut<1|2>:UPORt[:VALue]?

This command queries the control lines of the user ports.
This command is a query and therefore has no *RST value.

Example

```
INP : UPOR ?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

INPut<1|2>:UPORt:STATe

This command toggles the control lines of the user ports between INPut and OUTPut. With ON, the user port is switched to INPut, with OFF to OUTPut.

Parameters

ON | OFF

Example

```
INP:UPOR:STAT ON
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

INPut<1|2>:EATT

Requires option R&S FSV-B25.

Switches the electronic attenuator on (if not already active) and allows the attenuation of the electronic attenuator to be set.

This command is only available with option R&S FSV-B25.

The attenuation can be varied in 1 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value.

If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

Parameters

0...30

Example

```
INP1:EATT 10 dB
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

INPut<1|2>:EATT:AUTO

Switches the automatic behaviour of the electronic attenuator on or off. If activated, electronic attenuation is used to reduce the operation of the mechanical attenuation whenever possible.

This command is only available with option R&S FSV-B25.

Parameters

ON | OFF

Example

```
INP1:EATT:AUTO OFF
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

INPut<1|2>:EATT:STATe

Switches the electronic attenuator on or off.

This command is only available with option R&S FSV-B25.

Parameters

ON | OFF

Example

```
INP:EATT:STAT ON
```

Switches the electronic attenuator into the signal path.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

INPut<1|2>:COUPling

Toggles the RF input of the R&S FSV between AC and DC coupling.

Parameters

AC | DC

Example

```
INP:COUP AC
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

All

6.2.7 MMEMory Subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings.

For detailed information on the MMEMory subsystem, see the [Description of Basic Settings Commands](#).

Commands of the MMEMory Subsystem

◆ "[MMEMory:STORe<1|2>:SPURious](#)"

MMEMory:STORe<1|2>:SPURious

Saves the marker peak list for Spurious Emissions measurements in the defined file name.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<file_name> = DOS file name without extension

The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:STOR:SPUR 'test'
```

Saves the current marker peak list in the file test.dat.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all

6.2.8 OUTPut Subsystem

The OUTPut subsystem controls the output features of the instrument.

Commands of the OUTPut Subsystem

- ◆ ["OUTPut:DEModulation:SPEAker"](#)
- ◆ ["OUTPut:UPORt\[:VALue\]"](#)
- ◆ ["OUTPut:UPORt:STATe"](#)

OUTPut:DEModulation:SPEAker

This command defines whether the speaker on the front or the rear panel of the instrument is used for output.

Parameters

FRONt | REAR

Example

```
OUTP:DEM:SPEA:FRON
```

Characteristics

*RST value: OFF
 SCPI: device-specific

Mode

all

OUTPut:UPORt[:VALue]

This command sets the control lines of the user ports.
 The user port is written to with the given binary pattern. If the user port is programmed to INPut instead of OUTPut, the output value is temporarily stored.

Parameters

#B00000000 to #B11111111

Example

```
OUTP:UPOR #B10100101
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

OUTPut:UPORt:STATe

This command switches the control line of the user ports between INPut and OUTPut. The user port is switched to OUTPut with parameter ON, to INPut with OFF.

Parameters

ON | OFF

Example

```
OUTP:UPOR:STAT ON
```

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

all

6.2.9 SENSE Subsystem

The SENSE subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSE subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSE" is optional for this reason, which means that it is not necessary to include the SENSE node in command sequences.

The following subsystems are included:

- ◆ "[SENSe:ADJust Subsystem](#)" on page "452"
- ◆ "[SENSe:AVERage Subsystem](#)" on page "454"
- ◆ "[SENSe:BANDwidth Subsystem](#)" on page "456"
- ◆ "[SENSe:CORRection Subsystem](#)" on page 460
- ◆ "[SENSe:DETEctor Subsystem](#)" on page 463
- ◆ "[SENSe:ESpectrum Subsystem](#)" on page "464"
- ◆ "[SENSe:FREQuency Subsystem](#)" on page "478"
- ◆ "[SENSe:LIST Subsystem](#)" on page "484"
- ◆ "[SENSe:MPOWer Subsystem](#)" on page "495"
- ◆ "[SENSe:POWer Subsystem](#)" on page "501"
- ◆ "[SENSe:SWEEp Subsystem](#)" on page "514"

6.2.9.1 SENSe:ADJust Subsystem

The ADJust subsystem controls automatic definition of frequency and level settings.

Commands of the SENSe:ADJust Subsystem

- ◆ "[\[SENSe<1|2>:\]ADJust:ALL](#)"
- ◆ "[\[SENSe<1|2>:\]ADJust:FREQuency](#)"
- ◆ "[\[SENSe<1|2>:\]ADJust:LEVel](#)"
- ◆ "[\[SENSe<1|2>:\]ADJust:CONFigure:LEVel:DURation](#)"

[SENSe<1|2>:]ADJust:ALL

Activates all automatic settings:

- e) Frequency
- f) Level

Parameters

Example

ADJ : ALL

Characteristics

*RST value:
SCPI: device-specific

Mode

A

[SENSe<1|2>:]ADJust:FREQuency

Defines the center frequency automatically by determining the highest level in the frequency span.

Example

ADJ:FREQ

Characteristics

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ADJust:LEVel

Defines the optimal reference level for the current measurement automatically.

Example

ADJ:LEV

Characteristics

*RST value:

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ADJust:CONFigure:LEVel:DURation

Defines the duration of the level measurement used to determine the optimal reference level automatically (for [\[SENSe<1|2>:\]ADJust:LEVel](#)).

Parameters

<numeric value> in seconds

Example

ADJ:CONF:LEV:DUR:5

Characteristics

*RST value: 100 ms

SCPI: device-specific

Mode

A

6.2.9.2 SENSE:AVERage Subsystem

The SENSE:AVERage subsystem calculates the average of the acquired data. A new test result is obtained from several successive measurements.

There are two types of average calculation: logarithmic and linear. In case of logarithmic average calculation (denoted with VIDEO), the average value of the measured logarithmic power is calculated and in case of linear average calculation, the linear power is averaged before the logarithm is applied.

Commands of the SENSE:AVERage Subsystem

- ◆ "[SENSe<1|2>:]AVERage[:STATe<1...16>]"
- ◆ "[SENSe<1|2>:]AVERage:COUNT"
- ◆ "[SENSe<1|2>:]AVERage:TYPE"

[SENSe<1|2>:]AVERage[:STATe<1...16>]

This command switches on or off the average calculation for the selected trace (STATe<1...16>).

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
AVER OFF
```

Switches off the average calculation for trace 1.

```
AVER:STAT3 ON
```

Switches on the average calculation for trace 3.

Characteristics

*RST value: OFF

SCPI: conform

Mode

all

[SENSe<1|2>:]AVERage:COUNT

This command defines the number of measurements which contribute to the average value.

It should be noted that continuous averaging will be performed after the indicated number has been reached in continuous sweep mode.

In single sweep mode, the sweep is stopped as soon as the indicated number of measurements (sweeps) is reached. Synchronization to the end of the indicated number of measurements is only possible in single sweep mode.

The "[SENSe<1|2>:]AVERage:COUNT" command effects the same as the "[SENSe<1|2>:]SWEep:COUNT" command. In both cases, the number of measurements is defined whether the average calculation is active or not.

The number of measurements applies to all traces.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to 32767

Example

```
SWE:CONT OFF
```

Switching to single sweep mode.

```
AVER:COUN 16
```

Sets the number of measurements to 16.

```
AVER:STAT ON
```

Switches on the calculation of average.

```
INIT;*WAI
```

Starts the measurement and waits for the end of the 16 sweeps.

Characteristics

*RST value: 0

SCPI: conform

Mode

all

[SENSe<1|2>:]AVERage:TYPE

This command selects the type of average function.

Parameter

VIDeo The logarithmic power values are averaged.

LINear The power values are averaged before they are converted to logarithmic values.

POWER The power level values are converted into unit Watt prior to averaging. After the averaging, the data is converted back into its original unit.

Example

```
AVER:TYPE LIN
```

Switches to linear average calculation.

Characteristics

*RST value: VIDeo

SCPI: device-specific

Mode

A

6.2.9.3 SENSE:BANDwidth Subsystem

This subsystem controls the setting of the instruments filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

Commands of the SENSE:BANDwidth Subsystem

- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:RESolution]"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:RESolution]:AUTO"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:RESolution]:RATio"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:RESolution]:TYPE"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:VIDeo]"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:VIDeo:AUTO]"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:VIDeo:RATio]"
- ◆ "[SENSe<1|2>:BANDwidth|BWIDth:VIDeo:TYPE]"

[SENSe<1|2>:BANDwidth|BWIDth[:RESolution]

This command defines the analyzers resolution bandwidth.

The available resolution bandwidths are specified in the data sheet. For details on the correlation between resolution bandwidth and filter type refer to chapter "Instrument Functions", section "Selecting [the appropriate filter type](#)".

If the resolution bandwidth is modified, the coupling to the span is automatically switched off.

The numeric suffixes <1|2> are not relevant.

Parameters

refer to data sheet

Example

```
BAND 1MHz
```

Sets the resolution bandwidth to 1 MHz

Characteristics

*RST value: - (AUTO is set to ON)

SCPI: conform

Mode

all, except ADEMOD

[SENSe<1|2>:BANDwidth|BWIDth[:RESolution]:AUTO

This command either automatically couples the resolution bandwidth of the instrument to the span or cancels the coupling.

The automatic coupling adapts the resolution bandwidth to the currently set frequency span according to the relationship between frequency span and resolution bandwidth. The 6 dB bandwidths 200 Hz, 9 kHz and 120 kHz and the channel filters available are not set by the automatic coupling.

The ratio resolution bandwidth/span can be modified with the "[\[SENSe<1|2>:\]BANDwidth|BWIDth\[:RESolution\]:RATio](#)" command. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
BAND:AUTO OFF
```

Switches off the coupling of the resolution bandwidth to the span.

Characteristics

*RST value: ON

SCPI: conform

Mode

A-F

[\[SENSe<1|2>:\]BANDwidth|BWIDth\[:RESolution\]:RATio](#)

This command defines the ratio resolution bandwidth (Hz) / span (Hz). The ratio to be entered is reciprocal to the ratio span/RBW used in manual operation. The numeric suffixes <1|2> are not relevant.

Parameters

0.0001 to 1

Example

```
BAND:RAT 0.1
```

Characteristics

*RST value: 0.02 with BAND:TYPE NORMal or RBW > 30 kHz; 0.01 with BAND:TYPE FFT for RBW ≤ 30 kHz

SCPI: conform

Mode

A

[\[SENSe<1|2>:\]BANDwidth|BWIDth\[:RESolution\]:TYPE](#)

This command switches the filter type for the resolution bandwidth between "normal" analog or FIR filters in 1, 3, 10 steps and the FFT filtering for bandwidths <100 kHz.

For detailed information on filters see chapter "Instrument Functions", section "[Selecting the appropriate filter type](#)". and "[List of available RRC and channel filters](#)".

The numeric suffixes <1|2> are not relevant.

Note: When changing the filter type, the next larger filter bandwidth is selected if the same filter bandwidth is not available for the new filter type.

Parameter

NORMal	Gaussian filters
FFT	FFT filters
CFILter	channel filters
RRC	RRC filters
PULSe	EMI (6dB) filters

Example

BAND:TYPE NORM

Characteristics

*RST value: NORMal

SCPI: device-specific

Mode

all, except ADEMOD

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo

This command defines the instruments video bandwidth. The available video bandwidths are specified in the data sheet. The command is not available if FFT filtering is switched on and the set bandwidth is ≤ 30 kHz or if the quasi-peak detector is switched on.

The numeric suffixes <1|2> are not relevant.

Parameters

refer to data sheet

Example

BAND:VID 10kHz

Characteristics

*RST value: - (AUTO is set to ON)

SCPI: conform

Mode

A

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:AUTO

This command either automatically couples the instruments video bandwidth to the resolution bandwidth or cancels the coupling.

The ratio video bandwidth/resolution bandwidth can be modified with the "[\[SENSe<1|2>:\]BANDwidth|BWIDth:RESolution\]:RATio](#)" command.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
BAND:VID:AUTO OFF
```

Characteristics

*RST value: ON

SCPI: conform

Mode

A

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:RATio

This command defines the ratio video bandwidth (Hz) / resolution bandwidth (Hz). The ratio to be entered is reciprocal to the ratio RBW/VBW used in manual operation.

The numeric suffixes <1|2> are not relevant.

Parameters

0.01 to 1000

Example

```
BAND:VID:RAT 3
```

Sets the coupling of video bandwidth to video bandwidth = 3*resolution bandwidth

Characteristics

*RST value: 3

SCPI: conform

Mode

A

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:TYPE

This command selects the position of the video filter in the signal path, provided that the resolution bandwidth is ≤ 100 kHz.

The essential difference between the two modes is the transient response at falling signal edges: If LINear is selected, the measurement with logarithmic level scaling yields a much "flatter" falling edge than LOGarithmic. This behavior is due to the conversion of linear power into logarithmic level. If the linear power is halved, the level decreases by only 3 dB.

The numeric suffixes <1|2> are not relevant.

Parameter

LINear	The video filter is connected ahead of the logarithmic amplifier (default).
LOGarithmic	The video filter follows the logarithmic amplifier

Example

```
BAND:VID:TYPE LIN
```

Video filter ahead of the logarithmic amplifier

Characteristics

*RST value: LIN

SCPI: device-specific

Mode

A

6.2.9.4 SENSE:CORRection Subsystem

This subsystem controls calibration and normalization.

Commands of the SENSE:CORRection Subsystem

- ◆ ["\[SENSe<1|2>:\]CORRection\[:STATe\]"](#)
- ◆ ["\[SENSe<1|2>:\]CORRection:COLLect\[:ACQuire\]"](#)
- ◆ ["\[SENSe<1|2>:\]CORRection:EGain:INPut\[:MAGNitude\]"](#)
- ◆ ["\[SENSe<1|2>:\]CORRection:METHod"](#)
- ◆ ["\[SENSe<1|2>:\]CORRection:RECall"](#)

[SENSe<1|2>:]CORRection[:STATe]

This command activates/deactivates the normalization of the measurement results provided that the tracking generator is active. The command is available only after acquisition of a reference trace for the selected type of measurement (transmission/reflection, see "[SENSe<1|2>:]CORRection:COLLect[:ACQuire]" command).
The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
CORR ON
Activates normalization.
```

Characteristics

*RST value: OFF

SCPI: conform

Mode

A

[SENSe<1|2>:]CORRection:COLLect[:ACQuire]

When the tracking generator is active, this command determines the type of result acquisition for the normalization reference measurement and starts the measurement selected:

To obtain a correct reference measurement, a complete sweep with synchronization to the end of the sweep must have been carried out. This is only possible in the single sweep mode.

The numeric suffixes <1|2> are not relevant.

This command is an "event" and therefore has no *RST value and no query.

Parameter

THRough	"TRANsmission" mode	calibration with direct connection between tracking generator and device input
	"REFLection" mode	calibration with short circuit at the input
OPEN	only allowed in "REFLection" mode	calibration with open input

Example

```
INIT:CONT OFF
Selects single sweep operation
```

```
CORR:COLL THR;*WAI
Starts the measurement of reference data using direct connection between generator and device input and waits for the sweep end.
```

Characteristics

*RST value: -

SCPI: conform

Mode

A

[SENSe<1|2>:]CORRection:EGAIN:INPut[:MAGNitude]

This command makes an external gain known to the analyzer, which will take it into account during the display of measurement results. With this function the gain of an antenna or of an external preamplifier can be taken into account for the measurement values.

The numeric suffixes <1|2> are not relevant.

Parameters

-200...200dB

Example

```
CORR:EGA:INP 10DB
```

Takes 10 dB external gain into account.

Characteristics

*RST value: 0 dB

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:METHod

This command selects the type of measurement with active tracking generator (transmission/reflection).

The numeric suffixes <1|2> are not relevant.

Parameters

TRANsmission | REFLection

Example

```
CORR:METH TRAN
```

Sets the type of measurement to "transmission".

Characteristics

*RST value: TRANsmission

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:RECall

This command restores the instrument setting that was applied to the measurement of the reference data, provided that the tracking generator is active.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
CORR:REC
```

Characteristics

*RST value: -

SCPI: conform

Mode

A

6.2.9.5 SENSE:DETECTOR Subsystem

The SENSE:DETECTOR subsystem controls the acquisition of measurement data via the selection of the detector for the corresponding trace.

Commands of the SENSE:DETECTOR Subsystem

- ◆ "[\[SENSe<1|2>:\]DETECTOR<1...6>\[:FUNCTION\]](#)"
- ◆ "[\[SENSe<1|2>:\]DETECTOR<1...6>\[:FUNCTION\]:AUTO](#)"

[SENSe<1|2>:]DETECTOR<1...6>[:FUNCTION]

This command switches on the detector for the data acquisition in the selected trace.

The trace is indicated as numeric suffix in DETECTOR.

The numeric suffixes <1|2> are not relevant.

Parameters

APEak | NEGative | POSitive | SAMPlE | RMS | AVERAge | QPEak

For details on detectors refer to chapter "Instrument Functions", section "[Detector overview](#)".

Example

```
DET POS
```

Sets the detector to "positive peak".

Characteristics

*RST value: APEak
 SCPI: conform

Mode

A

[SENSe<1|2>:]DETEctor<1...6>[:FUNCTION]:AUTO

This command either couples the detector to the current trace setting or turns coupling off. The trace is selected by the numeric suffix at DETector. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

DET:AUTO OFF

Characteristics

*RST value: ON
 SCPI: conform

Mode

A

6.2.9.6 SENSE:ESpectrum Subsystem

The SENSE:ESpectrum subsystem contains the remote commands to configure Spectrum Emission Mask (SEM) measurements.

Commands of the SENSE:FREquency Subsystem

- ◆ "[\[SENSe<1|2>:\]ESpectrum:BWID](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:FILTer\[:RRC\]\[:STATe\]](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:FILTer\[:RRC\]:ALPH](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:PRESet\[:STANdard\]](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:PRESet:RESTore](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:PRESet:STORE](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth:RESolution](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth:VIDeo](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:COUNT?](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:DELeTe](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>\[:FREquency\]:STARt](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>\[:FREquency\]:STOP](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:FILTer:TYPE](#)"
- ◆ "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:INPut:ATTenuation](#)"

- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:INPut:ATTenuation:AUTO"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:INPut:GAIN:STATe"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:INSet"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:STARt"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:STOP"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:LIMit<1...4>:RELative:STARt"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:LIMit<1...4>:RELative:STOP"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:LIMit<1...4>:STATe"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:RLEVeI"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:SWEep:TIME"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:SWEep:TIME:AUTO"
- ◆ "[SENSe<1|2>]:ESpectrum:RANGe<1...20>:TRANsducer"
- ◆ "[SENSe<1|2>]:ESpectrum:RRANGe?"
- ◆ "[SENSe<1|2>]:ESpectrum:RTYPE"

[SENSe<1|2>]:ESpectrum:BWID

This command defines the bandwidth used for measuring the channel power (reference range). This setting takes only effect if channel power is selected as power reference type ("[\[SENSe<1|2>\]:ESpectrum:RTYPE](#)" command).

The numeric suffixes <1|2> are not relevant.

Parameters

minimum span ≤ value ≤ span of reference range

Example

```
ESP:RTYP CPOW
```

Sets the power reference type to channel power.

```
ESP:BWID 1MHZ
```

Sets the Tx bandwidth to 1 MHz.

Characteristics

*RST value: 3.84 MHz

SCPI: device-specific

Mode

A

[SENSe<1|2>]:ESpectrum:FILTer[:RRC][:STATe]

This command activates or deactivates the use of an RRC filter. This setting takes only effect if channel power is selected as power reference type ("[\[SENSe<1|2>\]:ESpectrum:RTYPE](#)" command).

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
ESP:RTYP CPOW
```

Sets the power reference type to channel power.

```
ESP:FILT OFF
```

Deactivates the use of an RRC filter.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:FILTer[:RRC]:ALPHA

This command sets the alpha value of the RRC filter. This setting takes only effect if channel power is selected as power reference type

("[SENSe<1|2>:]ESpectrum:RTYPE" command) and if the RRC filter is activated

("[SENSe<1|2>:]ESpectrum:FILTer[:RRC]:STATe" command).

The numeric suffixes <1|2> are not relevant.

Parameters

0 to 1

Example

```
ESP:RTYP CPOW
```

Sets the power reference type to channel power.

```
ESP:FILT ON
```

Activates the use of an RRC filter.

```
ESP:FILT:ALPH 0.5
```

Sets the alpha value of the RRC filter to 0.5.

Characteristics

*RST value: 0.22

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:PRESet[:STANdard]

This command selects the specified XML file under C:\r_s\instr\sem_std. If the file is stored in a subdirectory, include the relative path.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
ESP:PRES 'WCDMA\3GPP\DL\PowerClass_31_39.xml'
```

Selects the PowerClass_31_39.xml XML file in the

C:\R_S\instr\sem_std\WCDMA\3GPP\DL directory.

```
ESP:PRES?
```

```
W-CDMA 3GPP DL (31,39)dBm
```

The query returns information about the selected standard, the link direction and the power class. If no standard has been selected, the query returns None.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:PRESet:REStore

This command copies the XML files from the C:\R_S\instr\sem_backup folder to the C:\R_S\instr\sem_std folder. Files of the same name are overwritten.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
ESP:PRESet:RESt
```

Restores the originally provided XML files.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:PRESet:StORe

This command stores the current settings as presettings in the specified XML file under C:\r_s\instr\sem_backup.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Parameters

<string>; specifies the file in which the presettings are stored.

Example

```
ESP:PRESet:StOR 'WCDMA\3GPP\DL\PowerClass_31_39.xml'
```

Stores the settings in the PowerClass_31_39.xml file in the

C:\R_S\instr\sem_std\WCDMA\3GPP\DL directory.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

A

**[SENSe<1|2>:]ESpectrum:RANGe<1...20>:BANDwidth /
 [SENSe<1|2>:]ESpectrum:RANGe<1...20>:BANDwidth:RESolution**

This command sets the RBW value for the specified range.
 The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

Refer to the data sheet.

Example

```
ESP:RANG2:BAND:RES 5000
```

Sets the RBW for range 2 to 5 kHz.

Characteristics

*RST value: 30.0 kHz
 SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:BANDwidth:VIDeo

This command sets the VBW value for the specified range.
 The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

Refer to the data sheet.

Example

```
ESP:RANG1:BAND:VID 5000000
```

Sets the VBW for range 1 to 5 MHz.

Characteristics

*RST value: 10.0 MHz
 SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:COUNT?

This command returns the number of defined ranges.
The numeric suffixes are not relevant.
This command is only a query and therefore has no *RST value.

Example

```
ESP:RANG:COUNT?
```

Returns the number of defined ranges.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:DELeTe

This command deletes the specified range. The range numbers are updated accordingly. The reference range cannot be deleted. A minimum of three ranges is mandatory.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
ESP:RANG4:DEL
```

Deletes range 4.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>[:FREQUency]:STARt

This command sets the start frequency for the specified range.
In order to change the start/stop frequency of the first/last range, select the appropriate span. If you set a span that is smaller than the overall span of the ranges, the measurement includes only the ranges that lie within the defined span and have a minimum span of 20 Hz. The first and last range are adapted to the given span as long as the minimum span of 20 Hz is not violated.
The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

see rules in chapter 4, "[Ranges and settings](#)"

Example

```
ESP:RANG1:STAR 10000000
```

Sets the start frequency for range 1 to 100 MHz.

Characteristics

*RST value: -250.0 MHz (range 1), -2.52 MHz (range 2), 2.52 MHz (range 3)

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>[:FREQuency]:STOP

This command sets the stop frequency for the specified range. For further details refer to the "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>\[:FREQuency\]:START](#)" command.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

see rules in chapter 4, "[Ranges and settings](#)"

Example

```
ESP:RANG3:STOP 10000000
```

Sets the stop frequency for range 2 to 10 MHz.

Characteristics

*RST value: -2.52 MHz (range 1), 2.52 MHz (range 2), 250.0 MHz (range 3)

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:FILTer:TYPE

This command sets the filter type for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameter

NORMal	Gaussian filters
CFILter	channel filters
RRC	RRC filters
PULSe	EMI (6dB) filters

The available bandwidths of the filters are specified in the data sheet.

Example

```
ESP:RANG1:FILT:TYPE RRC
```

Sets the RRC filter type for range 1.

Characteristics

*RST value: NORM
SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:INPut:ATTenuation

This command sets the attenuation for the specified range.
The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

Refer to the data sheet.

Example

```
ESP:RANG3:INP:ATT 10
```

Sets the attenuation of range 3 to 10 dB.

Characteristics

*RST value: 0 dB
SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:INPut:ATTenuation:AUTO

This command activates or deactivates the automatic RF attenuation setting for the specified range.
The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
ESP:RANG2:INP:ATT:AUTO OFF
```

Deactivates the RF attenuation auto mode for range 2.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:INPut:GAIN:STATe

This command switches the preamplifier on or off for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
ESP:RANG3:INP:GAIN:STATe ON
```

Switches the preamplifier for range 3 on or off.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:INSert

This command inserts a new range before or after the specified range. The range numbers are updated accordingly.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

AFTer | BEFore

Example

```
ESP:RANG3:INS BEF
```

Inserts a new range before range 3.

```
ESP:RANG1:INS AFT
```

Inserts a new range after range 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:STARt

This command sets an absolute limit value at the start frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

-400 to in 400 dBm

Example

```
ESP:RANG1:LIM:ABS:STAR 10
```

Sets an absolute limit of 10 dBm at the start frequency of the range.

Characteristics

*RST value: -13 dBm

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:STOP

This command sets an absolute limit value at the stop frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

-400 to in 400 dBm

Example

```
ESP:RANG1:LIM:ABS:STOP 20
```

Sets an absolute limit of 20 dBm at the stop frequency of the range.

Characteristics

*RST value: -13 dBm

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:LIMit<1...4>:RELative:START

This command sets a relative limit value at the start frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

-400 to in 400 dBc

Example

```
ESP:RANG3:LIM:REL:STAR -20
```

Sets a relative limit of -20 dBc at the start frequency of the range.

Characteristics

*RST value: -50 dBc

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:LIMit<1...4>:RELative:STOP

This command sets a relative limit value at the stop frequency of the specified range. Different from manual operation, this setting is independently of the defined limit check type.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

-400 to in 400 dBc

Example

```
ESP:RANG3:LIM:REL:STOP 20
```

Sets a relative limit of 20 dBc at the stop frequency of the range.

Characteristics

*RST value: -50 dBc

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:LIMit<1...4>:STATe

This command sets the type of limit check for all ranges.

The numeric suffixes are not relevant.

Parameter

ABSolute	Checks only the absolute limits defined.
RELative	Checks only the relative limits. Relative limits are defined as relative to the measured power in the reference range.
AND	Combines the absolute and relative limit. The limit check fails when both limits are violated.
OR	Combines the absolute and relative limit. The limit check fails when one of the limits is violated.

Example

```
ESP:RANG3:LIM:STAT AND
```

Sets for all ranges the combined absolute/relative limit check.

Characteristics

*RST value: REL

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:RLEVel

This command sets the reference level for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

Refer to the data sheet.

Example

```
ESP:RANG2:RLEV 0
```

Sets the reference level of range 2 to 0 dBm.

Characteristics

*RST value: -20 dBm

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:SWEep:TIME

This command sets the sweep time for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

Allowed values depend on the ratio of span to RBW and RBW to VBW. For details refer to the data sheet.

Example

```
ESP:RANG1:SWE:TIME 1
```

Sets the sweep time for range 1 to 1 s.

Characteristics

*RST value: 0.27 s

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:SWEep:TIME:AUTO

This command activates or deactivates the automatic sweep time setting for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
ESP:RANG3:SWE:TIME:AUTO OFF
```

Deactivates the sweep time auto mode for range 3.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RANGe<1...20>:TRANsducer

This command sets a transducer for the specified range. You can only choose a transducer that fulfills the following conditions:

- ◆ The transducer overlaps or equals the span of the range.
- ◆ The x-axis is linear.
- ◆ The unit is dB.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

'string' = name of the transducer

Example

```
ESP:RANG1:TRAN 'test'
```

Sets the transducer called test for range 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RRANGe?

This command returns the current position (number) of the reference range.

The numeric suffixes <1|2> are not relevant.

This command is only a query and therefore has no *RST value.

Example

```
ESP:RRAN?
```

Returns the current position (number) of the reference range.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]ESpectrum:RTYPE

This command sets the power reference type.

The numeric suffixes <1|2> are not relevant.

Parameter

PEAK	Measures the highest peak within the reference range.
CPOWer	Measures the channel power within the reference range (integral bandwidth method).

Example

```
ESP:RTYP PEAK
```

Sets the peak power reference type.

Characteristics

*RST value: CPOWer

SCPI: device-specific

Mode

A

6.2.9.7 SENSE:FREQUENCY Subsystem

The SENSE:FREQUENCY subsystem defines the frequency axis of the active display. The frequency axis can either be defined via the start/stop frequency or via the center frequency and span.

Commands of the SENSE:FREQUENCY Subsystem

- ◆ "[\[SENSe<1|2>:\]FREQUENCY:CENTer](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:CENTer:STEP](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:CENTer:STEP:AUTO](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:CENTer:STEP:LINK](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:CENTer:STEP:LINK:FACTor](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:MODE](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:OFFSet](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:SPAN](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:SPAN:FULL](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:STARt](#)"
- ◆ "[\[SENSe<1|2>:\]FREQUENCY:STOP](#)"

[SENSe<1|2>:]FREQUency:CENTer

This command defines the center frequency of the analyzer or the measuring frequency for span = 0.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to f_{\max}

f_{\max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{\max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example

```
FREQ:CENT 100MHz
```

Characteristics

*RST value: $f_{\max} / 2$ with f_{\max} = maximum frequency

SCPI: conform

Mode

all

[SENSe<1|2>:]FREQUency:CENTer:STEP

This command defines the step size of the center frequency.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to f_{\max}

Example

```
FREQ:CENT:STEP 120MHz
```

Characteristics

*RST value: - (AUTO 0.1 × SPAN is switched on)

SCPI: conform

Mode

all

[SENSe<1|2>:]FREQUency:CENTer:STEP:AUTO

This command couples the step size of the center frequency to the span (ON) or sets the value of the center frequency entered via "[\[SENSe<1|2>:\]FREQUency:CENTer:STEP](#)" (OFF).

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
FREQ:CENT:STEP:AUTO ON
```

Activates the coupling of the step size to the span.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK

This command couples the step size of the center frequency to span (span >0) or to the resolution bandwidth (span = 0) or cancels the couplings.

The numeric suffixes <1|2> are not relevant.

Parameter

SPAN	coupling to frequency display range (for span > 0)
RBW	coupling to resolution bandwidth (for span = 0)
OFF	manual input, no coupling

Example

```
FREQ:CENT:STEP:LINK SPAN
```

Characteristics

*RST value: SPAN

SCPI: device-specific

Mode

A, ADEMOD

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK:FACTor

This command couples the step size of the center frequency with a factor to the span (span >0) or to the resolution bandwidth (span = 0).

The numeric suffixes <1|2> are not relevant.

Parameters

1 to 100 PCT

Example

```
FREQ:CENT:STEP:LINK:FACT 20PCT
```

Characteristics

*RST value: - (AUTO 0.1 × SPAN is switched on)

SCPI: device-specific

Mode

A

[SENSe<1|2>:]FREQUency:MODE

This command switches between span > 0 (SWEep) and zero span (CW | FIXed) in the **Spectrum Analyzer mode**.

For CW and FIXed, the frequency setting is via the

"[SENSe<1|2>:]FREQUency:CENTer" command. In the sweep mode, the setting is via the "[SENSe<1|2>:]FREQUency:STARt", "[SENSe<1|2>:]FREQUency:STOP", "[SENSe<1|2>:]FREQUency:CENTer", and "[SENSe<1|2>:]FREQUency:SPAN" commands.

The numeric suffixes <1|2> are not relevant.

Parameters

CW | FIXed | SWEep

Example

```
FREQ:MODE SWE
```

Characteristics

*RST value: SWEep

SCPI: conform

Mode

A

[SENSe<1|2>:]FREQUency:OFFSet

This command defines the frequency offset of the instrument.

The numeric suffixes <1|2> are not relevant.

Parameters

-100 GHz to 100 GHz

Example

```
FREQ:OFFS 1GHZ
```

Characteristics

*RST value: 0 Hz

SCPI: conform

Mode

A, ADEMOD, WCDMA

[SENSe<1|2>:]FREQUency:SPAN

This command defines the frequency span in the **Spectrum Analyzer mode**.
The numeric suffixes <1|2> are not relevant.

Parameters

0 to f_{\max}

f_{\max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{\max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example

```
FREQ:SPAN 10MHz
```

Characteristics

*RST value: f_{\max} with f_{\max} = maximum frequency

SCPI: conform

Mode

A

[SENSe<1|2>:]FREQUency:SPAN:FULL

This command sets the frequency span to its maximum.
The numeric suffixes <1|2> are not relevant.

Parameters

f_{\max} , specified in the data sheet.

Example

```
FREQ:SPAN:FULL
```

Characteristics

*RST value: -

SCPI: conform

Mode

A

[SENSe<1|2>:]FREQuency:STARt

This command defines the start frequency of the analyzer. This command is only available with span > 0.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to f_{\max}

f_{\max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{\max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example

```
FREQ:STAR 20MHz
```

Characteristics

*RST value: 0

SCPI: conform

Mode

A-F

[SENSe<1|2>:]FREQuency:STOP

This command defines the stop frequency of the analyzer. This command is only available with span > 0.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to f_{\max}

f_{\max} is specified in the data sheet. To help analyze signals located at the end of the frequency range, the f_{\max} value is extended by 0.05 GHz for direct entry. The preset and maximum values remain unchanged.

Example

```
FREQ:STOP 2000MHz
```

Characteristics

*RST value: f_{\max}

SCPI: conform

Mode

A-F

6.2.9.8 SENSE:LIST Subsystem

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in zero span. A new trigger event is required for each test point (exception: trigger "FREE RUN").

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average). The number of frequencies is limited to 100 entries.

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is performed via a configuration command ("[\[SENSe<1|2>:LIST:POWer:SET](#)"). This also includes the setting for trigger and gate parameters.

Note: Settings that are not directly included in commands of this subsystem can be configured by sending the corresponding commands prior to the "[SENSe:LIST Subsystem](#)" commands.

Please note that changes to the trigger level have to be executed in zero span in order to take effect for the "[SENSe:LIST Subsystem](#)" commands.

The following subsystem is included:

["SENSe:LIST:RANGe Subsystem"](#) on page "491"

Commands of the SENSE:LIST Subsystem

- ◆ "[\[SENSe<1|2>:LIST:POWer\[:SEQuence\]](#)"
- ◆ "[\[SENSe<1|2>:LIST:POWer:RESult?](#)"
- ◆ "[\[SENSe<1|2>:LIST:POWer:SET](#)"
- ◆ "[\[SENSe<1|2>:LIST:POWer:STATe](#)"

Further information

- ◆ "[More details on the SENSE:LIST Subsystem](#)"

More details on the SENSE:LIST Subsystem

The following setting parameters can be selected independently for each frequency point:

- analyzer frequency
- reference level
- resolution filter
- resolution bandwidth
- video bandwidth
- measurement time
- detector

The commands of this subsystem can be used in two different ways:

- Instrument setup, measurement and querying of the results in a single command line. With this method, there is the least delay between the measurement and the result output. However, it requires the control computer to wait for the response from the instrument.
- Instrument setup and querying of the result list at the end of the measurement: With this method, the control computer may be used for other activities while the measurement is being performed. However, more time is needed for synchronization via service request.

[SENSe<1|2>:]LIST:POWer[:SEQuence]

This command configures the list of settings (max. 200 entries) for the multiple power measurement and starts a measurement sequence. When synchronizing the command with *OPC, a service request is generated as soon as all frequency points are processed and the defined number of individual measurements is reached.

To reduce the setting time, all indicated parameters are set up simultaneously at each test point.

The query form of the command processes the list and immediately returns the list of results. The number of results per test point depends on the setting of the "[\[SENSe<1|2>:\]LIST:POWer:SET](#)" command.

The numeric suffixes <1|2> are not relevant.

Parameters

The following parameters are the settings for an individual frequency point. They are repeated for every other frequency point.

<analyzer freq>	Receive frequency for the signal to be measured (= center frequency in manual operation) Range of values: 0 Hz to max. frequency, depending on the instrument model.
<ref level>	Reference level Range of values: +30 dBm to -130 dBm in 0.01 dB steps
<rf att>	RF input attenuation Range of values: 0 dB to 70 dB in 5 dB steps With option R&S FSV-B25: 0 dB to 75 dB in 1 dB steps
<filter type>	For details refer to "[SENSe<1 2>]:BANDwidth BWIDth[:RESolution]:TYPE" on page "457"
<el att>	Electronic input attenuation Requires option R&S FSV-B25; Range of values: 0 dB to 30 dB in 1 dB steps or "OFF"
<rbw>	Resolution bandwidth For the range of values refer to chapter "Instrument Functions", section " Res BW Manual ". Refer to chapter "Instrument Functions", section " Selecting the appropriate filter type ". for possible combinations of filter type and filter bandwidth for the <filter type> = CFILter and <filter type> = RRC.
<vbw>	Video bandwidth Range of values: 1 Hz to 10 MHz in 1, 3, 10 steps. The value is ignored for <filter type> = CFILter or RRC
<meas time>	Measurement time Range of values: 1 us to 16000s For details refer to chapter "Instrument Functions", section " Sweeptime Manual "
<trigger level>	Reserved. Must be set to 0.

Return values

The query command returns a list of comma-separated values (CSV) which contains the power measurement results in floating-point format. The unit depends on the setting with "[CALCulate<1|2>:UNIT:POWer](#)"

The command

```
SENSe:LIST:POWer?
```

```
935.2MHz,0dBm,10dB,OFF,NORM,1MHz,3MHz,440us,0,
935.4MHz,0dBm,10dB,10dB,NORM,30kHz,100kHz,440us,0,
935.6MHz,0dBm,10dB,20dB,NORM,30kHz,100kHz,440us,0
```

thus returns the following list, for example:

```
-28.3,-30.6,-38.1
```

If the command sequence is extended to

```
SENSe:LIST:POWer:SET ON,ON,ON,IMM,POS,0,0
```

```
SENSe:LIST:POWer?
```

```
935.2MHz,0dBm,10dB,OFF,NORM,1MHz,3MHz,440us,0,
935.4MHz,0dBm,10dB,10dB,NORM,30kHz,100kHz,440us,0,
935.6MHz,0dBm,10dB,20dB,NORM,30kHz,100kHz,440us,0
```

the result list is extended to 3 results per frequency point (peak, RMS and average):

```
-28.3,-29.6,1.5,-30.6,-31.9,0.9,-38.1,-40.0,2.3
```

Example

```
SENSe:LIST:POWer
```

```
935.2MHz,0dBm,10dB,OFF,NORM,1MHz,3MHz,440us,0,
935.4MHz,0dBm,10dB,10dB,CFIL,30kHz,100kHz,440us,0,
935.6MHz,0dBm,10dB,20dB,CFIL,30kHz,100kHz,440us,0
```

Performs a measurement sequence with the following settings:

Step	Freq. [MHz]	Ref Level [dBm]	RF Att [dB]	el Att [dB]	Filter type	RBW	VBW	Meas Time [us]	TRG Level (reserved)
1	935.2	0	10	OFF	Normal	1 MHz	3 MHz	440	0
2	935.4	0	10	10	Channel	30 kHz	100 kHz	440	0
3	935.6	0	10	20	Channel	30 kHz	100 kHz	440	0

```
SENSe:LIST:POWer?
```

```
935.2MHz,0dBm,10dB,OFF,NORM,1MHz,3MHz,440us,0,
935.4MHz,0dBm,10dB,10dB,CFIL,30kHz,100kHz,440us,0,
935.6MHz,0dBm,10dB,20dB,CFIL,30kHz,100kHz,440us,0
```

Performs the same measurement and returns the result list immediately after the last frequency point.

Note: The measurement is performed in zero span and therefore the span is set to 0 Hz. If the span > 0 is set, the function is automatically switched off.

The measurement is not compatible with other measurements, especially as far as marker, adjacent channel power measurement or statistics are concerned. The corresponding commands thus automatically deactivate the function.

The function is only available in REMOTE operation. It is deactivated when switching the instrument back to LOCAL.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-F, A-T

[SENSe<1|2>:]LIST:POWer:RESult?

This command queries the result of a previous list measurement as configured and initiated with "[\[SENSe<1|2>:\]LIST:POWer:SEQuence](#)". The measured results are output in a list of floating point values separated by commas. The unit of the results depends on the setting made with the "[CALCulate<1|2>:UNIT:POWer](#)" command.

This command may be used to obtain measurement results in an asynchronous way, using the service request mechanism for synchronization with the end of the measurement.

If no measurement results are available, the command will return a query error. The numeric suffixes <1|2> are not relevant.

Example

```
*ESE 1
```

```
*SRE 32
```

Configuration of the status reporting system for the generation of an SRQ on operation complete

```
SENSe:LIST:POWer
```

```
935.2MHz,-20dBm,10dB,OFF,NORM,1MHz,3MHz,434us,0,
```

```
935.4MHz,-20dBm,10dB,10dB,NORM,30kHz,100kHz,434us,0,
```

```
935.6MHz,-20dBm,10dB,20dB,NORM,30kHz,100kHz,434us,0;
```

```
*OPC
```

Configuring and starting the measurement

```
...
```

Further actions of the control computer during measurement

On SRQ:

```
SENSe:LIST:POWer:RESult?
```

Response to service request

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F, A-T

[SENSe<1|2>:]LIST:POWer:SET

This command defines the constant settings for the list during multiple power measurement.

Parameters <PEAK meas>, <RMS meas> and <AVG meas> define, which measurements are to be performed at the same time at the frequency point.

Correspondingly, one, two or three results per frequency point are returned for the "[SENSe<1|2>:]LIST:POWer:SEQuence]" command. If all three parameters are set to OFF, the command generates an execution error.

The numeric suffixes <1|2> are not relevant.

Parameter

<PEAK meas>	ON: activates the measurement of the peak power (peak detector) OFF: deactivates the measurement of the peak power
<RMS meas>	ON: activates the measurement of the RMS power (RMS detector) OFF: deactivates the measurement of the RMS power
<AVG meas>	ON: activates the measurement of the average power (average detector) OFF: deactivates the measurement of the average power
<trigger mode>	Selection of the trigger source used for the list measurement Possible values: IMMEDIATE EXTERNAL VIDEO IFPOWER
<trigger slope>	Used trigger slope Possible values: POSITIVE NEGATIVE
<trigger offset>	Offset between the detection of the trigger signal and the start of the measurement at the next frequency point. Range of values: 0 s, 125 ns to 100s
<gate length>	Gate length with gated sweep Range of values: 0 s, 125 ns to 100s The value 0 s deactivates the use of gated trigger; other values activate the gated trigger function. Values <> 0 s are only possible if <trigger mode> is different from IMMEDIATE. Otherwise, an execution error is triggered.

Return values

The query command returns a list of comma-separated values (CSV) of the settings, i.e.

```
ON,ON,ON,IMM,POS,0,0
```

if the configuration has been set with the command

```
SENSe:LIST:POWer:SET ON,ON,ON,IMM,POS,0,0
```

Example

```
SENSe:LIST:POWer:SET ON,OFF,OFF,EXT,POS,10US,434US
```

Characteristics

*RST value: ON,OFF,OFF,IMM,POS,0S,0S

SCPI: device-specific

Mode

A-F, A-T

[SENSe<1|2>:]LIST:POWer:STATe

This command deactivates the list measurement.

The numeric suffixes <1|2> are not relevant.

Parameters

OFF

Example

```
SENSe:LIST:POWer:STATe OFF
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F, A-T

6.2.9.9 SENSE:LIST:RANGE Subsystem

The `SENSe:LIST:RANGE` Subsystem contains the remote commands to configure Spurious Emissions measurements.

Commands of the SENSE:LIST:RANGE Subsystem

- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:BANDwidth](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:BANDwidth:RESolution](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:BANDwidth:VIDeo](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:BREak](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:DElete](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:COUNT?](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:DETEctor](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>\[:FREQuency\]:STARt](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>\[:FREQuency\]:STOP](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:FILTer:TYPE](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:INPut:ATTenuation](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:INPut:ATTenuation:AUTO](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:INPut:GAIN:STATe](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:POINTs](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:RLEVel](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:SWEep:TIME](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:SWEep:TIME:AUTO](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:LIMit:STARt](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:LIMit:STOP](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:LIMit:STATe](#)"
- ◆ "[\[SENSe<1|2>:\]LIST:RANGE<1...20>:TRANsducer](#)"

[SENSe<1|2>:]LIST:RANGe<1...20>:BANDwidth

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth](#)" on page "468".

[SENSe<1|2>:]LIST:RANGe<1...20>:BANDwidth:RESolution

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth:RESolution](#)" on page "468".

[SENSe<1|2>:]LIST:RANGe<1...20>:BANDwidth:VIDeo

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:BANDwidth:VIDeo](#)" on page "468".

[SENSe<1|2>:]LIST:RANGe<1...20>:BREak

This command configures the sweep behavior.
The numeric suffixes are not relevant.

Parameter

- | | |
|-----|--|
| ON | The R&S FSV stops after one range is swept and continues only if you confirm (a message box is displayed). |
| OFF | The R&S FSV sweeps all ranges in one go. |

Example

```
LIST:RANG:BRE ON
```

Configures a stop after each range.

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

A

[SENSe<1|2>:]LIST:RANGe<1...20>:DELeTe

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:DELeTe](#)" on page "469".

[SENSe<1|2>:]LIST:RANGe<1...20>:COUNT?

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:COUNT?](#)" on page "469".

[SENSe<1|2>:]LIST:RANGe<1...20>:DETEctor

This command sets the detector for the specified range. For details refer to chapter 4, "[Detector overview](#)".

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameter

APEak	auto peak detector
NEGative	minimum peak detector
POSitive	peak detector
SAMPlE	sample detector
RMS	RMS detector
AVERAge	average detector

Example

```
LIST:RANGe3:DET SAMP
```

Sets the sample detector for range 3.

Characteristics

*RST value: RMS

SCPI: device-specific

Mode

A

[SENSe<1|2>:]LIST:RANGe<1...20>[:FREQuency]:STARt

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>\[:FREQuency\]:STARt](#)" on page "469".

[SENSe<1|2>:]LIST:RANGe<1...20>[:FREQuency]:STOP

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>\[:FREQuency\]:STOP](#)" on page "470".

[SENSe<1|2>:]LIST:RANGe<1...20>:FILTEr:TYPE

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:FILTEr:TYPE](#)" on page "470".

[SENSe<1|2>:]LIST:RANGe<1...20>:INPut:ATTenuation

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:INPut:ATTenuation](#)" on page "471".

[SENSe<1|2>:]LIST:RANGe<1...20>:INPut:ATTenuation:AUTO

For details refer to

["\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:INPut:ATTenuation:AUTO"](#) on page "471".

[SENSe<1|2>:]LIST:RANGe<1...20>:INPut:GAIN:STATe

For details refer to

["\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:INPut:GAIN:STATe"](#) on page "472".

[SENSe<1|2>:]LIST:RANGe<1...20>:POINts

This command sets the number of sweep points for the specified range.

The numeric suffixes <1...20> specify the range. The numeric suffixes <1|2> are not relevant.

Parameters

For details on possible values refer to chapter 4, **Sweep Points** softkey of the sweep menu.

Example

```
LIST:RANG3:POIN 601
```

Sets 601 sweep points for range 3.

Characteristics

*RST value: 501

SCPI: device-specific

Mode

A

[SENSe<1|2>:]LIST:RANGe<1...20>:RLEVel

For details refer to ["\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:RLEVel"](#) on page "475".

[SENSe<1|2>:]LIST:RANGe<1...20>:SWEep:TIME

For details refer to ["\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:SWEep:TIME"](#) on page "476".

[SENSe<1|2>:]LIST:RANGe<1...20>:SWEep:TIME:AUTO

For details refer to

["\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:SWEep:TIME:AUTO"](#) on page "476".

[SENSe<1|2>:]LIST:RANGe<1...20>:LIMit:START

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:START](#)" on page "473".

[SENSe<1|2>:]LIST:RANGe<1...20>:LIMit:STOP

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:LIMit<1...4>:ABSolute:STOP](#)" on page "473".

[SENSe<1|2>:]LIST:RANGe<1...20>:LIMit:STATE

For details refer to

"[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:LIMit<1...4>:STATE](#)" on page "475".

[SENSe<1|2>:]LIST:RANGe<1...20>:TRANsducer

For details refer to "[\[SENSe<1|2>:\]ESpectrum:RANGe<1...20>:TRANsducer](#)" on page "477".

6.2.9.10 SENSE:MPOWER Subsystem

The commands of this subsystem are used to determine the mean burst power or peak burst power for a given number of signal bursts, and for outputting the results in a list. Since all the settings required for a measurement are combined in a single command, the measurement speed is considerably higher than when using individual commands.

For measuring the signal bursts, the gated sweep function is used in zero span.

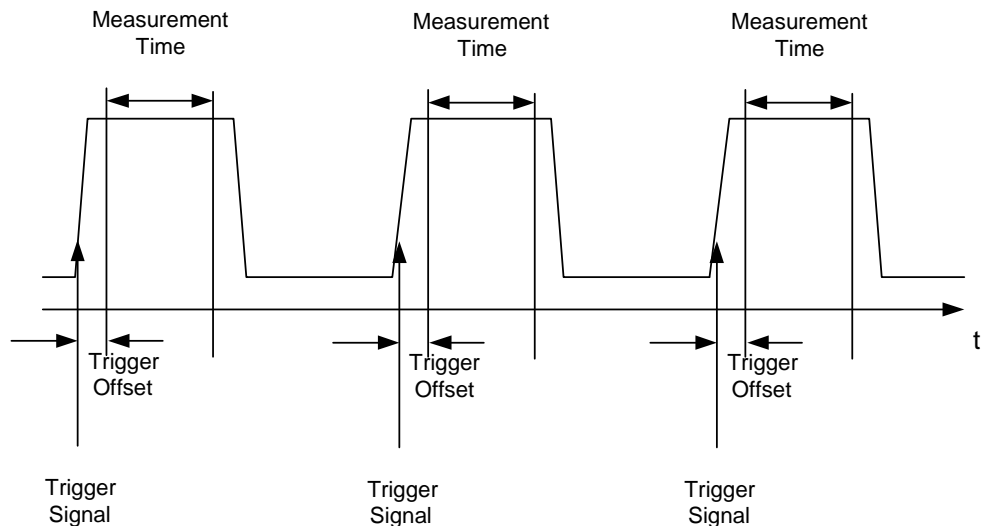
The gate is controlled either by an external trigger signal or by the video signal. An individual trigger event is required for each burst to be measured. If an external trigger signal is used, the threshold is fixed to TTL level, while with a video signal the threshold can be set as desired.

Commands of the SENSE:MPOWER Subsystem

- ◆ "[\[SENSe<1|2>:\]MPOWER:SEquence](#)"
 - ◆ "[\[SENSe<1|2>:\]MPOWER:FTYPE](#)"
 - ◆ "[\[SENSe<1|2>:\]MPOWER:RESult\[:LIST\]?](#)"
 - ◆ "[\[SENSe<1|2>:\]MPOWER:RESult:MIN?](#)"
- Further information
- ◆ "[More Details on the SENSE:MPOWER Subsystem](#)"

6.2.9.11 More Details on the SENSE:MPOWER Subsystem

The following graphics shows the relation between trigger time, trigger offset (for delayed gate opening) and measurement time.



Depending on the settings made, the measurements are performed with the RMS detector for RMS power or the PEAK detector for peak power. For all these measurements, trace 1 of the selected system is used.

The setting parameters for this measurement are:

- ◆ analyzer frequency
- ◆ resolution bandwidth
- ◆ measurement time used for a single burst
- ◆ trigger source
- ◆ trigger level
- ◆ trigger offset
- ◆ type of power measurement (PEAK, MEAN)
- ◆ number of bursts to be measured

The commands of this subsystem can be used in two different ways:

- ◆ Setting up the instrument and at the same time querying the result list: This method ensures the smallest delay between measurement and the output of the measured values, but requires the control computer to wait actively for the response of the instrument.
- ◆ Setting up the instrument and querying the result list after synchronization to the end of measurement: With this method the control computer can be used for other activities while the instrument is performing the measurement at the cost of additional time needed for synchronization via service request.

[SENSe<1|2>:]MPOWER[:SEQUence]

This command configures the instrument setup for multiple burst power measurement and starts a measurement sequence. When synchronizing the command with *OPC, a service request is generated as soon as the defined number of individual measurements (# of meas) is reached.

To reduce the setting time, the setup is performed simultaneously for all selected parameters.

The command in the form of a query makes the instrument settings, performs the defined number of measurements and outputs the measurement results list.

The numeric suffixes <1|2> are not relevant.

Parameter

<analyzer freq>	Receive frequency for the burst signals to be measured (= center frequency in manual operation) Range: 0 Hz to max. frequency, depending on instrument model
<rbw>	resolution bandwidth for the measurement Range: 10 Hz to 10 MHz in steps of 1, 3, 10
<meas time>	Time span during which measurement samples are sampled for RMS / peak measurement. The type of measurement is selected by <type of meas>. Range: 1 us to 30s
<trigger source>	trigger signal source. Possible settings: EXTernal: The trigger signal is fed from the "Ext. Trigger/Gate" input on the rear of the unit. VIDeo: The internal video signal is used as trigger signal.
<trigger level>	Signal level at which the trigger becomes active. For <trigger source> = VIDeo this is the level of the video signal as a percentage of the diagram height. If <trigger source> = EXTernal is selected, the value entered here is ignored, as in this case the trigger input uses TTL levels. Range: 0 - 100PCT(<trigger source> = VIDeo)
<trigger offset>	Offset between the detection of the trigger signal and the start of the measurement. Range: 125 ns to 100s
<type of meas>	Determines whether mean power (RMS) or peak power (PEAK) is to be measured. The detector is selected accordingly. Possible values: MEAN, PEAK
<# of meas>	Number of individual bursts to be measured. Range: 1 to 32001

Return values

The query command returns a list separated by commas (comma separated values = CSV), which contains the power measurement results in floating-point format. The unit used for the Return values is always dBm.

The command

```
SENSe:MPOWer? 935.2MHz, 1MHz, 434us, VIDEO, 50PCT, 5us, MEAN, 20
```

may, for instance, cause the following list to be returned:

```
18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9,18.3,18.6,18.1,18.0,17.9
```

Example

```
SENSe:MPOWer 935.2MHz, 1MHz, 434us, VIDEO, 50PCT, 5us, MEAN, 20
```

Performs a measurement sequence with the following settings:

Frequency	935.2 MHz,
Resolution bandwidth	1 MHz
Measurement time	434 µs
Trigger source	VIDEO
Trigger threshold	50%
Trigger offset	5 µs
Type of measurement	MEAN power
No. of measurements	20

```
SENSe:MPOWer? 935.2MHz, 1MHz, 434us, VIDEO, 50PCT, 5us, MEAN, 20
```

Performs the same measurement and in addition returns the results list immediately after completion of the last measurement.

Note: The measurement function always uses trace 1.

Repeated use of the command without changes to its parameters (i.e. using the same settings again) will speed up the measurement since the previous hardware settings will be cached and therefore additional hardware settling times will be avoided. This also holds true if only part of the parameters (e.g. only the trigger delay) are changed, as in this case the rest of the parameters will be cached.

This measurement is not compatible with other measurements, especially as far as marker functions, adjacent-channel measurement or statistics are concerned. The corresponding functions are therefore automatically switched off. In return incompatible commands will automatically deactivate the multi burst power function.

The function is only available in the REMOTE operation. It is deactivated on switching back to LOCAL.

Characteristics

*RST value: -
SCPI: device-specific

Mode

A

[SENSe<1|2>:]MPOWer:FTYPE

This command defines the filter type for the measurement.
The numeric suffixes <1|2> are not relevant.

Parameters

NORMal | CFILter | RRC

Example

```
SENSe:MPOWer:FTYPE CFILter
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

A

[SENSe<1|2>:]MPOWer:RESult[:LIST]?

This command queries the results of a multiple burst power measurement as configured and initiated with "[SENSe<1|2>:]MPOWer:SEQuence]". The results are output in a comma-separated list of floating point values. The unit used for the Return values is always dBm.

This command may be used to obtain measurement results in an asynchronous way using the service request mechanism for synchronization with the end of the measurement.

The numeric suffixes <1|2> are not relevant.

If no measurement results are available, the command returns a query error.

Example

```
*ESE 1
```

```
*SRE 32
```

Configuration of status reporting systems for the generation of an SRQ on operation complete

```
SENSe:MPOWer 935.2MHz,1MHz,434us,VIDEO,50PCT,5us,MEAN,20;*OPC
```

Configuring and starting the measurement

```
...
```

Further actions of the control computer during measurement

```
On SRQ:
```

Response to service request

```
SENSe:MPOWer:RESult?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]MPOWer:RESult:MIN?

This command queries the minimum power value in a multiple burst power measurement as configured and initiated with "[SENSe<1|2>:]MPOWer:SEQuence]". The unit used for the Return values is always dBm.

The numeric suffixes <1|2> are not relevant.

If no measurement result is available, the command will return a query error.

Example

```
*ESE 1
```

```
*SRE 32
```

Configuration of status reporting systems for the generation of an SRQ on operation complete

```
SENSe:MPower 935.2MHz,1MHz,434us,VIDEO,50PCT,5us,MEAN,20;*OPC
```

Configuring and starting the measurement

```
...
```

Further actions of the control computer during measurement

On SRQ:

Response to service request

```
SENSe:MPower:REsult:MIN?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

6.2.9.12 SENSE:POWer Subsystem

This subsystem controls the setting of the instruments channel and adjacent channel power measurements.

Commands of the SENSE:POWer Subsystem

- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:ACPairs"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:BANDwidth|BWIDth\[:CHANnel\]"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:BANDwidth|BWIDth:ACHannel"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:BANDwidth|BWIDth:ALTErnate<1..11>"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer:ALPHa"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer:ALPHa:ACHannel"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer:ALPHa:ALTErnate<1..11>"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer:ALPHa:CHANnel<1..12>"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer\[:STATe\]:ALL"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer\[:STATe\]:ACHannel"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer\[:STATe\]:ALTErnate<1..11>"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:FILTer\[:STATe\]:CHANnel<1..12>"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:MODE"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:PRESet"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:PRESet:RLEVe!"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:REFErence:AUTO"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:REFErence:TXCHannel:AUTO"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:REFErence:TXCHannel:MANual"](#)
- ◆ ["\[SENSe<1|2>:\]POWer:ACHannel:SPACing\[:ACHannel\]"](#)

- ◆ "[SENSe<1|2>:]POWer:ACHannel:SPACing:ALternate<1...11>"
- ◆ "[SENSe<1|2>:]POWer:ACHannel:SPACing:CHANnel"
- ◆ "[SENSe<1|2>:]POWer:ACHannel:TXChannel:COUNt"
- ◆ "[SENSe<1|2>:]POWer:BANDwidth|BWIDth"
- ◆ "[SENSe<1|2>:]POWer:HSPeed"
- ◆ "[SENSe<1|2>:]POWer:NCORrection"
- ◆ "[SENSe<1|2>:]POWer:TRACe"

[SENSe<1|2>:]POWer:ACHannel:ACPairs

This command sets the number of adjacent channels (upper and lower channel in pairs). The figure 0 stands for pure channel power measurement. The numeric suffixes <1|2> are not relevant.

Parameters

1 to 12

Example

```
POW:ACH:ACP 3
```

Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]

This command sets the channel bandwidth of the radio communication system. The bandwidths of adjacent channels are not influenced by this modification. With "[SENSe<1|2>:]POWer:HSPeed" set to ON, steep-edged channel filters are available. For further information on filters refer to chapter "Instrument Functions", section "[List of available RRC and channel filters](#)".

The numeric suffixes <1|2> are not relevant.

Parameters

100 Hz to 1000 MHz

Example

```
POW:ACH:BWID 30kHz
```

Sets the bandwidth of the TX channel to 30 kHz.

Characteristics

*RST value: 14 kHz

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel

This command defines the channel bandwidth of the adjacent channel of the radio transmission system. If the bandwidth of the adjacent channel is changed, the bandwidths of all alternate adjacent channels are automatically set to the same value.

With "[\[SENSe<1|2>:\]POWer:HSPeed](#)" set to ON, steep-edged channel filters are available. For further information on filters refer to chapter "Instrument Functions", section "[List of available RRC and channel filters](#)".

The numeric suffixes <1|2> are not relevant.

Parameters

100 Hz to 1000 MHz

Example

```
POW:ACH:BWID:ACH 30kHz
```

Sets the bandwidth of all adjacent channels to 30 kHz.

Characteristics

*RST value: 14 kHz

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:BANDwidth|BWIDth:ALTErnate<1...11>

This command defines the channel bandwidth of the alternate adjacent channels of the radio transmission system. If the channel bandwidth of alternate adjacent channel 1 is changed, the bandwidth of alternate adjacent channels 2 to 11 is automatically set to the same value.

With "[\[SENSe<1|2>:\]POWer:HSPeed](#)" set to ON, steep-edged channel filters are available. For further information on filters refer to chapter "Instrument Functions", section "[List of available RRC and channel filters](#)".

Parameters

100 Hz to 1000 MHz

Example

```
POW:ACH:BWID:ALT2 30kHz
```

Characteristics

*RST value: 14 kHz
SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer:ALPHA

This command defines the alpha value for the weighting filter for all channels.
The numeric suffixes <1|2> are not relevant.

Parameters

<numeric value>

Example

```
POW:ACH:FILT:ALPH:ALL 0,35
```

Characteristics

*RST value: 0,22
SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer:ALPHA:ACHannel

This command defines the alpha value for the weighting filter for the adjacent channel.
The numeric suffixes <1|2> are not relevant.

Parameters

<numeric value>

Example

```
POW:ACH:FILT:ALPH:ACH 0,35
```

Characteristics

*RST value: 0,22
SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer:ALPHa:ALTeRnate<1..11>

This command defines the alpha value for the weighting filter for all alternate channels.

The numeric suffixes <1|2> and <1..11> are not relevant.

Parameters

<numeric value>

Example

```
POW:ACH:FILT:ALPH:ALT1 0,35
```

Characteristics

*RST value: 0,22

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer:ALPHa:CHANnel<1..12>

This command defines the alpha value for the weighting filter for all TX channels.

The numeric suffixes <1|2> and <1..12> are not relevant.

Parameters

<numeric value>

Example

```
POW:ACH:FILT:ALPH:CHAN1 0,35
```

Characteristics

*RST value: 0,22

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer[:STATe]:ALL

This command activates the weighting filter for all channels.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
POW:ACH:FILT ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer[:STATe]:ACHannel

This command activates the weighting filter for the adjacent channel.
The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
POW:ACH:FILT:ACH ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer[:STATe]:ALTErnate<1..11>

This command activates the weighting filter for all alternate channels.
The numeric suffixes <1|2> and <1..11> are not relevant.

Parameters

ON | OFF

Example

```
POW:ACH:FILT:ALT1 ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:FILTer[:STATe]:CHAnnel<1..12>

This command activates the weighting filter for all TX channels.
The numeric suffixes <1|2> and <1..12> are not relevant.

Parameters

ON | OFF

Example

```
POW:ACH:FILT:CHA1 ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:MODE

This command switches between absolute and relative adjacent channel measurement. The command is only available with span > 0 and if the number of adjacent channel is greater than 0.

The numeric suffixes <1|2> are not relevant.

Parameters

ABSolute | RELative

Example

```
POW:ACH:MODE REL
```

Sets the adjacent channel measurement mode to relative.

Characteristics

*RST value: RELative

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:PRESet

This command adjusts the frequency span, the measurement bandwidths and the detector as required for the number of channels, the channel bandwidths and the channel spacings selected in the active power measurement. If necessary, adjacent-channel power measurement is switched on prior to the adjustment. To obtain correct results, a complete sweep with synchronization to the end of the sweep must be performed after the adjustment. Synchronization is possible only in the single sweep mode.

The result is queried with the
 "[CALCulate<1|2>:MARKer:FUNCtion:POWer:RESult?](#)" command.
 The numeric suffixes <1|2> are not relevant.

Parameters

ACPower | CPOWer | MCACpower | OBANdwidth | OBWidth | CN | CN0

Example

```
POW:ACH:PRES ACP
```

Sets the frequency span, the measurement bandwidths and the detector as required for the ACLR measurement.

```
INIT:CONT OFF
```

Switches over to single sweep mode.

```
INIT;*WAI
```

Starts a sweep and waits for the end of the sweep.

```
CALC:MARK:FUNC:POW:RES? ACP
```

Queries the result of the adjacent-channel power measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:PRESet:RLEVel

This command adapts the reference level to the measured channel power and - if required - switches on previously the adjacent channel power measurement. This ensures that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Note: Subsequent commands have to be synchronized with *WAI, *OPC or *OPC? to the end of the auto range process which would otherwise be aborted.

Example

```
POW:ACH:PRES:RLEV;*WAI
```

Adapts the reference level to the measured channel power.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F, WCDMA

[SENSe<1|2>:]POWer:ACHannel:REFerence:AUTO

This command sets the reference value to the currently measured channel power for the relative measurement.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Parameters

ONCE

Example

```
POW:ACH:REF:AUTO ONCE
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:REFerence:TXCHannel:AUTO

This command activates the automatic selection of a transmission channel to be used as a reference channel in relative adjacent-channel power measurements. The transmission channel with the highest power, the transmission channel with the lowest power, or the transmission channel nearest to the adjacent channels can be defined as a reference channel.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0

("CALCulate<1|2>:MARKer:FUNCtion:POWer:SElect").

The numeric suffixes <1|2> are not relevant.

Parameter

MINimum	Transmission channel with the lowest power
MAXimum	Transmission channel with the highest power
LHIGhest	Lowermost transmission channel for the lower adjacent channels, uppermost transmission channel for the upper adjacent channels

Example

```
POW:ACH:REF:TXCH:AUTO MAX
```

The transmission channel with the highest power is used as a reference channel.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:REFerence:TXCHannel:MANual

This command selects a transmission channel to be used as a reference channel in relative adjacent-channel power measurements.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0

("CALCulate<1|2>:MARKer:FUNCTion:POWer:SElect").

The numeric suffixes <1|2> are not relevant.

Parameters

1 to 12

Example

```
POW:ACH:REF:TXCH:MAN 3
```

Transmission channel 3 is used as a reference channel.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:SPACing[:ACHannel]

This command defines the spacing between the carrier signal and the adjacent channel (ADJ). The modification of the adjacent-channel spacing (ADJ) causes a change in all higher adjacent-channel spacings (ALT1, ALT2, ...): they are all multiplied by the same factor (new spacing value / old spacing value).

The numeric suffixes <1|2> are not relevant.

Parameters

100 Hz to 2000 MHz

Example

```
POW:ACH:SPAC 33kHz
```

Sets the spacing between the carrier signal and the adjacent channel to 33 kHz, the alternate adjacent channel 1 to 66 kHz, the alternate adjacent channel 2 to 99 kHz, and so on.

Characteristics

*RST value: 14 kHz

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:SPACing:ALTErnate<1...11>

This command defines the spacing between the alternate adjacent channels and the TX channel (ALT1, ALT2, ...). A modification of a higher adjacent-channel spacing causes a change by the same factor (new spacing value / old spacing value) in all higher adjacent-channel spacings, while the lower adjacent-channel spacings remain unchanged.

The numeric suffixes <1...11> defines the alternate adjacent channel. The numeric suffixes <1|2> are not relevant.

Parameters

100 Hz to 2000 MHz

Example

```
POW:ACH:SPAC:ALT1 100kHz
```

Sets the spacing between TX channel and alternate adjacent channel 1 (ALT1) from 40 kHz to 100 kHz. In consequence, the spacing between the TX channel and all higher alternate adjacent channels is increased by the factor $100/40 = 2.5$: ALT2 = 150 kHz, ALT3 = 200 kHz, ALT4 = 250 kHz.

Characteristics

*RST value: 40 kHz (ALT1), 60 kHz (ALT2), 80 kHz (ALT3), ...

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:SPACing:CHANnel<1...11>

This command defines the channel spacing for the carrier signals.

The numeric suffixes <1...11> defines the TX channel. The numeric suffixes <1|2> are not relevant.

Parameters

14 kHz to 2000 MHz

Example

```
POW:ACH:SPAC:CHAN 25kHz
```

Characteristics

*RST value: 20 kHz

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:ACHannel:TXCHannel:COUNT

This command selects the number of carrier signals.

The command is available only for multicarrier channel and adjacent-channel power measurements with span > 0

("CALCulate<1|2>:MARKer:FUNCtion:POWer:SElect").

The numeric suffixes <1|2> are not relevant.

Parameters

1 to 12

Example

```
POW:ACH:TXCH:COUN 3
```

Characteristics

*RST value: 1

SCPI: device-specific

Mode

A

[SENSe<1|2>:]POWer:BANDwidth|BWIDth

This command defines the percentage of the power with respect to the total power.

This value is the basis for the occupied bandwidth measurement

("[SENSe<1|2>:]POWer:ACHannel:PRESet").

The numeric suffixes <1|2> are not relevant.

Parameters

10 to 99.9PCT

Example

```
POW:BWID 95PCT
```

Characteristics

*RST value: 99PCT

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:HSPeed

This command switches on or off the high-speed channel/adjacent channel power measurement. The measurement itself is performed in zero span on the center frequencies of the individual channels. The command automatically switches to zero span and back.

Depending on the selected mobile radio standard, weighting filters with characteristic or very steep-sided channel filters are used for band limitation.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
POW:HSP ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:NCORrection

When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined.

The numeric suffixes <1|2> are not relevant.

Example

```
POW:NCOR ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-F

[SENSe<1|2>:]POWer:TRACe

This command assigns the channel/adjacent channel power measurement to the indicated trace. The corresponding trace must be active, i.e. its state must be different from blank.

The numeric suffixes <1|2> are not relevant.

Note: The measurement of the occupied bandwidth (OBW) is performed on the trace on which marker 1 is positioned. To evaluate another trace, marker 1 must be positioned to another trace with "[CALCulate<1|2>:MARKer<1...16>:TRACe](#)".

Parameters

1 to 6

Example

POW:TRAC 2

Assigns the measurement to trace 2.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

6.2.9.13 SENSE:SWEEP Subsystem

The SENSE:SWEEP subsystem controls the sweep parameters.

Commands of the SENSE:SWEEP Subsystem

- ◆ ["\[SENSe<1|2>:\]SWEEP:COUNT"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:COUNT:CURRENT?"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:HOLDoff"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:LENGTH"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:POLarity"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:SOURce"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:TRACe<1...6>:COMment"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:TRACe<1...6>:STATe<1...3>\]"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:TRACe<1...6>:STARt<1...3>"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:TRACe<1...6>:STOP<1...3>"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:EGATE:TRACe<1...6>:PERiod"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:MODE"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:POINTs"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:TIME"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:TIME:AUTO"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:TYPE"](#)
- ◆ ["\[SENSe<1|2>:\]SWEEP:TYPE:USED"](#)

[SENSe<1|2>:]SWEep:COUNT

This command defines the number of sweeps started with single sweep, which are used for calculating the average or maximum value. If the values 0 or 1 are set, one sweep is performed.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to 32767

Example

```
SWE:COUN 64
```

Sets the number of sweeps to 64.

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
INIT;*WAI
```

Starts a sweep and waits for its end.

Characteristics

*RST value: 0

SCPI: conform

Mode

A, ADEMOD, WCDMA

[SENSe<1|2>:]SWEep:COUNT:CURRent?

This query command returns the current number of started sweeps. A sweep count value should be set and the device should be in single sweep mode.

The numeric suffixes <1|2> are not relevant.

Example

```
SWE:COUNT 64
```

Sets sweep count to 64

```
INIT:CONT OFF
```

Switches to single sweep mode

```
INIT
```

Starts a sweep (without waiting for the sweep end!)

```
SWE:COUN:CURR?
```

Queries the number of started sweeps

Characteristics

*RST value: 0

SCPI: conform

Mode

A, ADEMOD

[SENSe<1|2>:]SWEep:EGATe

This command switches on/off the sweep control by an external gate signal. If the external gate is selected the trigger source is automatically switched to EXTERNAL as well.

In case of measurement with external gate, the measured values are recorded as long as the gate is opened. During a sweep the gate can be opened and closed several times. The synchronization mechanisms with *OPC, *OPC? and *WAI remain completely unaffected.

The sweep end is detected when the required number of measurement points (501 in **Spectrum Analyzer mode**) has been recorded.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
SWE:EGAT ON
```

Switches on the external gate mode.

```
SWE:EGAT:TYPE EDGE
```

Switches on the edge-triggered mode.

```
SWE:EGAT:HOLD 100US
```

Sets the gate delay to 100 µs.

```
SWE:EGAT:LEN 500US
```

Sets the gate opening time to 500 µs.

```
INIT;*WAI
```

Starts a sweep and waits for its end.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A, WLAN, OFDM, OFDMA/WiBro

[SENSe<1|2>:]SWEep:EGATe:HOLDoff

This command defines the delay time between the external gate signal and the continuation of the sweep.

The numeric suffixes <1|2> are not relevant.

Parameters

125 µs to 100 s

Example

```
SWE:EGAT:HOLD 100us
```

Characteristics

*RST value: 0s

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:LENGth

In case of edge triggering, this command determines the time interval during which the instrument sweeps.

The numeric suffixes <1|2> are not relevant.

Parameters

0 to 100 s

Example

```
SWE:EGAT:LENG 10ms
```

Characteristics

*RST value: 0s

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:POLarity

This command determines the polarity of the external gate signal. The setting applies both to the edge of an edge-triggered signal and the level of a level-triggered signal.

The numeric suffixes <1|2> are not relevant.

Parameters

POSitive | NEGative

Example

```
SWE:EGAT:POL POS
```

Characteristics

*RST value: POSitive

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:SOURce

This command toggles between external gate signal and IF power signal as a signal source for the gate mode. If an IF power signal is used, the gate is opened as soon as a signal at > -20 dBm is detected within the IF path bandwidth (10 MHz).

The numeric suffixes <1|2> are not relevant.

Parameters

EXTErnal | IFPower | VIDEo

Example

```
SWE:EGAT:SOUR IFP
```

Switches the gate source to IF power.

Characteristics

*RST value: IFPower

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TRACe<1...6>:COMMENT

Defines a comment for one of the traces for gated triggering.

The numeric suffixes <1|2> are not relevant.

Parameters

<string>

Example

```
SWE:EGAT:TRAC1:COMM "SlotA"
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TRACe<1...6>[:STATe<1...3>]

This command activates or deactivates tracing for a specific range using gated triggering.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
SWE:EGAT:TRAC1:STAT1 ON
```

Activates tracing for range 1 of trace 1.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TRACe<1...6>:STARt<1...3>

This command defines the starting point for the range to be traced using gated triggering.

The numeric suffixes <1|2> are not relevant.

Parameters

<numeric value>

Example

```
SWE:EGAT:TRAC1:STAR1 3ms
```

Sets the starting point for range 1 on trace 1 at 3 ms.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TRACe<1...6>: STOP<1...3>

This command defines the stopping point for the range to be traced using gated triggering.

The numeric suffixes <1|2> are not relevant.

Parameters

<numeric value>

Example

```
SWE:EGAT:TRAC1:STOP1 5ms
```

Sets the stopping point for range 1 on trace 1 at 5 ms.

Characteristics

*RST value: 1 μ s

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TRACe<1...6>: PERiod

This command defines the length of the period to be traced using gated triggering. The numeric suffixes <1|2> are not relevant.

Parameters

<numeric value>

Example

```
SWE:EGAT:TRAC1:PER 5ms
```

Defines the period for gated triggering to 5 ms.

Characteristics

*RST value: 0 s

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:EGATe:TYPE

This command sets the type of triggering (level or edge) by the external gate signal.

The gate is edge-triggered ("[\[SENSe<1|2>:\]SWEep:MODE](#)"):

After detection of the set gate signal edge, the gate remains open until the gate delay ("[\[SENSe<1|2>:\]SWEep:EGATe:HOLDoff](#)") has expired.

The gate is level-triggered ("[\[SENSe<1|2>:\]SWEep:MODE](#)"):

After detection of the gate signal, the gate remains open until the gate signal disappears. The gate opening time cannot be defined with the parameter "[\[SENSe<1|2>:\]SWEep:EGATe:LENGth](#)".

A delay between applying the gate signal and the start of recording measured values can be defined with "[\[SENSe<1|2>:\]SWEep:EGATe:HOLDoff](#)".

The numeric suffixes <1|2> are not relevant.

Parameters

LEVeL | EDGE

Example

```
SWE:EGAT:TYPE EDGE
```

Characteristics

*RST value: EDGE

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:MODE

This command changes from "Spectrum" to "Spectrum Emission Mask" or "Spurious Emissions" measurement mode and back.

The numeric suffixes <1|2> are not relevant.

Parameter

AUTO	Switches to "Spectrum" measurement mode or stays in the current mode if it is not ESP / LIST
ESpectrum	"Spectrum Emission Mask" measurement mode
LIST	"Spurious Emissions" measurement mode

Example

```
SWE:MODE ESP
```

Sets the Spectrum Emission Mask measurement mode.

Characteristics

*RST value: AUTO

SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:POINts

This command defines the number of measurement points to be collected during one sweep.

The numeric suffixes <1|2> are not relevant.

Parameters

101 to 32001

Example

```
SWE:POIN 251
```

Characteristics

*RST value: 501

SCPI: conform

Mode

A

[SENSe<1|2>:]SWEep:TIME

This command defines the sweep time. The available time values vary depending on the span setting.

If "[\[SENSe<1|2>:\]SWEep:TIME](#)" is directly programmed, automatic coupling to resolution bandwidth and video bandwidth is switched off.

The numeric suffixes <1|2> are not relevant.

Parameters

refer to data sheet

Example

```
SWE:TIME 10s
```

Characteristics

*RST value: - (AUTO is set to ON)

SCPI: conform

Mode

A, ADEMOD, NF, OFDM, OFDMA/WiBro, WLAN

[SENSe<1|2>:]SWEep:TIME:AUTO

This command controls the automatic coupling of the sweep time to the frequency span and bandwidth settings.

If "[\[SENSe<1|2>:\]SWEep:TIME](#)" is directly programmed, automatic coupling is switched off.

The numeric suffixes <1|2> are not relevant.

Parameters

ON | OFF

Example

```
SWE:TIME:AUTO ON
```

Switches on the coupling to frequency span and bandwidths.

Characteristics

*RST value: ON

SCPI: conform

Mode

A

[SENSe<1|2>:]SWEep:TYPE

Sets the sweep type.
The numeric suffixes <1|2> are not relevant.

Parameter

SWE Sweep list
AUTO Automatic selection of the sweep type.
FFT FFT mode

Example

```
SWE:TYPE FFT
```

Characteristics

*RST value: AUTO
SCPI: device-specific

Mode

A

[SENSe<1|2>:]SWEep:TYPE:USED

Returns the used sweep type.
The numeric suffixes <1|2> are not relevant.

Parameters

-

Example

```
SWE:TYPE:USED
```

Characteristics

*RST value: AUTO
SCPI: device-specific

Mode

A

6.2.10 STATus Subsystem

The STATus subsystem contains the commands for the status reporting system (for details refer to chapter 5 "Remote Control - Basics", section "Status Reporting System"). *RST does not influence the status registers.

The following subsystem is included:

["STATus:QUEStionable Subsystem"](#) on page "524"

6.2.10.1 STATus:QUEStionable Subsystem

The STATus:QUEStionable subsystem contains information about the observance of limits during adjacent power measurements, the reference and local oscillator, the observance of limit lines and limit margins and possible overloads of the unit.

Commands of the STATus:QUEStionable Subsystem

- ◆ "[STATus:QUEStionable:ACPLimit\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:ACPLimit:CONDition?](#)"
- ◆ "[STATus:QUEStionable:ACPLimit:ENABle](#)"
- ◆ "[STATus:QUEStionable:ACPLimit:NTRansition](#)"
- ◆ "[STATus:QUEStionable:ACPLimit:PTRansition](#)"
- ◆ "[STATus:QUEStionable:FREQuency\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:FREQuency:CONDition?](#)"
- ◆ "[STATus:QUEStionable:FREQuency:ENABle](#)"
- ◆ "[STATus:QUEStionable:FREQuency:NTRansition](#)"
- ◆ "[STATus:QUEStionable:FREQuency:PTRansition](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:CONDition?](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:ENABle](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:NTRansition](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:PTRansition](#)"
- ◆ "[STATus:QUEStionable:LMARgin<1|2>\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:LMARgin<1|2>:CONDition?](#)"
- ◆ "[STATus:QUEStionable:LMARgin<1|2>:ENABle](#)"
- ◆ "[STATus:QUEStionable:LMARgin<1|2>:NTRansition](#)"
- ◆ "[STATus:QUEStionable:LMARgin<1|2>:PTRansition](#)"
- ◆ "[STATus:QUEStionable:POWEr\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:POWEr:CONDition?](#)"
- ◆ "[STATus:QUEStionable:POWEr:ENABle](#)"
- ◆ "[STATus:QUEStionable:POWEr:NTRansition](#)"
- ◆ "[STATus:QUEStionable:POWEr:PTRansition](#)"
- ◆ "[STATus:QUEStionable:SYNC\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:SYNC:CONDition?](#)"
- ◆ "[STATus:QUEStionable:SYNC:ENABle](#)"
- ◆ "[STATus:QUEStionable:SYNC:NTRansition](#)"
- ◆ "[STATus:QUEStionable:SYNC:PTRansition](#)"

STATus:QUEStionable:ACPLimit[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:ACPLimit register. Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:ACPL?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:ACPLimit:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:ACPLimit register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:ACPL:COND?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:ACPLimit:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable:ACPLimit register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:ACPL:ENAB 65535
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:ACPLimit:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:ACPLimit register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:ACPL:NTR 65535
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:ACPLimit:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:ACPLimit register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:ACPL:PTR 65535
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:FREQuency[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable: FREQuency register.

Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:FREQ?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:FREQuency:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:FREQuency register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:FREQ:COND?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:FREQuency:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable:FREQuency register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:FREQ:ENAB 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:FREQuency:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:FREQuency register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:FREQ:NTR 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all, except NF

STATus:QUEStionable:FREQuency:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:FREQuency register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:FREQ:PTR 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all, except NF

STATus:QUEStionable:LIMit<1|2> [:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:LIMit register. Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:LIM?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LIMit<1|2>:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:LIMit register.
Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:LIM:COND?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LIMit<1|2>:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register. The ENABle register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LIM:ENAB 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LIMit<1|2>:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LIMit register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LIM:NTR 65535
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all, except NF

STATus:QUEStionable:LIMit<1|2>:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LIMit register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LIM:PTR 65535
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all, except NF

STATus:QUEStionable:LMARgin<1|2>[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:LMARgin register. Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:LMAR?
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all

STATus:QUEStionable:LMARgin<1|2>:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:LMARgin register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:LMAR:COND?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LMARgin<1|2>:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable:LMARgin register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LMAR:ENAB 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LMARgin<1|2>:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LMARgin register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LMAR:NTR 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:LMARgin<1|2>:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LMARgin register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:LMAR:PTR 65535
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

STATus:QUEStionable:POWer[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:POWer register. Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:POW?
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

STATus:QUEStionable:POWer:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:POWer register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:POW:COND?
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

STATus:QUEStionable:POWer:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable:POWer register. The ENABle register selectively enables the individual events of the associated EVENt section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:POW:ENAB 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:POWer:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:POWer register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUE:POWS:NTR 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:POWer:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:POWer register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:POW:PTR 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:SYNC[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:SYNC register.
Readout deletes the contents of the EVENT section.

Example

```
STAT:QUES:SYNC?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:SYNC:COND?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:SYNC:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable:SYNC register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameters

0 to 65535

Example

```
STAT:QUES:SYNC:ENAB 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:SYNC:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:SYNC register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:SYNC:NTR 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

STATus:QUEStionable:SYNC:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:SYNC register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:SYNC:PTR 65535
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

6.2.11 SYSTem Subsystem

SYSTem:TIME:TSTamp?

Returns the time and date from the internal real time clock.

Parameters

Example

```
SYST:TIME:TSTamp?
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

all

6.2.12 TRACe Subsystem

The TRACe subsystem controls access to the instruments internal trace memory.

The following subsystem is included:

- ◆ "[TRACe:IQ Subsystem](#)" on page "538"

Commands of the TRACe Subsystem

- ◆ "[TRACe<1|2>\[:DATA\]](#)"
- ◆ "[TRACe:COPY](#)"

TRACe<1|2>[:DATA]

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. The transfer of trace data from the control computer to the instrument takes place by indicating the trace name and then the data to be transferred.

For details on saving and recalling data refer to chapter 5 "Remote Control - Basics", section "[MMEMory Subsystem](#)".

Characteristics

*RST value: -
SCPI: conform

Mode

all

TRACe:COPY

This command copies data from one trace to another.
This command is an event and therefore has no query and no *RST value.

Parameters

TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6,
TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6

The first argument is the destination of the data to be copied, the second argument describes the source.

Example

```
TRAC:COPY TRACE1,TRACE2
```

Characteristics

*RST value: -
SCPI: conform

Mode

A

6.2.12.1 TRACe:IQ Subsystem

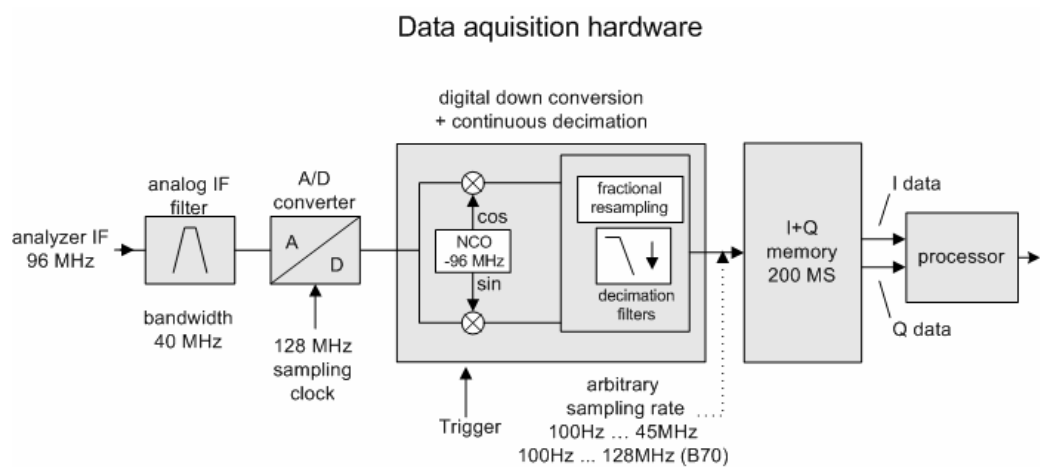
The commands of this subsystem are used for collection and output of measured IQ data. A special memory is therefore available in the instrument for a maximum of 200MS (1MS = 1024*1024) complex samples (pairs of I and Q data). The number of complex samples to be collected and the sample rate can be set (for details refer to "[Sample Rate and Maximum Usable Bandwidth](#)" on page "540"). Prior to being stored in memory or output via GPIB, the measurement data are corrected in terms of frequency response.

The block diagram below shows the analyzer hardware from the IF section to the processor.

The A/D converter samples the IF signal (96 MHz) at a rate of 128 MHz. The digital signal is down-converted to the complex baseband, lowpass-filtered, and the sampling rate is reduced. The continuously adjustable sampling rates are realized using an optimal decimation filter and subsequent resampling on the set sampling rate.

The I/Q data is written to a single memory, the data acquisition is hardware-triggered.

Figure 39: Block diagram illustrating the R&S FSV signal processing



The trigger sources "EXT" (external trigger) and "IFP" (IF Power Trigger) can be used for triggering, additionally "IMM" (Free Run). The number of complex samples to be recorded prior to the trigger event can be selected ("[TRACe<1|2>:IQ:SET](#)" command) for all available trigger sources, except for Free Run.

The measurement results are output in the form of a list, three different formats can be selected for this list ("[TRACe<1|2>:IQ:DATA:FORMat](#)" command).

The "FORMat" command can be used to select between binary output (32 bit IEEE 754 floating-point values) and output in ASCII format.

For details on formats refer to "[Formats for Returned Values: ASCII Format and Binary Format](#)" on page "553".

The commands of this subsystem can be used in two ways:

- ◆ Measurement and result query with one command:

This method causes the least delay between measurement and output of the result data, but it requires the control computer to wait actively for the response data.
- ◆ Setting up the instrument, start of the measurement via INIT and query of the result list at the end of the measurement:

With this method, the control computer can be used for other activities during the measurement. However, the additional time needed for synchronization via service request must be taken into account.

Commands of the TRACe:IQ Subsystem

- ◆ ["TRACe<1|2>:IQ:STATe\]"](#)
- ◆ ["TRACe<1|2>:IQ:AVERAge:STATe\]"](#)
- ◆ ["TRACe<1|2>:IQ:AVERAge:COUNt\]"](#)
- ◆ ["TRACe<1|2>:IQ:DATA?"](#)
- ◆ ["TRACe<1|2>:IQ:DATA:FORMat\]"](#)
- ◆ ["TRACe<1|2>:IQ:DATA:MEMory?"](#)
- ◆ ["TRACe<1|2>:IQ:SET"](#)
- ◆ ["TRACe<1|2>:IQ:SRATe"](#)

Further information

- ◆ ["Sample Rate and Maximum Usable Bandwidth"](#)

6.2.12.2 Sample Rate and Maximum Usable Bandwidth

Within the usable bandwidth range, the analog IF filter of the R&S FSV is equalized in regard to amplitude characteristic and group delay (provided that the R&S FSV is aligned; for details see chapter 4, section "Instrument Setup and Interface Configuration - SETUP Key", "[Alignment](#)"). In consequence, signals within this bandwidth range are hardly distorted at all (provided the R&S FSV is not overloaded). For the I/Q data acquisition, digital decimation filters are used internally. The passband of these digital filters corresponds to the maximum usable bandwidth. In consequence, signals within the usable bandwidth (passband) remain unchanged, while signals outside the usable bandwidth (passband) are suppressed. Usually, the suppressed signals are noise, artifacts, and the second IF side band. If frequencies of interest to you are also suppressed, you should try to increase the output sample rate, since this increases the maximum usable IQ bandwidth.

As a rule, the usable bandwidth is proportional to the output sample. Yet, when the I/Q bandwidth reaches the bandwidth of the analog IF filter (at very high output sample rates), the curve breaks.

R&S FSV with option B70 (IQ Bandwidth Extension):

maximum sample rate: 128 MHz
maximum bandwidth: 40 MHz
100 Hz to 64 MHz: linear bandwidth up to maximum 40 MHz,
64MHz to 128 MHz: 40 MHz bandwidth

R&S FSV without option B70 (IQ Bandwidth Extension):

maximum sample rate: 45 MHz
maximum bandwidth: 28 MHz
100 Hz to 44.8 MHz: linear bandwidth up to maximum 28 MHz,
44.8 MHz and above: 28 MHz bandwidth

TRACe<1|2>:IQ[:STATe]

This command switches the I/Q data acquisition on or off.

Note: The I/Q data acquisition is not compatible with other measurement functions. Therefore, all other measurement functions are switched off as soon as the I/Q measurement function is switched on. Furthermore, a trace display is not possible in this operating mode. Therefore, all traces are set to "BLANK".

Parameters

ON | OFF

Example

TRAC: IQ ON

Switches on I/Q data acquisition

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

TRACe<1|2>:IQ:AVERAge[:STATe]

The command enables averaging of the recorded I/Q data, provided that I/Q data acquisition was previously enabled with "[TRACe<1|2>:IQ\[:STATe\]](#)".

Note: With I/Q data averaging enabled, the maximum amount of I/Q data is limited to 512kS (524288 samples).

Parameters

ON | OFF

Example

TRAC: IQ ON

Switches on acquisition of I/Q data.

TRAC: IQ: AVER ON

Enables averaging of the I/Q measurement data.

TRAC: IQ: AVER: COUN 10

Selects averaging over 10 data sets.

TRAC: IQ: DATA?

Starts the measurement and reads out the averaged data.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A-T

TRACe<1|2>:IQ:AVERage:COUNT

This command defines the number of I/Q data sets that are to serve as a basis for averaging.

Parameters

0 to 32767

Example

```
TRAC: IQ ON
```

Switches on acquisition of I/Q data.

```
TRAC: IQ: AVER ON
```

Enables averaging of the I/Q measurement data

```
TRAC: IQ: AVER: COUN 10
```

Selects averaging over 10 data sets

```
TRAC: IQ: DATA?
```

Starts the measurement and reads out the averaged data.

Characteristics

*RST value: 0

SCPI: conform

Mode

all

TRACe<1|2>:IQ:DATA?

This command starts a measurement with the settings defined via "[TRACe<1|2>:IQ:SET](#)" and returns the list of measurement results immediately after they are corrected in terms of frequency response. The number of measurement results depends on the settings defined with "[TRACe<1|2>:IQ:SET](#)", the output format depends on the settings of the FORMat subsystem. The format of the list of data defined by the command "[TRACe<1|2>:IQ:DATA:FORMat](#)".

Note: The command requires that all response data is read out completely before the instrument accepts further commands.

Return values

The result values are scaled linear in unit `volt` and correspond to the voltage at the RF input of the instrument. In ASCII format, the number of the returned values is 2 * the number of samples.

Example

```
TRAC:IQ:STAT ON
```

Enables acquisition of I/Q data

```
TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,4096
```

Measurement configuration:

Sample Rate	32 MHz
Trigger Source	External
Trigger Slope	Positive
Pretrigger Samples	0
Number of Samples	4096

```
FORMat REAL,32
```

Selects format of response data

```
TRAC:IQ:DATA?
```

Starts measurement and reads results

Characteristics

*RST value: -

Note: Using the command with the *RST values for the "[TRACe<1|2>:IQ:SET](#)" command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, binary format: 2 kBytes

SCPI: device-specific

Mode

A-T

TRACe<1|2>:IQ:DATA:MEMory?

This command permits the readout of previously acquired (and frequency response corrected) I/Q data from the memory, with indication of the offset related to the start of measurement and with indication of the number of measurement values. Therefore a previously acquired data set can be read out in smaller portions. The maximum amount of available data depends on the settings of the "[TRACe<1|2>:IQ:SET](#)" command, the output format on the settings in the FORMat subsystem.

Note: The command requires that all response data is read out completely before the instrument accepts further commands.

If no I/Q data is available in memory because the corresponding measurement was not started, the command causes a query error.

Parameter

<offset samples>	Offset of the values to be read, in relation to the start of the acquired data. Value range: 0 to <# of samples> - 1, with <# of samples> being the value set by the " TRACe<1 2>:IQ:SET " command.
<# of samples>	Number of measurement values to be read. Value range: 1 to <# of samples> - <offset samples> with <# of samples> being the value set by the " TRACe<1 2>:IQ:SET " command.

Return values

The returned values are scaled linear in unit Volt and correspond to the voltage at the RF input of the instrument.

The format of the output buffer corresponds to the "[TRACe<1|2>:IQ:DATA?](#)" command.

Example

TRAC:IQ:STAT ON
Enables acquisition of I/Q data

TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,100,4096

Measurement configuration:

Sample Rate	32 MHz
Trigger Source	External
Trigger Slope	Positive
Pretrigger Samples	100
Number of Samples	4096

INIT;*WAI
Starts measurement and wait for sync

FORMat REAL,32
Determines output format

To read the results:

TRAC:IQ:DATA:MEM? 0,2048
Reads 2048 I/Q data starting at the beginning of data acquisition

TRAC:IQ:DATA:MEM? 2048,1024
Reads 1024 I/Q data from half of the recorded data

TRAC:IQ:DATA:MEM? 100,512
Reads 512 I/Q data starting at the trigger point (<Pretrigger Samples> was 100)

Characteristics

*RST value: -
SCPI: device-specific

Mode

A-T, WLAN, OFDM, OFDMA/WiBro

TRACe<1|2>:IQ:DATA:FORMAt

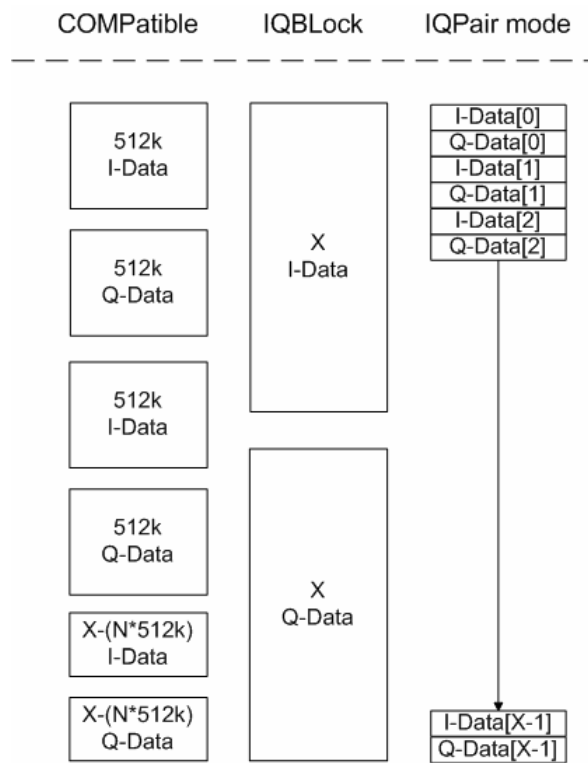
This command defines the format of the I/Q data.

Parameter

COMPAtible	Alternately 512 kS I data, 512 kS Q data
IQBLock	All I data, then all Q data
IQPair	Alternately one I-sample , then one Q sample

Note: For maximum performance, the formats "Compatible" or "QPair" should be used. Furthermore, for large amounts of data, the data should be in binary format to improve performance.

Figure 40: IQ data formats



In binary format, the number of I- and Q-data can be calculated as follows:

$$\# \text{ of } I\text{-Data} = \# \text{ of } Q\text{-Data} = \frac{\# \text{ of } \text{DataBytes}}{8}$$

For e.g. the format "QBLOCK", the offset of Q-data in the output buffer can be calculated as follows:

$$Q\text{-Data-Offset} = \frac{(\# \text{ of } \text{DataBytes})}{2} + \text{LengthIndicatorDigits}$$

with "LengthIndicatorDigits" being the number of digits of the length indicator including the #. In the example above (#41024...), this results in a value of 6 for LengthIndicatorDigits and the offset for the Q-data will result in $512 + 6 = 518$.

For further details on formats refer to "[Formats for Returned Values: ASCII Format and Binary Format](#)" on page "553".

Example

```
TRAC:IQ:DATA:FORM IQBL
```

Characteristics

*RST value: IQBL

SCPI: conform

Mode

all

TRACe<1|2>:IQ:SET

This command defines the settings of the analyzer hardware for the measurement of I/Q data. This allows setting the sample rate, trigger conditions and the record length.

Note: If this command is omitted, the current analyzer settings are used for the corresponding parameters.

This command switches to IQ mode automatically (see also "[TRACe<1|2>:IQ:STATe](#)").

The trigger level can be set using the "[TRIGger<1|2>:SEquence:LEVel:IFPower](#)" command.

Parameter

<rbw>	can be omitted
<sample rate>	Sampling rate for the data acquisition. Value range: 100 Hz to 45 MHz (for option B70 128MHz), continuously adjustable
<trigger mode>	Selection of the trigger source used for the measurement. Values: IMMEDIATE EXTERNAL IFPOWER
<trigger slope>	Used trigger slope. Values: POSITIVE NEGATIVE
<pretrigger samples>	Number of measurement values to be recorded before the trigger point. Range: -209715199(= -(200*1024*1024 - 1)) ... 209715199 (= 200*1024*1024 - 1). Negative values correspond to a trigger delay.
<Number of samples>	Number of measurement values to record. Value range:1 ... 209715200(= 200*1024*1024)

Example

```
TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,2048
```

Reads 2048 I/Q-values starting at the trigger point.

```
sample rate    32 MHz
trigger        External
slope          Positive
```

```
TRAC:IQ:SET NORM,10MHz,4MHz,EXT,POS,1024,512
```

Reads 512 I/Q-values from 1024 measurement points before the trigger point.

```
filter type    NORMAL
RBW            10 MHz
sample rate    4 MHz
trigger        External
slope          Positive
```

Characteristics

*RST values: -, -, 32MHz, IMM, POS, 0, 128

Note: When using these default settings with the "[TRACe<1|2>:IQ:DATA?](#)" command, the following minimum buffer sizes for the response data are recommended: ASCII format 10 kBytes, Binary format 2 kBytes.

SCPI: device-specific

Mode

A-T

TRACe<1|2>:IQ:SRATe

This command sets the sampling rate for the I/Q data acquisition. Thus the sample rate can be modified without affecting the other settings.

Parameters

100 Hz to 45 MHz (for option B70 128MHz), continuously adjustable

Example

TRAC:IQ:SRAT 4MHZ

Characteristics

*RST value: 32 MHz

SCPI: device-specific

Mode

A-T

6.2.13 TRIGger Subsystem

The TRIGger subsystem is used to synchronize instrument actions with events. It is thus possible to control and synchronize the start of a sweep.

Commands of the TRIGger Subsystem

- ◆ "[TRIGger<1|2>\[:SEQuence\]:HOLDoff\[:TIME\]](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:IFPower:HOLDoff](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:IFPower:HYSTerisis](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:LEVel:IFPower](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:SLOPe](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:SOURce](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:TIME:RINTerval](#)"

TRIGger<1|2>[:SEQuence]:HOLDoff[:TIME]

This command defines the length of the trigger delay.
A negative delay time (pretrigger) can be set in zero span only.

Parameters

-100 s to +100 s

Example

```
TRIG:HOLD 500us
```

Characteristics

*RST value: 0 s

SCPI: conform

Mode

All

TRIGger<1|2>[:SEQuence]:IFPower:HOLDoff

This command sets the holding time before the next IF power trigger event.

Parameters

<numeric_value> in s: 150 ns to 1000 s

Example

```
TRIG:SOUR IFP
```

Sets the IF power trigger source.

```
TRIG:IFP:HOLD 200 ns
```

Sets the holding time to 200 ns.

Characteristics

*RST value: 150 ns

SCPI: device-specific

Mode

A-F

TRIGger<1|2>[:SEQuence]:IFPower:HYSTeris

This command sets the limit that the hysteresis value has to fall below in order to trigger the next measurement.

Parameters

<numeric_value> in dB: 3 dB to 50 dB

Example

```
TRIG:SOUR IFP
```

Sets the IF power trigger source.

```
TRIG:IFP:HYST 10DB
```

Sets the hysteresis limit value.

Characteristics

*RST value: 3 dB

SCPI: device-specific

Mode

A-F

TRIGger<1|2>[:SEQuence]:LEVel:IFPower

This command sets the level of the IF power trigger source.

Parameters

-50 to -10 DBM

Example

```
TRIG:LEV:IFP -30DBM
```

Characteristics

*RST value: -20 DBM

SCPI: device-specific

Mode

All

TRIGger<1|2>[:SEQuence]:SLOPe

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Parameters

POSitive | NEGative

Example

```
TRIG:SLOP NEG
```

Characteristics

*RST value: POSitive

SCPI: conform

Mode

all

TRIGger<1|2>[:SEQuence]:SOURce

This command selects the trigger source for the start of a sweep.

Parameters

IMMediate (Free Run) | EXTern | IFPower | TIME

For details on trigger modes refer to chapter "Instrument Functions", section ["Trigger mode overview"](#).

Example

```
TRIG:SOUR EXT
```

Selects the external trigger input as source of the trigger signal

Characteristics

*RST value: IMMEDIATE

SCPI: conform

Mode

A, ADEMOD, WCDMA

TRIGger<1|2>[:SEQuence]:TIME:RINTerval

This command sets the time interval for the time trigger source.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

0.1 to 5000 s

Example

```
TRIG:SOUR TIME
```

Selects the time trigger input for triggering.

```
TRIG:TIME:RINT 50
```

The sweep starts after 50 s.

Characteristics

*RST value: 1.0

SCPI: device-specific

Mode

A

6.2.14 UNIT Subsystem

The UNIT subsystem sets the basic unit of the setting parameters.

Commands of the UNIT Subsystem

- ◆ "[UNIT<1|2>:POWer](#)"

UNIT<1|2>:POWer

This command selects the default unit.

Parameters

DBM | V | A | W | DBPW | WATT | DBPT | DBUV | DBMV | VOLT | DBUA | AMPere

Example

```
UNIT:POW DBUV
```

Sets the power unit to dBm.

Characteristics

*RST value: DBM

SCPI: conform

Mode

A

6.2.14.1 Formats for Returned Values: ASCII Format and Binary Format

- ◆ ASCII Format (FORMat ASCII):
The command reads out a list of comma separated values (CSV) of the measured values in floating point format.
- ◆ Binary Format (FORMat REAL,32):
The command reads out binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format.
The schema of the result string is as follows:
#41024<value1><value2>...<value n> with
#4 number of digits (= 4 in the example) of the following number of data bytes
1024 number of following data bytes (= 1024 in the example)
<value> 4-byte floating point value

Note: Reading out data in binary format is quicker than in ASCII format. Thus, binary format is recommended for large amounts of data.

6.3 Remote Control - Description of Basic Settings Commands

In this section all remote control commands for basic settings are described in detail. For details on analyzer commands refer to section "[Remote Control - Description of Analyzer Commands](#)".

Subsystems for basic settings

- ◆ "[Common Commands](#)" on page "555"
- ◆ "[CALibration Subsystem](#)" on page "560"
- ◆ "[DIAGnostic Subsystem](#)" on page "562"
- ◆ "[DISPlay Subsystem](#)" on page "567"
- ◆ "[FORMat Subsystem](#)" on page "575"
- ◆ "[HCOPY Subsystem](#)" on page "576"
- ◆ "[INSTrument Subsystem](#)" on page "584"
- ◆ "[MMEMory Subsystem](#)" on page "585"
- ◆ "[OUTPut Subsystem \(Option Additional Interfaces, B5\)](#)" on page "602"
- ◆ "[SENSe Subsystem](#)" on page "603"
- ◆ "[SOURce Subsystem](#)" on page "609"
- ◆ "[STATus Subsystem](#)" on page "611"
- ◆ "[SYSTem Subsystem](#)" on page "616"

6.3.1 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. Some commands have the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands refer to the status reporting system which is described in detail in chapter 5 "Remote Control - Basics".

Available Common Commands

- ◆ ["*CAL?"](#)
- ◆ ["*CLS"](#)
- ◆ ["*ESE"](#)
- ◆ ["*ESR?"](#)
- ◆ ["*IDN?"](#)
- ◆ ["*IST?"](#)
- ◆ ["*OPC"](#)
- ◆ ["*OPT?"](#)
- ◆ ["*PCB"](#)
- ◆ ["*PRE"](#)
- ◆ ["*PSC"](#)
- ◆ ["*RST"](#)
- ◆ ["*SRE"](#)
- ◆ ["*STB?"](#)
- ◆ ["*TRG"](#)
- ◆ ["*TST?"](#)
- ◆ ["*WAI"](#)

*CAL?

CALIBRATION QUERY initiates a calibration of the instrument and subsequently queries the calibration status. Responses > 0 indicate errors.

*CLS

CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENT part of the QUESTIONable and the OPERATION register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

*ESE

EVENT STATUS ENABLE sets the event status enable register to the value indicated. The query form `*ESE?` returns the contents of the event status enable register in decimal form.

Parameters

0 to 255

***ESR?**

STANDARD EVENT STATUS QUERY returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.

Parameters

0 to 255

***IDN?**

IDENTIFICATION QUERY queries the instrument identification.

Return values (examples)

LEGacy format, example for R&S FSV-7:

Rohde&Schwarz,R&S FSV-7, 101768/007,1.05

NEW format, example for R&S FSV-7:

Rohde&Schwarz,R&S FSV-7,1307.9002K07/101768,1.05

R&S FSV-7	device name
101768/007	serial number/model
1307.9002K07/101768	part number/serial number
1.05	firmware version

***IST?**

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll (see chapter 5 "Remote Control - Basics").

Parameters

0 | 1

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register after all preceding commands have been executed. This bit can be used to initiate a service request (see chapter 5 "Remote Control - Basics").

***OPT?**

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas.\$

Parameter

B<number> hardware options
K<number> software options

For a list of all available options and their description refer to the CD-ROM.

Example

B4,B5,B6,B7,B8,B10,B22,B30,B31,K7,K9

***PCB**

PASS CONTROL BACK indicates the controller address which the remote control is to be returned to after termination of the triggered action.

Parameters

0 to 30

***PRE**

PARALLEL POLL REGISTER ENABLE sets the parallel poll enable register to the indicated value. The query form *PRE? returns the contents of the parallel poll enable register in decimal form.

Parameters

0 to 255

***PSC**

POWER ON STATUS CLEAR determines whether the contents of the ENABLE registers are preserved or reset during power-up.

The query form *PSC? reads out the contents of the power-on-status-clear flag. The response can be 0 or 1.

Parameter

0 Causes the contents of the status registers to be preserved. Thus a service request can be generated when switching on the instrument, if the status registers ESE and SRE are suitably configured.
1 Resets the registers.

***RST**

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the **PRESET** key. The default settings are described in section "Remote Control - Description of Analyzer Commands", "[Initializing the Configuration - PRESET Key](#)".

***SRE**

SERVICE REQUEST ENABLE sets the service request enable register to the indicated value. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is generated. The query form ***SRE?** reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

Parameters

0 to 255

***STB?**

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

***TRG**

TRIGGER initiates all actions in the currently active test screen expecting a trigger event. This command corresponds to the `INITiate:IMMediate` command. For details refer to section "Remote Control - Description of Analyzer Commands", "[TRIGger Subsystem](#)".

***TST?**

SELF TEST QUERY initiates the self test of the instrument and outputs an error code in decimal form.

Parameters

0 = no error

***WAI**

WAIT-to-CONTINUE permits servicing of subsequent commands only after all preceding commands have been executed and all signals have settled (see chapter 5 "Remote Control - Basics", and "[*OPC](#)" command).

6.3.2 CALibration Subsystem

The commands of the CALibration subsystem determine the data for system error correction in the instrument.

Commands of the CALibration Subsystem

- ◆ "[CALibration\[:ALL\]?](#)"
- ◆ "[CALibration:RESult?](#)"
- ◆ "[CALibration:STAtE](#)"
- ◆ "[CALibration:ABORt](#)"

CALibration:ABORt

This command aborts the current calibration process.

Parameters

-

Example

```
CAL:ABORt
```

Sets up the instrument to ignore the calibration data.

Characteristics

*RST value: -

SCPI: conform

Mode

all



CALibration[:ALL]?

This command initiates the acquisition of system error correction data. A "0" is returned if the acquisition was successful.

Note: *During the acquisition of correction data the instrument does not accept any remote control commands.*

In order to recognize when the acquisition of correction data is completed, the MAV bit in the status byte can be used. If the associated bit is set in the Service Request Enable Register, the instrument generates a service request after the acquisition of correction data has been completed.

Example

*CLS

Resets the status management.

*SRE 16

Enables MAV bit in the Service Request Enable Register.

*CAL?

Starts the correction data recording, and then a service request is generated.

Characteristics

*RST value: -

SCPI: conform

Mode

all

CALibration:RESult?

This command outputs the results of the correction data acquisition. The lines of the result table are output as string data separated by commas:

```
Total Calibration Status: PASSED,Date (dd/mm/yyyy):  
12/07/2004,  
Time: 16:24:54,Runtime: 00.06
```

Example

CAL:RES?

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

CALibration:STATe

This command determines whether the current calibration data are taken into account by the instrument (ON) or not (OFF).

Parameters

ON | OFF

Example

CAL:STAT OFF

Sets up the instrument to ignore the calibration data.

Characteristics

*RST value: -
 SCPI: conform

Mode

All

6.3.3 DIAGnostic Subsystem

The DIAGnostic subsystem contains the commands which support instrument diagnostics for maintenance, service and repair. In accordance with the SCPI standard, all of these commands are device-specific.

Commands of the DIAGnostic Subsystem

- ◆ "[DIAGnostic<1|2>:SERVice:BIOSInfo?](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:HWINfo?](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:INPut\[:SElect\]](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:INPut:PULSed:CFRequency](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:INPut:PULSed\[:STATe\]](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:NSOurce \(option Additional Interfaces, B5\)](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:SFUNction](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:SFUNction:LASTresult?](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:SFUNction:RESults:DELeTe](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:SFUNction:RESults:SAVE](#)"
- ◆ "[DIAGnostic<1|2>:SERVice:STESt:RESult?](#)"

DIAGnostic<1|2>:SERVice:BIOSInfo?

This command reads the CPU board BIOS version and returns it as ASCII string. The numeric suffixes <1|2> are irrelevant for this command.

Example

```
DIAG:SERV:BIOS?
Returns the BIOS version.
```

Return values (example)

```
47.11
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:HWINfo?

This command queries the hardware information.

The numeric suffixes <1|2> are irrelevant for this command.

Return values

```
"<component 1>|<serial #>|<order #>|<model>|
<hardware code>|<revision>|<subrevision>",
"<component 2>|<serial #>|<order #>|<model>|
<hardware code>|<revision>|<subrevision>",
```

...

Table lines are output as string data and are separated by commas. The individual columns of the table are separated from each other by |.

Example

```
DIAG:SERV:HWIN?
```

Queries the hardware information.

```
"FRONTEND|100001/003|1300.3009|03|01|00|00",
"MOTHERBOARD|123456/002|1300.3080|02|00|00|00",
...
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:INPut[:SElect]

This command toggles between the RF input on the front panel and the internal 65.83 MHz reference signal.

Parameters

```
CALibration | RF | TG
```

Example

```
DIAG:SERV:INP CAL
```

Characteristics

*RST value: RF

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:INPut:PULSed:CFRequency

This command sets the calibration frequency. This command only takes effect if the internal reference signal is selected for calibration

("DIAGnostic<1|2>:SERVice:INPut[:SElect]").

Parameters

<numeric value>

Example

```
DIAG:SERV:INP:PULS:PRAT COMB64
```

Characteristics

*RST value: COMB1

SCPI: conform

Mode

all

DIAGnostic<1|2>:SERVice:INPut:PULSed[:STATe]

This command toggles the calibration signal in the selected measurement window between pulsed and non-pulsed. The selection takes effect only if the RF input has been set to the internal reference signal using `DIAG:SERV:INP:CAL`.

Parameters

ON | OFF

Example

```
DIAG:SERV:INP:PULS ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:NSOource (option Additional Interfaces, B5)

This command switches the 28 V supply of the noise source at the rear panel on or off.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
DIAG:SERV:NSO ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:SFUNction

This command activates a service function which can be selected by indicating the five parameters: function group number, board number, function number, parameter 1 and parameter 2 (see service manual). The contents of the parameter string are identical to the code to be entered in the edit dialog box of manual operation.

The entry of a service function is accepted only if the system password level 1 or level 2 has been entered previously ("[SYSTem:PASSword\[:CENable\]](#)").

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<string>

Example

```
DIAG:SERV:SFUN 2.0.2.12.1
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:SFUNction:LASTresult?

This command returns the results for the most recently performed service function.

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
DIAG:SERV:SFUN:LAST?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:SFUNction:RESults:DELeTe

This command clears the results of the most recently performed service function. The numeric suffixes <1|2> are irrelevant for this command.

Example

```
DIAG:SERV:SFUN:RES:DEL
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:SFUNction:RESults:SAVE

This command stores the results of the most recently performed service function in the specified file.

The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<string> (file name for results)

Example

```
DIAG:SERV:SFUN:RES:SAVE "C:\diag"
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

DIAGnostic<1|2>:SERVice:STESt:RESult?

This command reads the results of the self test out of the instrument. The lines of the result table are output as string data separated by commas:

```
"Total Selftest Status: PASSED", "Date (dd/mm/yyyy): 09/07/2004
```

```
TIME: 16:24:54", "Runtime: 00:06", "...
```

The numeric suffixes <1|2> are irrelevant for this command.

Example

```
DIAG:SERV:STES:RES?
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

all

6.3.4 DISPlay Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

Commands of the DISPlay Subsystem

- ◆ ["DISPlay:ANNotation:FREQuency"](#)
- ◆ ["DISPlay:CMAP<1...41>:DEFault<1|2>"](#)
- ◆ ["DISPlay:CMAP<1...41>:HSL"](#)
- ◆ ["DISPlay:CMAP<1...41>:PDEFined"](#)
- ◆ ["DISPlay:FORMat"](#)
- ◆ ["DISPlay:LOGO"](#)
- ◆ ["DISPlay:PSAVeJ:STATeJ"](#)
- ◆ ["DISPlay:PSAVe:HOLDoff"](#)
- ◆ ["DISPlay:TBAR\[STATe\]"](#)
- ◆ ["DISPlay:THEMe:CATalog?"](#)
- ◆ ["DISPlay:THEMe:SElect"](#)
- ◆ ["DISPlay:TOUCHscreen:STATe"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TEXT\[:DATA\]"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TEXT:STATe"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TIME"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TIME:FORMat"](#)

Further Information

- ◆ ["CMAP Suffix Assignment"](#)

DISPlay:ANNotation:FREQuency

This command switches the x-axis annotation on or off.

Parameters

ON | OFF

Example

```
DISP:ANN:FREQ OFF
```

Characteristics

*RST value: ON

SCPI: conform

Mode

all

DISPlay:CMAP<1...41>:DEFault<1|2>

This command resets the screen colors of all display items to their default settings. Two default settings DEFault1 and DEFault2 are available. The numeric suffix of CMAP is irrelevant.

This command is an event and therefore has no query and no *RST value.

Example

```
DISP:CMAP:DEF2
```

Selects default setting 2 for setting the colors.

Characteristics

*RST value: -

SCPI: conform

Mode

all

DISPlay:CMAP<1...41>:HSL

This command defines the color table of the instrument.

For the numeric suffix assignment of CMAP refer to "[CMAP Suffix Assignment](#)" on page "574".

The set values are not changed by *RST.

Parameters

hue = TINT

sat = SATURATION

lum = BRIGHTNESS

The value range is 0 to 1 for all parameters.

Example

```
DISP:CMAP2:HSL 0.3,0.8,1.0
```

Changes the grid color.

Characteristics

*RST value: -

SCPI: conform

Mode

all

DISPlay:CMAP<1...41>:PDEFined

This command defines the color table of the instrument using predefined color values. Each numeric suffix of CMAP is assigned to one or several graphical elements which can be modified by varying the corresponding color setting. For the numeric suffix assignment of CMAP refer to "[CMAP Suffix Assignment](#)" on page "574".

The values set are not changed by *RST.

Parameters

BLACK | BLUE | BROWn | GREen | CYAN | RED | MAGenta | YELLOW | WHITE | DGRAY | LGRAY | LBLUe | LGREen | LCYan | LRED | LMAGenta

Example

```
DISP:CMAP2:PDEF GRE
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

DISPlay:FORMat

This command switches the measurement result display between FULL SCREEN and SPLIT SCREEN.

Parameters

SINGle | SPLit

Example

```
DISP:FORM:SING
```

Characteristics

*RST value: SPL

SCPI: conform

Mode

all

DISPlay:LOGO

This command switches the company logo on the screen on or off.

Parameters

ON | OFF

Example

```
DISP:LOGO OFF
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

DISPlay:PSAVe[:STATe]

This command switches on or off the power-save mode of the display. With the power-save mode activated the display including backlight is completely switched off after the elapse of the response time (see "[DISPlay:PSAVe:HOLDoff](#)" command).

Note: This mode is recommended for preserving the display especially if the instrument is exclusively operated via remote control.

Parameters

ON | OFF

Example

```
DISP:PSAVe ON
```

Switches on the power-save mode.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

DISPlay:PSAVe:HOLDoff

This command sets the holdoff time for the power-save mode of the display. The available value range is 1 to 60 minutes, the resolution 1 minute. The entry is dimensionless.

Parameters

1 to 60

Example

```
DISP:PSAV:HOLD 30
```

Characteristics

*RST value: 15
SCPI: device-specific

Mode

all

DISPlay:TBAR[STATe]

This command switches the toolbar above the diagram on or off.

Parameters

ON | OFF

Example

```
DISP:TOOL ON
```

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

all

DISPlay:THEMe:CATalog?

Displays the selection list of available themes for the screen display.

Example

```
DISP:THEME:CAT?
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

DISPlay:THEMe:SELEct

Selects a theme for the screen display. The theme defines the colors used for keys and screen elements, for example.

Parameters

<string>

Example

```
DISP:THEM:SEL "OceanBlue"
```

Characteristics

*RST value: SPL

SCPI: conform

Mode

all

DISPlay:TOUCHscreen:STATe

.Switches the touchscreen functionality on, off, or partially on.

Parameter

ON Touchscreen function is active for entire screen

OFF Touchscreen is deactivated for entire screen

FRAME Touchscreen is deactivated for the diagram area of the screen, but active for the surrounding softkeys, toolbars and menus.

Example

DISP:TOUC:STAT ON

Characteristics

*RST value: ON

SCPI: conform

Mode

all

DISPlay[:WINDow<1|2>]:TEXT[:DATA]

This command defines a comment (max. 20 characters) which can be displayed on the screen.

Parameters

<string>

Example

DISP:WIND:TEXT 'Noise Measurement'

Defines the screen title.

Characteristics

*RST value: " (empty)

SCPI: conform

Mode

all

DISPlay[:WINDow<1|2>]:TEXT:STATe

This command switches on or off the display of the comment (screen title).

Parameters

ON | OFF

Example

```
DISP:TEXT:STAT ON
```

Switches on the title.

Characteristics

*RST value: OFF

SCPI: conform

Mode

all

DISPlay[:WINDow<1|2>]:TIME

This command switches on or off the screen display of date and time. The numeric suffix in WINDow<1| 2> is irrelevant.

Parameters

ON | OFF

Example

```
DISP:TIME ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

DISPlay[:WINDow<1|2>]:TIME:FORMat

This command switches the format of the date and time displayed on the screen between German and US. The numeric suffix in WINDow<1| 2> is irrelevant.

Parameters

US | DE

Example

```
DISP:TIME ON
```

Switches the screen display of date and time on.

```
DISP:TIME:FORM US
```

Switches the date and time format to US.

Characteristics

*RST value: DE
 SCPI: device-specific

Mode

all

6.3.4.1 CMAP Suffix Assignment

Each numeric suffix of CMAP is assigned one or several graphical elements which can be modified by varying the corresponding color setting. The following assignment applies:

Suffix	Description
CMAP1	Background
CMAP2	Grid
CMAP3 *)	Common Text
CMAP4 *)	Check Status OK
CMAP5 *)	Check Status Error
CMAP6 *)	Text Special 1
CMAP7 *)	Text Special 2
CMAP8	Trace 1
CMAP9	Trace 2
CMAP10	Trace 3
CMAP11	Marker Info Text
CMAP12	Limit Lines
CMAP13	Limit and Margin Check - "Pass"
CMAP14	Limit and Margin Check - "Fail"
CMAP15 *)	Softkey Text
CMAP16 *)	Softkey Background
CMAP17 *)	Selected Field Text
CMAP18 *)	Selected Field Background
CMAP19 *)	Softkey 3D Bright Part
CMAP20 *)	Softkey 3D Dark Part
CMAP21 *)	Softkey State "On"
CMAP22 *)	Softkey State "Dialog open"
CMAP23 *)	Softkey Text Disabled
CMAP24	Logo
CMAP25	Trace 4
CMAP26	Grid – Minorlines
CMAP27	Marker
CMAP28	Display Lines
CMAP29 *)	Sweepcount – Text
CMAP30	Limit and Margin Check – Text
CMAP31	Limit and Margin Check - "\"Margin\""
CMAP32 *)	Table Overall – Title Text
CMAP33 *)	Table Overall – Title Background
CMAP34 *)	Table Overall – Text
CMAP35 *)	Table Overall – Background
CMAP36 *)	Table Value – Title Text
CMAP37 *)	Table Value – Title Background
CMAP38 *)	Table Value – Text

Suffix	Description
CMAP39 *)	Table Value – Background
CMAP40	Trace 5
CMAP41	Trace 6

*) these settings can only be defined via the theme, see "[DISPlay:THEMe:SElect](#)", and are thus ignored in the SCPI command

6.3.5 FORMat Subsystem

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

Commands of the FORMat Subsystem

◆ "[FORMat\[:DATA\]](#)"

FORMat[:DATA]

This command specifies the data format for the data transmitted from the instrument to the control PC. It is used for the transmission of trace data. The data format of trace data received by the instrument is automatically recognized, regardless of the format which is programmed. In the Spectrum Analyzer mode, the format setting REAL, 32 is used for the binary transmission of trace data (see also [TRACe<1 | 2>\[:DATA\]](#) command).

Parameters

ASCIi | REAL | UINT | MATLAB [,8 | 32]

ASCII data are transmitted in plain text, separated by commas. REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block format". The format UINT is only used in operating mode vector signal analysis, for the symbol table.

Example

```
FORM REAL, 32
FORM ASC
FORM UINT, 8
```

Characteristics

*RST value: ASCII

SCPI: conform

Mode

all

6.3.6 HCOPy Subsystem

The HCOPy subsystem controls the output of display information for documentation purposes on output devices or files. The instrument allows two independent printer configurations which can be set separately with the numeric suffix <1|2>.

Commands of the HCOPy Subsystem

- ◆ "[HCOPy\[:IMMEDIATE<1|2>\]](#)"
- ◆ "[HCOPy\[:IMMEDIATE<1|2>\]:NEXT](#)"
- ◆ "[HCOPy:ABORT](#)"
- ◆ "[HCOPy:CMAP<1...41>:DEFAULT](#)"
- ◆ "[HCOPy:CMAP<1...41>:HSL](#)"
- ◆ "[HCOPy:CMAP<1...41>:PDFINED](#)"
- ◆ "[HCOPy:DESTINATION<1|2>](#)"
- ◆ "[HCOPy:DEVICE:COLOR](#)"
- ◆ "[HCOPy:DEVICE:LANGUAGE<1|2>](#)"
- ◆ "[HCOPy:ITEM:ALL](#)"
- ◆ "[HCOPy:ITEM:WINDOW<1|2>:TABLE:STATE](#)"
- ◆ "[HCOPy:ITEM:WINDOW<1|2>:TEXT](#)"
- ◆ "[HCOPy:ITEM:WINDOW<1|2>:TRACE:STATE](#)"
- ◆ "[HCOPy:TDSTAMP:STATE<1|2>](#)"

HCOPy[:IMMEDIATE<1|2>]

This command starts a hardcopy output. The numeric suffix selects which printer configuration (device 1 or 2) is to be used for the hardcopy output. If there is no suffix, configuration 1 is automatically selected.

This command is an event and therefore has no *RST value and no query.

Example

```
HCOP:DEV:LANG BMP
```

Selects the data format.

```
HCOP:DEST 'MMEM'
```

Directs the hardcopy to a file.

```
MMEM:NAME 'C:\R_S\instr\user\Print.bmp'
```

Selects the file name. If the file Print.bmp already exists, it is replaced.

```
HCOP
```

Saves the hardcopy output into the file Print.bmp.

Characteristics

*RST value: -

SCPI: conform

Mode

all

HCOPY[:IMMEDIATE<1|2>]:NEXT

This command starts a hardcopy output. The numeric suffix selects which printer configuration (device 1 or 2) is to be used for the hardcopy output. If there is no suffix, configuration 1 is automatically selected. If the output is printed to a file (see "[HCOPY:DESTINATION<1|2>](#)" command), the file name used in the last saving process is automatically counted up to the next unused name.

This command is an event and therefore has no *RST value and no query.

Example

```
HCOP:DEV:LANG BMP
```

Selects the data format.

```
HCOP:DEST 'MMEM'
```

Directs the hardcopy to a file.

```
MMEM:NAME 'C:\R_S\instr\user\Print.bmp'
```

Selects the file name.

```
HCOP
```

Saves the hardcopy output into the file Print.bmp.

```
HCOP:NEXT
```

Saves the hardcopy output into the file Print_001.bmp.

```
HCOP:NEXT
```

Saves the hardcopy output into the file Print_002.bmp.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

HCOPY:ABORT

This command aborts a running hardcopy output.

This command is an event and therefore has no *RST value and no query.

Example

```
HCOP:ABOR
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

HCOPY:CMAP<1...41>:DEFault

This command sets the colors for a printout or hardcopy. The numeric suffix in CMAP is not significant.

This command is an event and therefore has no query and no *RST value.

Parameter

- 1 current screen colors with the background in white and the grid in black.
- 2 optimized color set
- 3 user defined color set
- 4 current screen colors without any changes (setting for hardcopies)

Example

```
HCOP:CMAP:DEF2
```

Selects the optimized color set for the color settings of a printout or a hardcopy.

Characteristics

*RST value: -

SCPI: conform

Mode

all

HCOPY:CMAP<1...41>:HSL

This command defines the color table in user defined colors.

To each numeric suffix of CMAP is assigned one or several picture elements which can be modified by varying the corresponding color setting. For details on the CMAP assignment refer to "[CMAP Suffix Assignment](#)" on page "574".

The values set are not changed by *RST.

Parameters

hue = tint

sat = saturation

lum = brightness

The value range is 0 to 1 for all parameters.

Example

```
HCOP:CMAP2:HSL 0.3,0.8,1.0
```

Changes the grid color

Characteristics

*RST value: -

SCPI: conform

Mode

all

HCOPY:CMAP<1...41>:PDEFined

This command defines the color table in user defined colors using predefined color values. To each numeric suffix of CMAP is assigned one or several picture elements which can be modified by varying the corresponding color setting. For details on the CMAP assignment refer to "[CMAP Suffix Assignment](#)" on page "574".

The values set are not changed by *RST.

Parameters

BLACK | BLUE | BROWN | GREEN | CYAN | RED | MAGENTA | YELLOW | WHITE | DGRAY | LGRAY | LBLUE | LGREEN | LCYAN | LRED | LMAGENTA

Example

```
HCOPY:CMAP2:PDEF GREEN
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

HCOPY:DESTINATION<1|2>

This command selects the printer output medium (Disk, Printer or Clipboard) associated with configuration 1 or 2.

Note: The type of instrument is selected with "[SYSTEM:COMMunicate:PRINter:SElect <1|2>](#)", which will automatically select a default output medium. Therefore the "[HCOPY:DESTINATION<1|2>](#)" command should always be sent after setting the device type.

Parameter

MMEM	Directs the hardcopy to a file. The " MMEMory:NAME " command defines the file name. All formats can be selected for " HCOPY:DEvice:LANGUage<1 2> ".
SYST:COMM:PRIN	Directs the hardcopy to the printer. The printer is selected with the " SYSTEM:COMMunicate:PRINter:SElect <1 2> " command. GDI should be selected for " HCOPY:DEvice:LANGUage<1 2> ".
SYST:COMM:CLIP	Directs the hardcopy to the clipboard. EWMF should be selected for " HCOPY:DEvice:LANGUage<1 2> ".

Example

```
SYST:COMM:PRIN:SEL2 'LASER on LPT1'  
Selects the printer and output medium for device 2.  
HCOP:DEST2 'SYST:COMM:PRIN'  
Selects the printer interface as device 2.
```

Characteristics

*RST value: SYST:COMM:CLIP
SCPI: conform

Mode

all

HCOPy:DEvice:COLor

This command selects between color and monochrome hardcopy of the screen.

Parameters

ON | OFF

Example

```
HCOP:DEV:COL ON
```

Characteristics

*RST value: OFF
SCPI: conform

Mode

all

HCOPY:DEvice:LANGUage<1|2>

This command determines the data format of the printout.

Parameter

GDI	Graphics Device Interface: Default format for the output to a printer configured under Windows. Must be selected for the output to the printer interface. Can be used for the output to a file. The printer driver configured under Windows is used in this case and a printer-specific file format is thus generated. (see also " HCOPY:DESTination<1 2> " command)
WMF, EWMF	WINDOWS Metafile and Enhanced Metafile Format: Data formats for output files which can be integrated in corresponding programs for documentation purposes at a later time. WMF can only be used for output to a file and EWMF also for the output to the clipboard. (see also " HCOPY:DESTination<1 2> " command)
BMP, JPG, PNG	Data format for output to files only.

Example

```
HCOP:DEV:LANG WMF
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

HCOPY:ITEM:ALL

This command selects the complete screen to be output.

The hardcopy output is always provided with comments, title, time and date. As an alternative to the whole screen, e.g. only traces ("[HCOPY:ITEM:WINDow<1|2>:TRACe:STATe](#)" command) can be output.

Example

```
HCOP:ITEM:ALL
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

HCOPY:ITEM:WINDow<1|2>:TABLE:STATe

This command selects the output of the currently displayed table.
The numeric suffixes <1|2> are irrelevant for this command.

Parameters

ON | OFF

Example

```
HCOP:ITEM:WIND:TRACe:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

HCOPY:ITEM:WINDow<1|2>:TEXT

This command defines the comment text for the printout.
The numeric suffixes <1|2> are irrelevant for this command.

Parameters

<string> with a maximum of 100 characters; line feed by means of character @

Example

```
HCOP:ITEM:WIND:TEXT 'comment '
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

HCOPY:ITEM:WINDow<1|2>:TRACe:STATe

This command selects the output of the currently displayed trace.
The numeric suffixes <1|2> are irrelevant for this command.
Both the "[HCOPY:ITEM:WINDow<1|2>:TRACe:STATe](#)" command and the "[HCOPY:ITEM:ALL](#)" command enable the output of the whole screen.

Parameters

ON | OFF

Example

```
HCOP:ITEM:WIND:TRACe:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

HCOPY:TDSTamp:STATE<1|2>?

This command queries if the time and date are included in the printout.

The numeric suffixes <1|2> define the print device number.

Return value

ON | OFF

Example

```
HCOPY:TDST:STAT?
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

HCOPY:TDSTamp:STATE<1|2>

This command includes or removes the time and date in the printout.

The numeric suffixes <1|2> define the print device number.

Parameters

ON | OFF

Example

```
HCOPY:TDST:STAT OFF
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

HCOPy:PAGE:ORlentation<1|2>

The command selects the format of the output (portrait and landscape) (hardcopy unit 1 or 2).

Note: The command is only available if the output device "printer" ("[HCOPy:DESTination<1|2>](#)") has been selected.

Parameters

LANDscape | PORTrait

Example

```
HCOP:PAGE:ORI LAND
```

Characteristics

*RST value: PORT

SCPI: conform

Mode

all

6.3.7 INSTRument Subsystem

The INSTRument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

Commands of the INSTRument Subsystem

- ◆ "[INSTRument\[:SElect\]](#)"
- ◆ "[INSTRument:NSElect](#)"

INSTRument[:SElect]

This command switches between the measurement modes by means of text parameters.

Parameter

SANalyzer spectrum analyzer

The parameters of the other measurement modes are included in the option descriptions.

Example

```
INST SAN
```

Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: SANalyzer

SCPI: conform

Mode

all

INSTrument:NSElect

This command switches between the measurement modes by means of numbers.

Parameter

1 spectrum analyzer

The parameters of the other measurement modes are included in the option descriptions.

Example

```
INST:NSEL 1
```

Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: 1

SCPI: conform

Mode

all

6.3.8 MMEMory Subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings.

The various drives can be addressed via the "mass storage unit specifier" <msus> using the conventional DOS syntax. The internal hard disk is addressed by "C:". For details on drives refer to chapter 4 "Instrument Functions - Basic Settings", section ["Saving and Recalling Settings Files - SAVE/RCL Key"](#).

The file names <file_name> are indicated as string parameters with the commands being enclosed in quotation marks. They also comply with DOS conventions. DOS file names consist of max. 8 ASCII characters and an extension of up to three characters separated from the file name by a dot "." Both, the dot and the extension are optional. The dot is not part of the file name. DOS file names do not distinguish between uppercase and lowercase notation. All letters and digits are permitted as well as the special characters "_", "^", "\$", "~", "!", "#", "%", "&", "-", "{", "}", "(", ")", "@", and "~". Reserved file names are CLOCK\$, CON, AUX, COM1 to COM4, LPT1 to LPT3, NUL and PRN.

The two characters "*" and "?" have the function of so-called "wildcards", i.e., they are variables for selection of several files. The question mark "?" replaces exactly one character, the asterisk means any of the remaining characters in the file name. "*. *" thus means all files in a directory.

Commands of the MMEMory Subsystem

- ◆ ["MMEMory:CATalog?"](#)
- ◆ ["MMEMory:"](#)
- ◆ ["MMEMory:CLEar:ALL"](#)
- ◆ ["MMEMory:CLEar:STATe"](#)
- ◆ ["MMEMory:COpy"](#)
- ◆ ["MMEMory:COMMeNt"](#)
- ◆ ["MMEMory:DATA"](#)
- ◆ ["MMEMory:DELeTe"](#)
- ◆ ["MMEMory:LOAD:AUTO"](#)
- ◆ ["MMEMory:LOAD:STATe"](#)
- ◆ ["MMEMory:MDIRectory"](#)
- ◆ ["MMEMory:MOVe"](#)
- ◆ ["MMEMory:MSIS"](#)
- ◆ ["MMEMory:NAME"](#)
- ◆ ["MMEMory:NETWork:MAP"](#)
- ◆ ["MMEMory:NETWork:DISConnect"](#)
- ◆ ["MMEMory:NETWork:UNUSeddrives?"](#)
- ◆ ["MMEMory:NETWork:USEDdrives?"](#)
- ◆ ["MMEMory:RDIRectory"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:ALL"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:DEFault"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:HWSettings"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:LINES:ALL"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:NONE"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:TRACe\[:ACTive\]"](#)
- ◆ ["MMEMory:SELeCt\[:ITEM\]:TRANSDucer:ALL"](#)
- ◆ ["MMEMory:STORe<1|2>:LIST"](#)
- ◆ ["MMEMory:STORe<1|2>:PEAK"](#)
- ◆ ["MMEMory:STORe<1|2>:STATe:NEXT"](#)
- ◆ ["MMEMory:STORe<1|2>:TRACe"](#)

MMEMory:CATalog?

This command reads the indicated directory. According to DOS convention, wild card characters can be entered in order to query e.g. a list of all files of a certain type.

This command is an event and therefore has no *RST value and no query.

Parameters

<path> = DOS Path name

The path name should be in conformance with DOS conventions and may also include the drive name.

Example

```
MMEM:CAT? 'C:\R_S\Instr\user\*.DFL'
```

Returns all files in C:\R_S\Instr\user with extension ".DFL"

```
MMEM:CAT? 'C:\R_S\Instr\user\SPOOL?.WMF'
```

Returns all files in C:\R_S\Instr\user whose names start with SPOOL, have 6 letters and the extension ".WMF".

Response value

List of file names in the form of strings separated by commas, i.e.

SPOOL1.WMF,SPOOL2.WMF,SPOOL3.WMF

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:CDIRectory

This command changes the current directory.

Parameters

<directory_name> = DOS path name

In addition to the path name, the indication of the directory may contain the drive name. The path name complies with the DOS conventions.

Example

```
MMEM:CDIR 'C:\R_S\Instr\user'
```

Selects the directory C:\R_S\Instr\user.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:COMMeNt

This command defines a comment for the stored settings.

Parameters

<string>

Example

```
MMEMory:COMMeNt "ACP measurement with Standard Tetra from  
23.05."
```

```
MMEMory::MMEMory:STORe1:STATe 1, "ACP_T"
```

As a result, in the selection list for recall settings, the comment "ACP measurement with Standard Tetra from 23.05." is added to the ACP entry.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:CLEAr:ALL

This command deletes all settings files in the current directory. The current directory can be selected with the "[MMEMory:](#)" command. The default directory is C:\R_S\instr\user.

This command is an event and therefore has no *RST value and no query.

Example

```
MMEM:CLE:ALL
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:CLEar:STATe

This command deletes the instrument settings file selected by <file_name>. All associated files on the mass memory storage are cleared.

This command is an event and therefore has no *RST value and no query.

Parameters

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.

Example

```
MMEM:CLE:STAT 1, 'TEST'
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:COpy

This command copies the files indicated in <file_source> to the destination directory indicated with <file_destination> or to the destination file indicated by <file_destination> if <file_source> is just a file.

This command is an event and therefore has no *RST value and no query.

Parameters

<file_source>,<file_destination> = <file_name> = DOS file name

The indication of the file name may include the path and the drive name. The file names and path information must be in accordance with the DOS conventions.

Example

```
MMEM:COpy 'C:\R_S\Instr\user\SETUP.CFG', 'E:'
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:DATA

This command writes the block data contained in <block> into the file characterized by <file_name>. The delimiter must be set to EOI to obtain error-free data transfer.

The associated query command reads the indicated file from the mass memory and transfers it to the remote control computer. It should be noted that the buffer memory of the control computer should be large enough to store the file. The setting of the delimiter is irrelevant in this case.

The command is useful for reading stored settings files or trace data from the instrument or for transferring them to the instrument.

Parameters

<file_name>[,<block>]

<file_name>	selects the file to be transferred
<block>	binary data block with the following structure: character '#' digit for the length of the length information indicated number of digits as length information (number of bytes) for the binary data themselves binary data with the indicated number of bytes

Example

```
MMEM:DATA 'TEST01.HCP,#216This is the file'
```

means: #2: the next 2 characters are the length indication; 16: number of subsequent binary data bytes; This is the file: 16 bytes stored as binary data in the file TEST01.HCP.

```
MMEM:DATA? 'TEST01.HCP'
```

Transfers the file TEST01.HCP from the instrument to the control computer.

Characteristics

*RST value: -
SCPI: conform

Mode

all

MMEMory:DELeTe

This command deletes the indicated files.

Parameters

<file_name> = DOS file name

The indication of the file name contains the path and, optionally, the drive name. Indication of the path complies with DOS conventions.

Example

```
MMEM:DEL 'TEST01.HCP'
```

The file TEST01.HCP is deleted.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:LOAD:AUTO

This command defines which settings file is automatically loaded after the device is switched on. The contents of the file are read after switching on the device and used to define the new device state.

The settings file defined as auto recall set can also be restored by the "[*RST](#)" command.

This command is an event and therefore has no *RST value and no query.

Parameter

1,'FACTORY' deactivates the startup recall function

1,'<file_name>' activates the startup recall function and defines the settings file to be loaded

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive name.

The path name complies with DOS conventions.

Example

```
MMEM:LOAD:AUTO 1, 'C:\R_S\Instr\user\TEST'
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:LOAD:STATe

This command loads the device settings from *.dfl files. The contents of the file are loaded and set as the new device state.

Parameters

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive name.

The path name complies with DOS conventions.

Example

```
MMEM:LOAD:STAT 1, 'C:\R_S\Instr\user\TEST01'
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:MDIRectory

This command creates a new directory. The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameters

<directory_name> = DOS path name

Example

```
MMEM:MDIR 'C:\R_S\Instr\user'
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:MOVE

This command renames existing files, if <file_destination> contains no path indication. Otherwise the file is moved to the indicated path and stored under the file name specified there, if any.

This command is an event and therefore has no *RST value and no query.

Parameters

<file_source>,<file_destination> = <file_name> = DOS file name

The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.

Example

```
MMEM:MOVE 'C:\TEST01.CFG', 'SETUP.CFG'
```

Renames TEST01.CFG in SETUP.CFG in directory C:\.

```
MMEM:MOVE 'C:\TEST01.CFG', 'C:\R_S\Instr\user'
```

Moves TEST01.CFG from C:\ to C:\R_S\Instr\user.

```
MMEM:MOVE 'C:\TEST01.CFG', 'C:\R_S\Instr\user\SETUP.CFG'
```

Moves TEST01.CFG from C:\ to C:\R_S\Instr\user and renames the file in SETUP.CFG.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:MSIS

This command changes to the drive indicated. The drive may be the internal hard disk C:.

Parameters

<device> = A: | C: ... Z:

The path name complies with DOS conventions.

Example

```
MMEM:MSIS 'C:'
```

Characteristics

*RST value: "C:

SCPI: conform

Mode

all

MMEMory:NAME

This command defines a destination file for the printout started with the "[HCOPYj:IMMediate<1|2>](#)" command. In this case the printer output must be routed to a file as destination.

This command is an event and therefore has no *RST value and no query.

Parameters

<file_name> = DOS file name

The file name includes indication of the path and may also include the drive name. The file name and path information comply with DOS conventions.

Example

```
MMEM:NAME 'C:\R_S\instr\user\PRINT1.BMP'
```

Selects the file name.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:NETWork:MAP

This command maps a drive to a server or server folder of the network. As a prerequisite in Microsoft networks, sharing of this server or server folder must be enabled.

This command is an event and therefore has no *RST value and no query.

Parameters

```
'<string>','<string>',['<string>','<string>'],[<Boolean>]
```

with '<string>','<string>' = '<drive>','<host name or IP address>\share name'
 ['<string>','<string>'],[<Boolean>] = '<user name>','<password>',ON |
 OFF for connecting under a different user name, and enabling/disabling
 reconnect at logon.

The entry is optional. The Boolean parameter can be omitted.

Example

```
MMEM:NETW:MAP 'T: ','\server\folder'
```

Maps drive T: to folder on server.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:NETWork:DISConnect

This command disconnects the selected drive.

This command is an event and therefore has no *RST value and no query.

Parameters

'<string>' = <drive name>

Example

```
MMEM:NETW:DISC 'T: '
```

Disconnects network drive T:

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:NETWork:UNUSeddrives?

This command lists all unused network drive names.

This command is only a query and therefore has no *RST value.

Example

```
MMEM:NETW:UNUS?
```

Lists all unused network drive names.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:NETWork:USEDdrives?

This command lists all mapped network drives.

Parameter

ON Lists all mapped network drives including the folder information.

OFF Lists all mapped network drive names.

Example

```
MMEM:NETW:USED ON
```

Lists all mapped network drives including the folder information.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

MMEMory:RDIRectory

This command deletes the indicated directory. The directory name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameters

<directory_name> = DOS path name

Example

```
MMEM:RDIR 'C:\TEST'
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:ALL

This command includes all data subsets in the list of device settings to be stored/loaded.

This command is an event and therefore has no *RST value.

Example

```
MMEM:SEL:ALL
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:DEFault

This command includes the default list in the settings file to be stored/loaded. For details on hardware settings refer to the "[MMEMory:SELEct\[:ITEM\]:HWSettings](#)" command.

Example

```
MMEM:SEL:DEFault
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:HWSettings

This command includes the hardware settings in the settings file to be stored/loaded. The hardware settings include:

- current configuration of general device parameters (general setup)
- current setting of the measurement hardware including markers
- activated limit lines:

A settings file may include 8 limit lines at maximum. This number includes the activated limit lines and, if available, the de-activated limit lines last used.

Therefore the combination of the non-activated restored limit lines depends on the sequence of use with the "[MMEMory:LOAD:STATe](#)" command.

- user-defined color setting
- configuration for the hardcopy output

Parameters

ON | OFF

Example

```
MMEM:SEL:HWS ON
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:LINes:ALL

This command includes all limit lines (activated and de-activated) in the settings file to be stored/loaded.

Parameters

ON | OFF

Example

```
MMEM:SEL:LIN:ALL ON
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:NONE

This command excludes all items from the settings file to be stored/loaded.
This command is an event and therefore has no *RST value.

Example

```
MMEM:SEL:NONE
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:TRACe[:ACTive]

This command includes the active traces in the settings file to be stored/loaded.
Active traces are all traces whose state is not blank.

Parameters

ON | OFF

Example

```
MMEM:SEL:TRAC ON
```

Characteristics

*RST value: OFF, i.e. no traces will be stored

SCPI: device-specific

Mode

all

MMEMory:SELEct[:ITEM]:TRANsducer:ALL

This command includes all transducer factors and sets in the settings file to be stored/loaded.

Parameters

ON | OFF

Example

```
MMEM:SEL:TRAN:ALL ON
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

all

MMEMory:STORe<1|2>:LIST

This command stores the current list evaluation results in a *.dat file. The file consists of a data section containing the list evaluation results.

The numeric suffixes <1|2> are not relevant.

This command is an event and therefore has no *RST value and no query.

Example

```
MMEM:STOR:LIST 'test'
```

Stores the current list evaluation results in the a test.dat file.

Characteristics

*RST value: -

SCPI: device-specific

Mode

A

MMEMory:STORe<1|2>:PEAK

This command stores the current marker peak list in a *.dat file. The file consists of a data section containing the peak list.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

<file_name> = DOS file name without extension

The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:STOR:PEAK 'test'
```

Saves the current marker peak list in the file test.dat.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

MMEMory:STORe<1|2>:STATe

This command stores the current device settings in a *.df1 file.

The numeric suffixes <1|2> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query.

Parameters

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes the indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:STOR:STAT 1, 'Save'
```

Saves the current device settings in the file Save.dfl.

Characteristics

*RST value: -

SCPI: conform

Mode

all

MMEMory:STORe<1|2>:STATe:NEXT

This command stores the current device settings in a *.df1 file. The file name used in the last saving process is automatically counted up to the next unused name.

The numeric suffix in STORe<1|2> is irrelevant with this command.

This command is an event and therefore has no *RST value and no query.

Example

```
MMEM:STOR:STAT 1, 'Save'
```

Saves the current device settings in the file Save.dfl.

```
MMEM:STOR:STAT:NEXT
```

Saves the current device settings in the file Save_001.dfl

```
MMEM:STOR:STAT:NEXT
```

Saves the current device settings in the file Save_002.dfl

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

MMEMory:STORe<1|2>:TRACe

This command stores the selected trace in a file with ASCII format. The file format is described in chapter 4 "Instrument Functions - Analyzer", section "Setting Traces - TRACE Key", "[ASCII Trace Export](#)" softkey.

The decimal separator (decimal point or comma) for floating-point numerals contained in the file is defined with the [FORMat:DEXPort:DSEPARATOR](#) command.

This command is an event and therefore has no *RST value and no query.

Parameters

1 to 6,<file_name>

with 1 to 6 = selected measurement curve trace 1 to 6 and <file_name> = DOS file name

The file name includes indication of the path and the drive name. Indication of the path complies with DOS conventions.

Example

```
MMEM:STOR:TRAC 3, 'TEST.ASC'
```

Stores trace 3 in the file TEST.ASC.

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

6.3.9 OUTPut Subsystem (Option Additional Interfaces, B5)

The OUTPut subsystem controls the output features of the instrument.

Commands of the OUTPut Subsystem

◆ "[OUTPut<1|2>:IF:SOURce\]](#)"

OUTPut<1|2>:IF[:SOURce]

This command switches the source of the IF output between the demodulated signal (2 possible values) and the IF signal.

Note: *The AF output available at the frontpanel can only be used if the IF output source is set to video.*

Parameter

IF	intermediate frequency output
VIDeo	video output, 200 mV
HVIDeo	video output, 1V

Example

```
OUTP IF VID
```

Selects the video signal for the IF output connector.

Characteristics

*RST value: IF

SCPI: conform

Mode

A

6.3.10 SENSE Subsystem

The SENSE subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings; they do not refer to the signal characteristics of the measurement signal.

The SENSE subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSE" is optional for this reason, which means that it is not necessary to include the SENSE node in command sequences.

The following subsystems are included:

- ◆ "[SENSE:CORRection Subsystem](#)" on page "603"
- ◆ "[SENSE:ROSCillator Subsystem](#)" on page "608"

6.3.10.1 SENSE:CORRection Subsystem

This subsystem controls calibration and normalization.

Commands of the SENSE:CORRection Subsystem

- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer\[:STATe\]](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:ADJust:RLEVel\[:STATe\]](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:COMMeNt](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:DATA](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:DELeTe](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:SCALing](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:SELeCt](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:UNIT](#)"
- ◆ "[\[SENSE<1|2>:CORRection:TRANsducer:VIEW](#)"

[SENSe<1|2>:]CORRection:TRANsducer[:STATe]

This command switches the selected transducer factor on or off.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELEct](#) command must be sent.

Parameters

ON | OFF

Example

```
CORR:TRAN ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode A**[SENSe<1|2>:]CORRection:TRANsducer:ADJust:RLEVe[:STATe]**

This command switches the automatic adjustment of the reference level to the selected transducer factor on or off. For details refer to chapter 4, section "Instrument Setup and Interface Configuration – SETUP Key", "[Ref Level Adjust Man/Auto](#)" softkey.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELEct](#) command must be sent.

Parameters

ON | OFF

Example

```
CORR:TRAN:ADJ:RLEV ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:COMMeNt

This command defines the comment for the selected transducer factor.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SElect](#) command must be sent.

Parameters

<string>

Example

```
CORR:TRAN:COMM 'FACTOR FOR ANTENNA'
```

Characteristics

*RST value: (empty comment)

SCPI: device-specific

Mode A

[\[SENSe<1|2>:\]CORRection:TRANsducer:DATA](#)

This command defines the reference values of the transducer factor selected. These values are entered as a sequence of frequency/level pairs. The frequencies must be sent in ascending order.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SElect](#) command must be sent. The level values are sent as dimensionless numbers; the unit is specified by means of the [\[SENSe<1|2>:\]CORRection:TRANsducer:UNIT](#) command.

Parameters

<freq>,<level>

Example

```
SENS:CORR:TRAN:SEL 'TRAN_1'
```

Selects the transducer factor

```
CORR:TRAN:UNIT 'DB'
```

Selects the unit for the transducer.

```
CORR:TRAN:DATA 1MHZ,-30,2MHZ,-40
```

Defines the frequency/level pairs 1 MHz, -30 dB and 2 MHz, -40 dB.

Characteristics

*RST value: –
SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:DELeTe

This command deletes the selected transducer factor.
This command is an event and therefore has no *RST value.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELeCt](#) command must be sent.

Example

```
CORR:TRAN:DEL
```

Characteristics

*RST value: –
SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:SCALIng

This command defines whether the frequency scaling of the transducer factor is linear or logarithmic.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELeCt](#) command must be sent.

Parameters

LINear | LOGarithmic

Example

```
CORR:TRAN:SCAL LOG
```

Characteristics

*RST value: LINear

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:SELEct

This command selects the transducer factor designated by <name>. If <name> does not exist yet, a new transducer factor is created.

Note: This command must be sent prior to the subsequent commands for modifying/activating transducer factors.

Parameters

<name> = Name of the transducer factor in string data form with a maximum of 8 characters.

Example

```
CORR:TRAN:SEL 'FACTOR1'
```

Characteristics

*RST value: –

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:UNIT

This command defines the unit of the transducer factor selected.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELEct](#) command must be sent.

Parameters

<string> = DB | DBM | DBMV | DBUV | DBUV/M | DBUA DBUA/M | DBPW | DBPT

Example

```
CORR:TRAN:UNIT 'DBUV'
```

Characteristics

*RST value: DB

SCPI: device-specific

Mode

A

[SENSe<1|2>:]CORRection:TRANsducer:VIEW

This command switches on the display of the active transducer factor or set.

Note: Prior to this command, the

[\[SENSe<1|2>:\]CORRection:TRANsducer:SELEct](#) command must be sent.

Parameters

ON | OFF

Example

CORR:TRAN:VIEW ON

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

A

6.3.10.2 SENSE:ROSCillator Subsystem

This subsystem controls the reference oscillator. The numeric suffix in SENSE is irrelevant for the commands of this subsystem.

Commands of the SENSE:ROSCillator Subsystem

- ◆ "[\[SENSe<1|2>:\]ROSCillator:EXTernal:FREQUENCY](#)"
- ◆ "[\[SENSe<1|2>:\]ROSCillator:SOURce](#)"

[SENSe<1|2>:]ROSCillator:EXTernal:FREQUENCY

This command controls the frequency of the external reference oscillator. If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Parameters

<numeric value>

Example

ROSC:EXT:FREQ 20

Characteristics

*RST value: -

SCPI: conform

Mode

all

[SENSe<1|2>:]ROSCillator:SOURce

This command controls selection of the reference oscillator.

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

Parameters

INTernal | EXTernal

Example

ROSC : SOUR EXT

Characteristics

*RST value: -

SCPI: conform

Mode

all

6.3.11 SOURce Subsystem

The SOURce subsystem controls the output signals of the instrument.

Commands of the SOURce Subsystem

- ◆ "["SOURce<1|2>:EXTernal<1|2>:EXTernal:FREQuency"](#)
- ◆ "["SOURce<1|2>:EXTernal<1|2>:ROSCillator\[:SOURce\]"](#)
- ◆ "["SOURce<1|2>:TEMPerature:APRobe?"](#)

SOURce<1|2>:EXTernal<1|2>:EXTernal:FREQuency

This command outputs the frequency of the external reference oscillator to the REF OUT connector.

The external reference must be connected to the rear panel of the instrument.

Parameters

<numeric value>

Example

SOUR : EXT : EXT : FREQ

Characteristics

*RST value: -

SCPI: conform

Mode

all

SOURce<1|2>:EXTernal<1|2>:ROSCillator[:SOURce]

This command switches between external and internal reference oscillator.

Parameters

INTernal | EXTernal

Example

```
SOUR:EXT:ROSC EXT
```

Switches to external reference oscillator

Characteristics

*RST value: INT

SCPI: device-specific

Mode

all

SOURce<1|2>:TEMPerature:APRobe?

This command queries the sensor temperature.

Parameters

1 (CPU)

Example

```
SOUR:TEMP:APR? 1
```

Queries the temperature of the CPU sensor.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

6.3.12 STATus Subsystem

The STATus subsystem contains the commands for the status reporting system (see chapter 5 "Remote Control - Basics"). *RST does not influence the status registers.

Commands of the STATus Subsystem

- ◆ ["STATus:OPERation\[:EVENT\]?"](#)
- ◆ ["STATus:OPERation:CONDition?"](#)
- ◆ ["STATus:OPERation:ENABLE"](#)
- ◆ ["STATus:OPERation:PTRansition"](#)
- ◆ ["STATus:OPERation:NTRansition"](#)
- ◆ ["STATus:PRESet"](#)
- ◆ ["STATus:QUEStionable\[:EVENT\]?"](#)
- ◆ ["STATus:QUEStionable:CONDition?"](#)
- ◆ ["STATus:QUEStionable:ENABLE"](#)
- ◆ ["STATus:OPERation:PTRansition"](#)
- ◆ ["STATus:QUEStionable:NTRansition"](#)
- ◆ ["STATus:QUEuej:NEXT?"](#)

STATus:OPERation[:EVENT]?

This command queries the contents of the EVENT section of the STATus:OPERation register. The contents of the EVENT section are deleted after readout.

Example

```
STAT:OPER?
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:OPERation:CONDition?

This command queries the CONDition section of the STATus:OPERation register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example

```
STAT:OPER:COND?
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

STATus:OPERation:ENABLE

This command sets the bits of the ENABLE section of the STATus:OPERation register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

Parameters

0 to 65535

Example

```
STAT:OPER:ENAB 65535
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

STATus:OPERation:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:OPER:PTR 65535
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

STATus:OPERation:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:OPER:NTR 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:PRESet

This command resets the edge detectors and ENABLE parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABLE part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e. all events in these registers are not passed on.

Example

```
STAT:PRESet
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable register. The contents of the EVENT section are deleted after the readout.

Example

```
STAT:QUES?
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:CONDition?

This command queries the CONDition section of the STATus:QUEStionable register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:COND?
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

Parameters

0 to 65535

Example

```
STAT:QUES:ENAB 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:PTR 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEStionable:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameters

0 to 65535

Example

```
STAT:QUES:NTR 65535
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

STATus:QUEue[:NEXT?]

This command queries the earliest error queue entry and deletes it. Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned. This command is identical to the ["SYSTEM:ERROR\[:NEXT\]?"](#) command.

Example

```
STAT:QUES?
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

6.3.13 SYSTem Subsystem

This subsystem contains a series of commands for general functions.

Commands of the SYSTem Subsystem

- ◆ ["SYSTem:COMMunicate:GPIB\[:SELF\]:ADDRess"](#)
- ◆ ["SYSTem:COMMunicate:GPIB\[:SELF\]:RTERminator"](#)
- ◆ ["SYSTem:COMMunicate:PRINter:ENUMerate\[:NEXT?\]"](#)
- ◆ ["SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?"](#)
- ◆ ["SYSTem:COMMunicate:PRINter:SElect <1|2>"](#)
- ◆ ["SYSTem:COMMunicate:TCPIP:CONTrol?"](#)
- ◆ ["SYSTem:COMPatible"](#)
- ◆ ["SYSTem:DATE"](#)
- ◆ ["SYSTem:DISPlay:FPANel"](#)
- ◆ ["SYSTem:DISPlay:UPDate"](#)
- ◆ ["SYSTem:ERRor\[:NEXT\]?"](#)
- ◆ ["SYSTem:ERRor:CLEar:ALL "](#)
- ◆ ["SYSTem:ERRor:LIST?"](#)
- ◆ ["SYSTem:FIRMware:UPDate"](#)
- ◆ ["SYSTem:FORMat:IDENt"](#)
- ◆ ["SYSTem:LANGuage"](#)
- ◆ ["SYSTem:LXI:DISPlay"](#)
- ◆ ["SYSTem:LXI:LCI"](#)
- ◆ ["SYSTem:PASSword\[:CENable\]"](#)
- ◆ ["SYSTem:PASSword:RESet"](#)
- ◆ ["SYSTem:PRESet"](#)
- ◆ ["SYSTem:TIME"](#)
- ◆ ["SYSTem:VERSion?"](#)

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

This command changes the GPIB address of the unit.

Parameters

0 to 30

Example

```
SYST:COMM:GPIB:ADDR 18
```

Characteristics

*RST value: - (no influence on this parameter, factory default 20)

SCPI: conform

Mode

all

SYSTem:COMMunicate:GPIB[:SELF]:RTERminator

This command changes the GPIB receive terminator.

According to the standard the terminator in ASCII is <LF> and/or <EOI>. For binary data transfers (e.g. trace data) from the control computer to the instrument, the binary code (0AH) used for <LF> might be included in the binary data block, and therefore should not be interpreted as a terminator in this particular case. This can be avoided by changing the receive terminator to EOI.

Output of binary data from the instrument to the control computer does not require such a terminator change.

Parameters

LFEOI | EOI

Example

```
SYST:COMM:GPIB:RTER EOI
```

Characteristics

*RST value: - (no influence on this parameter, factory default LFEOI)

SCPI: device-specific

Mode

all

SYSTem:COMMunicate:PRINter:ENUMerate[:NEXT?]

This command queries the name of the next printer installed under Windows XP. After all available printer names have been output, an empty string enclosed by quotation marks ("") is output for the next query. Further queries are answered by a query error.

The "[SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?](#)" command should be sent previously to return to the beginning of the printer list and query the name of the first printer.

Example

```
SYST:COMM:PRIN:ENUM?
```

Characteristics

*RST value: NONE

SCPI: device-specific

Mode

all

SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?

This command queries the name of the first printer (in the list of printers) available under Windows XP.

The names of other installed printers can be queried with the "[SYSTem:COMMunicate:PRINter:ENUMerate:NEXT?](#)" command.
If no printer is configured an empty string is output.

Example

```
SYST:COMM:PRIN:ENUM:FIRS?
```

Characteristics

*RST value: NONE

SCPI: device-specific

Mode

all

SYSTem:COMMunicate:PRINter:SElect <1|2>

This command selects one of the printers configured under Windows XP including the associated output destination.

The specified printer name must be a string as returned by the commands "[SYSTem:COMMunicate:PRINter:ENUMerate:FIRSt?](#)" or "[SYSTem:COMMunicate:PRINter:ENUMerate:NEXT?](#)"

Note: The "[HCOpy:DESTination<1|2>](#)" command is used to select an output medium other than the default one.

Parameters

<printer_name>

Example

```
SYST:COMM:PRIN:SEL LASER on LPT1
```

Characteristics

*RST value: NONE

SCPI: device-specific

Mode

all

SYSTem:COMMunicate:TCPIP:CONTRol?

This command outputs the control port for the LAN socket connection. An error indicates that the socket connection is not supported.

Example

```
SYST:COMM:TCP:CONT?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

all

SYSTem:COMPatible

Sets the device in a state compatible to previous R&S signal analyzers, e.g. regarding the number of sweep points.

Parameters

DEFault | FSU | FSP

Example

```
SYST:COMP:FSP
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

SYSTem:DATE

This command is used to enter the date for the internal calendar.
The sequence of entry is year, month, day.

Parameters

1980 to 2099, 1 to 12, 1 to 31

Example

```
SYST:DATE 2000,6,1
```

Characteristics

*RST value: -
SCPI: conform

Mode

all

SYSTem:DISPlay:FPANel

This command activates or deactivates the display of the front panel keys on the screen.

With the display activated, the instrument can be operated on the screen using the mouse by pressing the corresponding buttons.

Parameters

ON | OFF

Example

```
SYST:DISP:FPAN ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

SYSTem:DISPlay:UPDate

In remote control mode, this command switches on or off the instrument display. If switched on, only the diagrams, traces and display fields are displayed and updated.

Note: *The best performance is obtained if the display output is switched off during remote control.*

Parameters

ON | OFF

Example

```
SYST:DISP:UPD ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

SYSTem:ERRor[:NEXT]?

This command queries the earliest error queue entry and deletes it. Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example

```
STAT:ERR?
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

SYSTem:ERRor:CLEar:ALL

This command deletes all entries in the table SYSTEM MESSAGES.

This command is an event and therefore has no query and no *RST value.

Example

```
SYST:ERR:CLE:ALL
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

SYSTem:ERRor:LIST?

This command reads all system messages and returns a list of comma separated strings. Each string corresponds to an entry in the table SYSTEM MESSAGES.

If the error list is empty, an empty string " " will be returned.

This command is a query and therefore has no *RST value.

Example

```
SYST:ERR:LIST?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

SYSTem:FIRMware:UPDate

This command starts a firmware update using the *.msi files in the selected directory. The default path is D:\FW_UPDATE. The path is changed via the "[MMEMory:](#)" command. To store the update files the "[MMEMory:DATA](#)" command is used.

This command is an event and therefore has no query and no *RST value.

Example

```
SYST:FIRM:UPD 'D:\FW_UPDATE'
```

Starts the firmware update from directory "D:\FW_UPDATE".

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

SYSTem:FORMat:IDENt

This command defines the response format to the "[*IDN?](#)" command. This function is intended for re-use of existing control programs together with the R&S FSV.

Parameter

LEGacy Format is compatible to the R&S FSP/FSU/FSQ family

NEW R&S FSV format

FSL Format is compatible to the R&S FSL family

Example

```
SYST:FORM:IDEN LEG
```

Adapts the return value of *IDN? to the R&S FSP/FSU/FSQ family.

Characteristics

*RST value: NEW

SCPI: device-specific

Mode

all

SYSTem:LANGuage

This command defines the system language.

Parameters

SCPI

Example

```
SYST:LANG 'SCPI'
```

Sets the system language to SCPI.

Characteristics

*RST value: SCPI

SCPI: device-specific

Mode

all

SYSTem:LXI:DISPlay

This command shows or hides the **LXI Observer** dialog box. To use this command, the LXI Class C functionality must be installed and enabled. For further details refer to chapter "[Instrument Setup and Interface Configuration - SETUP Key](#)".

Parameters

ON | OFF

Example

```
SYST:LXI:DISP ON
```

Shows the **LXI Observer** dialog box.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

all

SYSTem:LXI:LCI

This command executes the LAN configuration initialize (LCI) on the R&S FSV. To use this command, the LXI Class C functionality must be installed and enabled. For further details refer to chapter "[Instrument Setup and Interface Configuration - SETUP Key](#)".

This command is an event and therefore has no *RST value and no query.

Example

```
SYST:LXI:LCI
```

Sets the LAN configuration initialize (LCI) reset values.

Characteristics

*RST value: -

SCPI: device-specific

Mode

all

SYSTem:PASSword[:CENable]

This command enables access to the service functions by means of the password.

This command is an event and therefore has no *RST value and no query.

Parameters

<password>

Example

```
SYST:PASS XXXX
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

SYSTem:PASSword:RESet

This command resets the service password.

This command is an event and therefore has no *RST value and no query.

Example

```
SYST:PASS:RES
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

SYSTem:PRESet

This command initiates an instrument reset.

The effect of this command corresponds to that of the **PRESET** key with manual operation or to the "[*RST](#)" command. For details on preset settings refer to chapter 4 "Instrument Functions - Analyzer", section "[Initializing the Configuration - PRESET Key](#)".

Example

```
SYST:PRES
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

SYSTem:TIME

This command sets the internal clock. The sequence of entry is hour, minute, second.

Parameters

0 to 23, 0 to 59, 0 to 59

Example

```
SYST:TIME 12,30,30
```

Characteristics

*RST value: -

SCPI: conform

Mode

all

SYSTem:VERSion?

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no *RST value.

Example

```
SYST:VERS?
```

Characteristics

*RST value: –

SCPI: conform

Mode

all

7 Remote Control - Programming Examples

The following programming examples have a hierarchical structure, i.e. subsequent examples are based on previous ones. It is thus possible to compile very easily an operational program from the modules of the given examples. VISUAL BASIC has been used as programming language. However, the programs can be translated into other languages.

Note: In programming languages as C, C++ or programs as MATLAB, NI Interactive Control, a backslash starts an escape sequence (e.g. "\n" is used to start a new line). In these programming languages and programs, two backslashes instead of one must be used in remote commands (for an example refer to the Quick Start Guide, chapter 6.)

7.1 Analyzer Measurements - Programming Examples

In this chapter, more complex programming examples are given. In the Quick Start Guide, chapter 6, basic steps in remote control programming are provided.

7.1.1 Service Request

The service request routine requires an extended initialization of the instrument in which the relevant bits of the transition and enable registers are set. In addition the service request event must be enabled in the VISA session.

7.1.1.1 Initiate Service Request

```

REM ---- Example of initialization of the SRQ in the case of errors -----
PUBLIC SUB SetupSRQ()
CALL InstrWrite(analyzer, "*CLS")      'Reset status reporting system
CALL InstrWrite(analyzer,"*SRE 168")  'Enable service request for
'STAT:OPER,STAT:QUES and ESR
'register
CALL InstrWrite(analyzer,"*ESE 60")   'Set event enable bit for
'command, execution, device-
'dependent and query error
CALL InstrWrite(analyzer,"STAT:OPER:ENAB 32767")
'Set OPERATION enable bit for
'all events
CALL InstrWrite(analyzer,"STAT:OPER:PTR 32767")
'Set appropriate OPERATION
'Ptransition bits
CALL InstrWrite(analyzer,"STAT:QUES:ENAB 32767")
'Set questionable enable bits
'for all events
CALL InstrWrite(analyzer,"STAT:QUES:PTR 32767")
'Set appropriate questionable
'Ptransition bits
CALL viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, 0)
'Enable the event for service
'request
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, SRQWaitTimeout,
VI_NULL, VI_NULL)
IF (status = VI_SUCCESS) THEN CALL Srq      'If SRQ is recognized =>
'subroutine for evaluation
END SUB
REM *****

```

7.1.1.2 Waiting for the Arrival of a Service Request

There are basically two methods of waiting for the arrival of a service request:

Blocking (user inputs not possible):

This method is appropriate if the waiting time until the event to be signaled by an SRQ is short (shorter than the selected timeout), if no response to user inputs is required during the waiting time, and if - as the main criterion - the event is absolutely certain to occur.

Reason:

From the time the viWaitOnEvent() function is called until the occurrence of the expected event, it does not allow the program to respond to mouse clicks or key entries during the waiting time. Moreover, it returns an error if the SRQ event does not occur within the predefined timeout period.

The method is, therefore, in many cases not suitable for waiting for measurement results, especially when using triggered measurements.

The following function calls are required:

```

                Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ,
SRQWaitTimeout, VI_NULL, VI_NULL)
'Wait for service request user
'inputs are not possible during
'the waiting time!
                IF (status = VI_SUCCESS) THEN CALL Srq
'If SRQ is recognized =>
'subroutine for evaluation

```

Non-blocking (user inputs possible):

This method is recommended if the waiting time until the event to be signaled by an SRQ is long (longer than the selected timeout), and user inputs should be possible during the waiting time, or if the event is not certain to occur. This method is, therefore, the preferable choice for waiting for the end of measurements, i.e. the output of results, especially in the case of triggered measurements.

The method necessitates a waiting loop that checks the status of the SRQ line at regular intervals and returns control to the operating system during the time the expected event has not yet occurred. In this way, the system can respond to user inputs (mouse clicks, key entries) during the waiting time.

It is advisable to employ the Hold() auxiliary function, which returns control to the operating system for a selectable waiting time (see section "[Waiting Without Blocking the Keyboard and Mouse](#)"), so enabling user inputs during the waiting time.

```

        result% = 0
        For i = 1 To 10           'Abort after max. 10 loop
'iterations
            Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ,
VI_TMO_IMMEDIATE, VI_NULL, VI_NULL)
'Check event queue
                If (status = VI_SUCCESS) Then
                    result% = 1
                    CALL Srq           'If SRQ is recognized =>
' subroutine for evaluation
                Else
                    CALL Hold(20) 'Call hold function with
'20 ms 'waiting time. User inputs
'are possible.
                Endif
            Next i
            If result% = 0 Then
                Debug.Print "Timeout Error; Program aborted"
'Output error message
                STOP           'Stop software
            Endif

```

7.1.1.3 Waiting Without Blocking the Keyboard and Mouse

A frequent problem with remote control programs using Visual Basic is to insert waiting times without blocking the keyboard and the mouse.

If the program is to respond to user inputs also during a waiting time, control over the program events during this time must be returned to the operating system. In Visual Basic, this is done by calling the `DoEvents` function. This function causes keyboard- or mouse-triggered events to be executed by the associated elements. For example, it allows the operation of buttons and input fields while the user waits for an instrument setting to be completed.

The following programming example describes the `Hold()` function, which returns control to the operating system for the period of the waiting time selectable in milliseconds.

```

Rem *****
Rem The waiting function below expects the transfer of the desired
Rem waiting time in milliseconds. The keyboard and the mouse remain
Rem operative during the waiting period, thus allowing desired elements
Rem to be controlled
Rem *****

```

```

Public Sub Hold(delayTime As Single)
    Start = Timer 'Save timer count on calling the
'function
    Do While Timer < Start + delayTime / 1000 'Check timer count
        DoEvents 'Return control to operating
'system to enable control of
'desired elements as long as
'timer has not elapsed
    Loop
End Sub
Rem *****

```

The waiting procedure is activated simply by calling Hold(<Waiting time in milliseconds>).

7.1.1.4 Service Request Routine

A service request is processed in the service request routine.

Note: The variables userN% and userM% must be pre-assigned usefully!

```

REM ----- Service request routine -----
Public SUB Srq()
ON ERROR GOTO noDevice'No user existing
CALL viReadSTB(analyzer, STB%)'Serial poll, read status byte
IF STB% > 0 THEN 'This instrument has bits set in
'the STB
    SRQFOUND% = 1
    IF (STB% AND 16) > 0 THEN CALL Outputqueue
    IF (STB% AND 4) > 0 THEN CALL ErrorQueueHandler
    IF (STB% AND 8) > 0 THEN CALL Questionablestatus
    IF (STB% AND 128) > 0 THEN CALL Operationstatus
    IF (STB% AND 32) > 0 THEN CALL Esrread
END IF
noDevice:
END SUB 'End of SRQ routine
Rem *****

```

Reading out the status event registers, the output buffer and the error/event queue is effected in subroutines.

7.1.1.5 Reading Out the Output Buffer

```

REM ----- Subroutine for the individual STB bits -----
Public SUB Outputqueue()      'Reading the output buffer
result$ = SPACE$(100) 'Make space for response
CALL InstrRead(analyzer, result$)
Debug.Print "Contents of Output Queue : "; result$
END SUB
REM *****

```

7.1.1.6 Reading Error Messages

```

REM ----- Subroutine for reading the error queue -----
Public SUB ErrorQueueHandler()
ERROR$ = SPACE$(100) 'Make space for error variable
CALL InstrWrite(analyzer, "SYSTEM:ERROR?")
CALL InstrRead(analyzer, ERROR$)
Debug.Print "Error Description : "; ERROR$
END SUB
REM *****

```

7.1.1.7 Evaluation of SCPI Status Registers

```

REM ----- Subroutine for evaluating Questionable Status Register -----
Public SUB Questionablestatus()
Ques$ = SPACE$(20) 'Preallocate blanks to text
'variable
CALL InstrWrite(analyzer, "STATus:QUEStionable:EVENT?")
CALL InstrRead(analyzer, Ques$)
Debug.Print "Questionable Status: "; Ques$
END SUB
REM *****

REM ----- Subroutine for evaluating Operation Status Register -----
Public SUB Operationstatus()
Oper$ = SPACE$(20) 'Preallocate blanks to text
'variable
CALL InstrWrite(analyzer, "STATus:OPERation:EVENT?")
CALL InstrRead(analyzer, Oper$)
Debug.Print "Operation Status: "; Oper$
END SUB
REM *****

```


7.1.1.8 Evaluation of Event Status Register

```

REM ----- Subroutine for evaluating the Event Status Register -----
Public SUB Esrread()
Esr$ = SPACE$(20)      'Preallocate blanks to text
'variable
CALL InstrWrite(analyzer, "*ESR?")  'Read ESR
CALL InstrRead(analyzer, Esr$)
IF (VAL(Esr$) AND 1) > 0 THEN Debug.Print "Operation complete"
IF (VAL(Esr$) AND 2) > 0 THEN Debug.Print "Request Control"
IF (VAL(Esr$) AND 4) > 0 THEN Debug.Print "Query Error"
IF (VAL(Esr$) AND 8) > 0 THEN Debug.Print "Device dependent error"
IF (VAL(Esr$) AND 16) > 0 THEN
    Debug.Print "Execution Error; Program aborted"
'Output error message
    STOP                'Stop software
    END IF
IF (VAL(Esr$) AND 32) > 0 THEN
    Debug.Print "Command Error; Program aborted"
'Output error message
    STOP                'Stop software
    END IF
IF (VAL(Esr$) AND 64) > 0 THEN Debug.Print "User request"
IF (VAL(Esr$) AND 128) > 0 THEN Debug.Print "Power on"
END SUB
REM *****

```

7.1.2 Using Marker and Delta Marker

7.1.2.1 Shape Factor Measurement (using n dB down)

The n-dB-down function of the R&S FSV is used twice to determine the shape factor of a filter (ratio of bandwidths at 60 dB and 3 dB below the filter maximum).

The following example is again based on a signal with a level of -30 dBm at 100 MHz.

The shape factor is determined for the 30 kHz resolution bandwidth. The default setting of the R&S FSV is used for measurements (SetupInstrument).

```

REM *****
Public Sub ShapeFactor()
result$ = Space$(100)
'----- R&S FSV default setting -----
CALL SetupInstrument 'Default setting
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep

```

```

'----- Set frequency -----
CALL InstrWrite(analyzer,"FREQ:SPAN 1MHz")
'Span
CALL InstrWrite(analyzer,"BAND:RES 30kHz")
'Resolution bandwidth
CALL InstrWrite(analyzer,"INIT;*WAI")           'Perform sweep with sync
'----- Measure 60 dB value -----
CALL InstrWrite(analyzer,"CALC:MARK:PEXC 6DB")
'Peak excursion
CALL InstrWrite(analyzer,"CALC:MARK:STAT ON")
'Marker1 on
CALL InstrWrite(analyzer,"CALC:MARK:TRAC 1")
'Assign marker1 to trace1
CALL InstrWrite(analyzer,"CALC:MARK:MAX")       'Set marker1 to 100 MHz
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:NDBD 45dB")
'Read out bandwidth measured at
'45 dB
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:NDBD:RES?")
CALL InstrRead(analyzer,result$)
result60 = Val(result$)
'----- Measure 3 dB down value-----
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:NDBD 3dB")
'Read out bandwidth measured at
'3 dB
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:NDBD:RES?")
CALL InstrRead(analyzer,result$)
result3 = Val(result$)
'----- Read out shape factor-----
Print "Shapefaktor 60dB/3dB: ";result60/result3
END SUB
REM *****

```

7.1.2.2 Measuring the Third Order Intercept Point

The third order intercept point (TOI) is the (virtual) level of two adjacent useful signals at which the intermodulation products of third order have the same level as the useful signals.

The intermodulation product at f_{S2} is obtained by mixing the first harmonic of the useful signal P_{N2} with signal P_{N1} , the intermodulation product at f_{S1} by mixing the first harmonic of the useful signal P_{N1} with signal P_{N2} .

$$f_{S1} = 2 \times f_{n1} - f_{n2} \quad (1)$$

$$f_{S2} = 2 \times f_{n2} - f_{n1} \quad (2)$$

The following example is based on two adjacent signals with a level of -30 dBm at 100 MHz and 110 MHz. The intermodulation products lie at 90 MHz and 120 MHz according to the above formula. The frequency is set so that the examined mixture products are displayed in the diagram. Otherwise, the default setting of the R&S FSV is used for measurements (SetupInstrument).

```

REM *****
Public Sub TOI()
result$ = Space$(100)
'----- R&S FSV default setting -----
CALL SetupStatusReg 'Set status registers
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep
CALL InstrWrite(analyzer,"SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'----- Set frequency -----
CALL InstrWrite(analyzer,"FREQ:START 85MHz;STOP 125 MHz")
'Span
'----- Set level -----
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:RLEV -20dBm")
'Reference level
CALL InstrWrite(analyzer,"INIT;*WAI") 'Perform sweep with sync
'----- TOI measurement -----
CALL InstrWrite(analyzer,"CALC:MARK:PEXC 6DB")
'Peak excursion
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:TOI ON")
'Switch on TOI measurement
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:TOI:RES?")
'and read out results
CALL InstrRead(analyzer,result$)
'----- Read out result -----
Print "TOI [dBm]: ";result$
END SUB
REM *****

```

7.1.2.3 Measuring the AM Modulation Depth

The example below is based on an AM-modulated signal at 100 MHz with the following characteristics:

Carrier signal level	-30 dBm
AF frequency	100 kHz
Modulation depth	50 %

The default setting of the analyzer for measurements can be used for the measurements described below (SetupInstrument).

```

REM *****
Public Sub AMMod()
result$ = Space$(100)
CALL SetupInstrument 'Default setting
CALL InstrWrite(analyzer,"BAND:RES 30kHz") 'Set appropriate RBW
'----- Peak search -----
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep
CALL InstrWrite(analyzer,"INIT:*WAI") 'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:PEXC 6DB")
'Peak excursion
CALL InstrWrite(analyzer,"CALC:MARK:STAT ON")
'Marker 1 on
CALL InstrWrite(analyzer,"CALC:MARK:TRAC 1")
'Assign marker1 to tracel
'----- Measure modulation depth-----
CALL InstrWrite(analyzer,"CALC:MARK:MAX;FUNC:MDEP ON")
'Marker to Peak;
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:MDEP:RES?")
'Measure mod. depth
CALL InstrRead(analyzer, result$) 'Read out result
'----- Read out result -----
Print "AM Mod Depth [%]: ";result$
END SUB
REM *****

```

7.1.3 Limit Lines and Limit Test

The example below shows the definition and use of a new limit line 5 for trace 1 with the following characteristics:

- ◆ Upper limit line
- ◆ Absolute x-axis in the frequency range
- ◆ 7 reference values:
 - 120 MHz / -70 dB,
 - 126 MHz/-40 dB,
 - 127 MHz/-40 dB,
 - 128 MHz/-10 dB,
 - 129 MHz/-40 dB,
 - 130 MHz/-40 dB,
 - 136 MHz / -70 dB

- ◆ Relative y-axis with unit dB
- ◆ Absolute threshold at -75 dBm
- ◆ No margin

The signal of the integrated calibration source (128 MHz, -30 dBm) is used to check the limit test.

```

REM *****
Public Sub LimitLine()
result$ = Space$(100)
'----- R&S FSV default setting -----
CALL SetupInstrument 'Default setting
CALL InstrWrite(analyzer,"FREQUENCY:CENTER 128MHz;Span 10MHz")
'Span
CALL InstrWrite(analyzer,"Diag:Serv:Inp Cal;CSO -30dBm")
'Cal signal on

'----- Definition of limit lines -----
CALL InstrWrite(analyzer,"CALC:LIM5:NAME 'TEST1'")
'Define name
CALL InstrWrite(analyzer,"CALC:LIM5:COMM 'Upper limit'")
'Define comment
CALL InstrWrite(analyzer,"CALC:LIM5:TRAC 1")
'Assign trace
CALL InstrWrite(analyzer,"CALC:LIM5:CONT:DOM FREQ")
'Define x-axis range
CALL InstrWrite(analyzer,"CALC:LIM5:CONT:MODE ABS")
'Define x-axis scaling
CALL InstrWrite(analyzer,"CALC:LIM5:UNIT DB")
'Define y-axis unit
CALL InstrWrite(analyzer,"CALC:LIM5:UPP:MODE REL")
'Define y-axis scaling

'----- Definition of data points and threshold -----
xlimit$ = "CALC:LIM5:CONT 120MHZ,126MHZ,127MHZ,128MHZ,129MHZ,130MHZ,136MHZ"
CALL InstrWrite(analyzer, xlimit$) 'Set values for x-axis
CALL InstrWrite(analyzer,"CALC:LIM5:UPP -70,-40,-40,-20,-40,-40,-70")
'Set values for y-axis
CALL InstrWrite(analyzer,"CALC:LIM5:UPP:THR -75DBM")
'Set y threshold (only
'possible for relative
'y-axis)

'----- Definition of margin or x /y offset-----
'A margin or an x /y offset can be defined here.

```

```

'----- Activate and evaluate the limit line -----
CALL InstrWrite(analyzer,"CALC:LIM5:UPP:STAT ON")
'Activate line 5
CALL InstrWrite(analyzer,"CALC:LIM5:STAT ON")
'Activate limit check
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:LIM5:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)      'Result: 1 (= FAIL)
'----- Read out result -----
Print "Limit Result Line 5: ";result$
'----- Evaluate limit line by means of status register -----
CALL InstrWrite(analyzer,"*CLS")          'Reset status register
'----- Measure -----
CALL InstrWrite(analyzer,"INIT;*OPC")      'Perform sweep with sync
CALL viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, 0)
Status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, SRQWaitTimeout, VI_NULL,
VI_NULL)
IF (status = VI_SUCCESS) THEN CALL Srq      'If SRQ is recognized =>
'subroutine for evaluation
'----- Read out result -----
IF (status% = 1) THEN
    CALL InstrWrite(analyzer,"STAT:QUES:LIM1:COND?")
'Read out STAT:QUES:LIMit
'register
    CALL InstrRead(analyzer, result$)
    IF ((Val(result$) And 16) <> 0) THEN
        Print "Limit5 failed"
    ELSE
        Print "Limit5 passed"
    END IF
END IF
END SUB
REM *****

```

7.1.4 Measuring the Channel and Adjacent Channel Power

In the following example, the channel and adjacent channel power is first measured on a signal with a level of 0 dBm at 800 MHz to IS95. Then the channel and adjacent channel power is measured on a GSM signal at 935.2 MHz with fast ACP measurement (FAST ACP).

In addition, the limit test is activated.

```

REM *****
Public Sub ACP()
result$ = Space$(100)

'----- R&S FSV default setting -----
CALL SetupStatusReg 'Set status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep
CALL InstrWrite(analyzer,"SYST:DISP:UPD ON")
'ON: display on
'OFF: off

'----- Set frequency -----
CALL InstrWrite(analyzer,"FREQ:CENT 800MHz")
'Set frequency

'----- Set level -----
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:RLEV 10dBm")
'Reference level

'----- Example 1: Configure CP/ACP for CDMA-----
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:SEL ACP")
'ACP measurement on
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:PRES F8CDMA")
'Select CDMA800 FWD
CALL InstrWrite(analyzer,"SENS:POW:ACH:ACP 2")
'Select 2 adjacent channels
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES ACP")
'Optimize settings
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES:RLEV")
'Optimize reference level
CALL InstrWrite(analyzer,"SENS:POW:ACH:MODE ABS")
'Absolute measurement
CALL InstrWrite(analyzer,"SENS:POW:HSP ON")
'Fast ACP measurement

'----- Perform measurement and query results -----
CALL InstrWrite(analyzer,"INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:RES? ACP") 'Query result
CALL InstrRead(analyzer, result$)

'----- Read out result -----
Print "Result (CP, ACP low, ACP up, Alt low, Alt up): "
Print result$

'----- Example 2: Configure CP/ACP manually for GSM-----
result$ = Space$(100)
CALL InstrWrite(analyzer,"FREQ:CENT 935.2MHz")
'Set frequency
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:SEL ACP")
'ACP measurement on

```

Analyzer Measurements - Programming Examples

```

CALL InstrWrite(analyzer,"SENS:POW:ACH:ACP 1")
'1 adjacent channel
CALL InstrWrite(analyzer,"SENS:POW:ACH:BAND 200KHZ")
'Channel bandw. 200 kHz
CALL InstrWrite(analyzer,"SENS:POW:ACH:BAND:ACH 200KHZ")
'Adjacent channel band-
'width 200 kHz
CALL InstrWrite(analyzer,"SENS:POW:ACH:SPAC 200KHZ")
'Channel spacing 200 kHz
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES ACP")
'Optimize settings
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES:RLEV")
'Optimize reference level
CALL InstrWrite(analyzer,"SENS:POW:ACH:MODE ABS")
'Absolute measurement
'----- Start measurement and query result -----
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:RES? ACP")
'Query result
CALL InstrRead(analyzer, result$)
'----- Read out result -----
Print "Result (CP, ACP low, ACP up): "
Print result$
'----- Active limit check -----
result$ = Space$(100)
CALL InstrWrite(analyzer,"CALC:LIM:ACP:ACH 30DB, 30DB")
'Set relative limit
CALL InstrWrite(analyzer,"CALC:LIM:ACP:ACH:ABS -35DBM,-35DBM")
'Set absolute limit
CALL InstrWrite(analyzer,"CALC:LIM:ACP:ACH:STAT ON")
'Rel. limit check on
CALL InstrWrite(analyzer,"CALC:LIM:ACP:ACH:ABS:STAT ON")
'Abs. limit check on
CALL InstrWrite(analyzer,"CALC:LIM:ACP ON")
'Limit check on

'----- Start measurement and query result -----
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:LIM:ACP:ACH:RES?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
'----- Read out result -----
Print "Result Limit Check: ";result$
END SUB
REM *****

```


7.1.5 Occupied Bandwidth Measurement

In the following example, the bandwidth is to be found in which 95% of the power of a GSM signal is contained. Signal frequency is 935.2 MHz; channel bandwidth is 200 kHz.

```

REM *****
Public Sub OBW()
result$ = Space$(100)
'----- R&S FSV default setting -----
CALL SetupStatusReg 'Set status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep
CALL InstrWrite(analyzer,"SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'----- Configure R&S FSV for OBW for GSM-----
CALL InstrWrite(analyzer,"FREQ:CENT 935.2MHZ")
'Set frequency
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:SEL OBW")
'OBW measurement on
CALL InstrWrite(analyzer,"SENS:POW:ACH:BAND 200KHZ")
'Channel bandw. 200 kHz
CALL InstrWrite(analyzer,"SENS:POW:BWID 95PCT")
'Percentage of power
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES OBW")
'Set frequency and optimize reference level
CALL InstrWrite(analyzer,"SENS:POW:ACH:PRES:RLEV")
CALL InstrWrite(analyzer,"SENS:POW:NCOR OFF")
'Noise correction
'OFF: switch off
'ON: switch on
'----- Perform measurement and query results -----
CALL InstrWrite(analyzer,"INIT;*WAI") 'Perform sweep with sync
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:POW:RES? OBW")
'Query result
CALL InstrRead(analyzer, result$)
Print result$
END SUB
REM *****

```

7.1.6 Time Domain Power Measurement

In the following example, the mean carrier power of a signal with 300 kHz bandwidth at 100 MHz is to be determined. In addition, the peak power, the rms value and the standard deviation are measured. To do this, the time-domain-power measurement functions are used.

```

REM *****
Public Sub TimeDomainPower()
result$ = Space$(100)
'----- R&S FSV default setting -----
CALL SetupStatusReg 'Set status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep
CALL InstrWrite(analyzer,"SYST:DISP:UPD ON")
'ON: display on
'OFF: off
'----- Configure R&S FSV for time domain power measurement -----
CALL InstrWrite(analyzer,"FREQ:CENT 100MHZ;SPAN 0Hz")
'Set frequency
CALL InstrWrite(analyzer,"BAND:RES 300kHz")
'Resolution bandwidth
CALL InstrWrite(analyzer,"SWE:TIME 200US") 'Sweep time
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:SUMM:PPE ON")
'Peak measurement on
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:SUMM:MEAN ON")
'Mean measurement on
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:SUMM:RMS ON")
'RMS measurement on
CALL InstrWrite(analyzer,"CALC:MARK:FUNC:SUMM:SDEV ON")
'Standard deviation on
'----- Perform measurement and query results -----
CALL InstrWrite(analyzer,"INIT;*WAI") 'Perform sweep with sync
'Query results:
query$ = " CALC:MARK:FUNC:SUMM:PPE:RES?;" 'Peak measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:MEAN:RES?;"
'Mean measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:RMS:RES?;"
'RMS measurement
query$ = query$ + ":CALC:MARK:FUNC:SUMM:SDEV:RES?"
'Standard deviation
CALL InstrWrite(analyzer, query$)
CALL InstrRead(analyzer, result$)
Print result$
END SUB
REM *****

```

7.1.7 Fast Power Measurement on Power Ramps

A frequent task in mobile radio tests is measurement of a DUT at various power control levels at the highest possible speed. The R&S FSV offers two test functions for this task, which can be used depending on the signal characteristics.

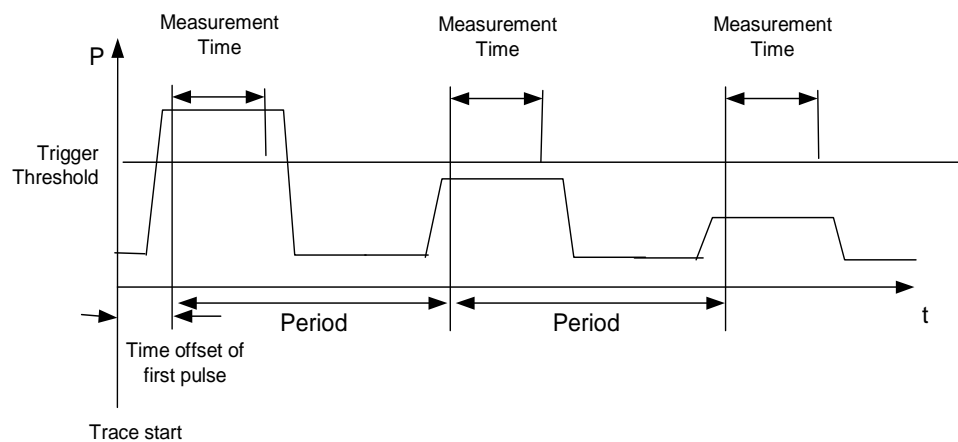
In the following, the two methods are presented by means of two examples.

7.1.7.1 Power Measurement with Multi-Summary Marker

The multi-summary marker function is suitable for measuring the power of a sequence of pulses with the following characteristics:

- ◆ The pulses occur at identical time intervals, which is typical of GSM transmission in slots, for example.
- ◆ The level of the first signal is reliably above threshold.
- ◆ The subsequent pulses may have any levels.
- ◆ The function uses the first pulse as a trigger signal. The power of the subsequent pulses is determined exclusively via the timing pattern selected for the pulse sequence. The function is, therefore, suitable for adjustments where the DUT output power varies considerably and is not reliably above the trigger threshold.
- ◆ The measurement accuracy is determined by the ratio of pulse duration to total measurement time; this should not be below 1:50.
- ◆ The function always uses TRACE 1.

Figure 41: Block diagram illustrating signal processing in analyzer



In the example below, a GSM pulse sequence of 8 pulses is measured with an offset of 50 μs of the first pulse, 450 μs measurement time/pulse and 576.9 μs pulse period.

```

REM *****
Public Sub MultiSumMarker()
result$ = Space$(200)
'----- R&S FSV default setting-----
CALL SetupStatusReg 'Configure status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite(analyzer,"SYST:DISP:UPD ON")
'ON: switch display on
'OFF: switch display off
'----- Configure R&S FSV for power measurement in time domain -----
CALL InstrWrite(analyzer,"FREQ:CENT 935.2MHz;SPAN 0Hz")
'Frequency setting
CALL InstrWrite(analyzer,"DISP:WIND:TRAC:Y:RLEV 10dBm")
'Set reference level to 10 dB
CALL InstrWrite(analyzer,"INP:ATT 30 dB") 'Set input attenuation to 30 dB
CALL InstrWrite(analyzer,"BAND:RES 1MHz;VID 3MHz")
'Bandwidth setting
CALL InstrWrite(analyzer,"DET RMS") 'Select RMS detector
CALL InstrWrite(analyzer,"TRIG:SOUR VID") 'Trigger source: video
CALL InstrWrite(analyzer,"TRIG:LEV:VID 50 PCT")
'Trigger threshold: 50%
CALL InstrWrite(analyzer,"SWE:TIME 50ms") 'Sweep time ≥ 1 frame

'----- Perform measurement and query results -----
CALL InstrWrite(analyzer,"INIT;*WAI") 'Perform sweep with sync
'Query results:
cmd$ = "CALC:MARK:FUNC:MSUM? "
cmd$ = cmd$ + "50US," 'Offset of first pulse
cmd$ = cmd$ + "450US," 'Measurement time
cmd$ = cmd$ + "576.9US," 'Pulse period
cmd$ = cmd$ + "8" 'Number of bursts
CALL InstrWrite(analyzer,cmd$)
CALL InstrRead(analyzer, result$) 'Read results
Print result$
END SUB
REM *****

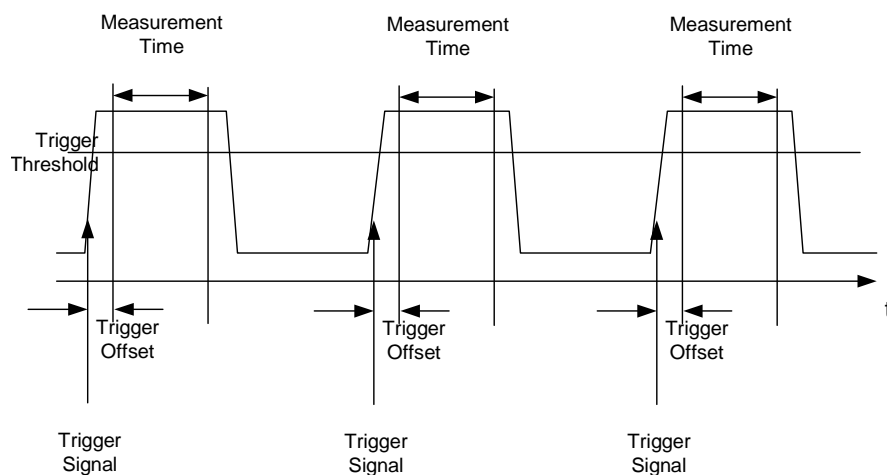
```

7.1.7.2 Multi-Burst Power Measurement

The multi-burst power measurement function is suitable for measuring the power of a sequence of pulses with the following characteristics:

- ◆ The pulses occur at variable time intervals.
- ◆ The levels of all pulses of the sequence are reliably above the trigger threshold, or an external trigger signal is used.
- ◆ The function requires one trigger event per pulse. This means that if the video trigger or the IF power trigger is used, the levels of all pulses must be above the trigger threshold.
- ◆ The function is, therefore, particularly suitable for re-measuring DUTs already adjusted and whose output power is within the specified range. The measurement is optimized for minimum overhead relative to the actual measurement time.

Figure 42: Block diagram illustrating signal processing in analyzer



Either the root-mean-square power or the peak power is measured, depending on whether the RMS detector or the PEAK detector is selected. The function always uses TRACE 1.

The following parameters are to be set for this measurement:

- ◆ Analyzer frequency
- ◆ Resolution bandwidth
- ◆ Measurement time per single pulse
- ◆ Trigger source
- ◆ Trigger threshold
- ◆ Trigger offset
- ◆ Type of power measurement (PEAK, MEAN)
- ◆ Number of pulses to be measured

During the measurement, each pulse is mapped into a pixel of the screen, i.e. any change of the trace can be detected only at the left-hand edge of the screen. Maximum measurement speed is as usual achieved with the display switched off.

In the example below, a GSM pulse sequence of 8 pulses is measured with 5 μ s trigger offset, 434 μ s measurement time/pulse, video trigger with 50% trigger threshold, and peak detection:

```

REM *****
Public Sub MultiBurstPower()
result$ = Space$(200)
'----- R&S FSV default setting -----
CALL SetupStatusReg 'Configure status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite(analyzer,"SYST:DISP:UPD OFF")
'OFF: display off
'----- Perform measurement and query results -----
cmd$ = "MPOW? "
cmd$ = cmd$ + "935.2 MHZ," 'Center frequency
cmd$ = cmd$ + "1MHZ," 'Resolution bandwidth
cmd$ = cmd$ + "434US," 'Measurement time
cmd$ = cmd$ + "VID," 'Trigger source
cmd$ = cmd$ + "50PCT," 'Trigger threshold
cmd$ = cmd$ + "1US," 'Trigger offset, must be > 125 ns
cmd$ = cmd$ + "PEAK," 'Peak detector
cmd$ = cmd$ + "8" 'Number of bursts
CALL InstrWrite(analyzer, cmd$)
CALL InstrRead(analyzer, result$) 'Read results
Print result$
END SUB
REM *****

```

7.1.8 Fast Level Measurement Using Frequency Lists

A typical task for the R&S FSV is power measurement at a number of frequency points, e.g. at multiples of the fundamental (harmonics measurement), or at frequencies defined by a mobile radio standard (e.g. spectrum due to transients at ± 200 kHz, ± 400 kHz, etc about the carrier frequency of a GSM signal). In many cases, different level and/or bandwidth settings are required for the different frequency points to match the channel spacing and meet the requirements of dynamic range.

Especially for this application, the R&S FSV offers a number of remote-control functions (commands available in SENSE:LIST subsystem) that allow level measurement based on a frequency list with different instrument settings assigned to different frequencies. Not only the frequency list can be programmed, but also the measurement types (PEAK, RMS, AVG) to be performed simultaneously can be selected.

The example below describes a harmonics measurement on a dual-band amplifier. The harmonics level in general decreases as the frequency increases. To boost measurement sensitivity, therefore, the reference level is lowered by 10 dB from the third harmonic.

The following settings are used:

Reference level:	10.00 dBm up to first harmonic, 0 dBm from 2nd harmonic
RF attenuation:	20 dB
Electronic attenuation:	0 dB (OFF)
Filter type:	NORMal
RBW:	1 MHz
VBW:	3 MHz
Measurement time:	300 µs
Trigger delay:	100 µs
Trigger:	video, 45 %

Frequency	Type
935.2 MHz	GSM 900 fundamental
1805.2 MHz	GSM 1800 fundamental
1870.4 MHz	GSM 900 2nd harmonic
2805.6 MHz	GSM 900 3rd harmonic
3610.4 MHz	GSM 1800 2nd harmonic
3740.8 MHz	GSM 900 4th harmonic
5815.6 MHz	GSM 1800 3rd Harmonic

The frequencies are selected in ascending order to minimize system-inherent waiting times resulting from frequency changes.

At each frequency point the peak power and the rms power are measured. The peak power and the rms power values are stored alternately in the results memory.

```
REM *****
Public Sub FrequencyList()
result$ = Space$(500)
```

```

'----- R&S FSV default setting -----
CALL SetupStatusReg 'Configure status register
CALL InstrWrite(analyzer,"*RST") 'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF") 'Single sweep mode
CALL InstrWrite(analyzer,"SYST:DISP:UPD OFF")
'Display off

'-----Configure R&S FSV for power measurement based on frequency list -
CALL InstrWrite(analyzer, "TRIG:LEV:IFP -20dBm")
'Set IF power trigger level
CALL InstrWrite(analyzer, "LIST:POWER:SET ON,ON,OFF,IFP,POS,100us,0")

'----- Perform measurement and query results -----
cmd$ = "LIST:POWER?"
cmd$ = cmd$ + "935.2MHZ,10dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "1805.2MHZ,10dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "1870.4MHZ,10dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "2805.6MHZ,0dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "3610.4MHz,10dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "3740.8MHz,0dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0,"
cmd$ = cmd$ + "5815.6MHz,0dBm,20dB,OFF,NORM,1MHz,3MHz,300us,0"
CALL InstrWrite(analyzer, cmd$)
CALL InstrRead(analyzer, result$)
Print result$

END SUB

REM *****

```

7.1.9 Level Correction of Transducers

In more complex test systems, the frequency response of the test setup must be taken into account in all power measurements to avoid any measurement errors being introduced from sources other than the DUT.

The R&S FSV offers the possibility of defining a frequency-dependent attenuation correction factor (transducer factor).

In the example below, a factor with the following characteristics is defined:

Name:	Transtest
Unit:	dB
Scaling:	lin
Comment:	simulated cable correction
Frequency	Level
10 MHz	0 dB
100 MHz	3 dB
1 GHz	7 dB
3 GHz	10 dB

The factor is defined and can be activated as required.


```

REM *****
Public Sub TransducerFactor()
  '----- Define transducer factor -----
  CALL InstrWrite(analyzer,"CORR:TRAN:SEL 'TRANSTEST' ")
  'Define "Transtest"
  'transducer factor
  CALL InstrWrite(analyzer,"CORR:TRAN:UNIT 'dB'")
  'Unit 'dB'
  CALL InstrWrite(analyzer,"CORR:TRAN:SCAL LIN")
  'Linear frequency-axis
  CALL InstrWrite(analyzer,"CORR:TRAN:COMM 'Simulated cable correction'")
  cmd$ = "CORR:TRAN:DATA " 'Enter frequency and level
  cmd$ = cmd$ + "10MHz, 0," 'values. Level values without
  cmd$ = cmd$ + "100MHz, 3," 'unit!
  cmd$ = cmd$ + "1GHz, 7,"
  cmd$ = cmd$ + "3GHz, 10"
  CALL InstrWrite(analyzer,cmd$) 'Enter frequency and level values
  '----- Activate transducer -----
  CALL InstrWrite(analyzer,"CORR:TRAN:STAT ON")
  'Activate transducer factor
END SUB
REM *****

```

7.1.10 Averaging I/Q Data

The R&S FSV has averaging capability also for I/Q measurements, i.e. I/Q data can be averaged over several test runs. This is subject to the following conditions:

- ◆ An external trigger signal must be available for data measurement, and the trigger signal must be phase-locked to the signal measured.
- ◆ The same reference-frequency signal must be used for the DUT and the R&S FSV.
- ◆ Internal I/Q data averaging is supported up to 512 k I/Q samples.

If all of the above conditions are fulfilled, no phase shift will occur between consecutive test runs. Phase shift may falsify the measured average so that in extreme cases a value of 0 is obtained.

The default setting of the instrument for data measurement without averaging has to be changed as follows:

```

REM *****
'----- R&S FSV default setting -----
CALL SetupInstrument 'Default setting
CALL InstrWrite(analyzer,"TRAC:IQ:STAT ON")
'Activate I/Q data acquisition
'mode; this must be
'done before TRAC:IQ:SET!
'Select max. number of test points (= 512 * 1024) at 10 MHz RBW,
'32 MHz sampling rate, external
'trigger, pos. trigger edge and
'0 s trigger delay.
CALL InstrWrite(analyzer,"TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,0,524288")
CALL InstrWrite(analyzer,"TRAC:IQ:AVER ON") 'Switch on I/Q averaging
CALL InstrWrite(analyzer,"TRAC:IQ:AVER:COUN 10") 'Set 10 test runs
'----- Read data in binary format -----
...
REM *****

```

7.1.11 Reading and Writing Files

7.1.11.1 Reading a File from the Instrument

In the following example, the TEST1.R&S FSV.DFL file stored under C:\R_S\Instr\user is read from the instrument and stored in the controller.

```

REM *****
Public Sub ReadFile()
'----- Generate variables -----
Dim digits As Byte 'Number of digits of
'length information
Dim fileBytes As Long 'Length of file with trace data
'in bytes
result$ = Space$(100) 'Buffer for simple results
'----- Default setting of status register -----
CALL SetupStatusReg 'Configure status register
'----- Read out file -----
CALL InstrWrite(analyzer, "MMEM:DATA? 'C:\R_S\Instr\user\TEST1.R&S FSV.DFL'")
'Select file
CALL ilrd(analyzer, result$, 2) 'Read and store number of
digits = Val(Mid$(result$, 2, 1)) 'digits of length information
CALL ilrd(analyzer, result$, digits) 'Read and store length
fileBytes = Val(Left$(result$, digits)) 'information
FileBuffer$ = Space$(fileBytes) 'Buffer for file

```

```

CALL ilrd(analyzer, FileBuffer, fileBytes)
'Read file into buffer
CALL ilrd(analyzer, result$, 1)      'Read terminator <NL>
'----- Store file to controller -----
Open "TEST1.R&S FSV.DFL" For Output As #1
Print #1, FileBuffer; ' ; to avoid linefeed at
'   end of file
Close #1
END SUB
REM *****

```

7.1.11.2 Creating a File on the Instrument

In the following example, the TEST1.R&S FSV.DFL file available on the controller is stored in the instrument under C:\R_S\Instr\user\DUPLICAT.R&S FSV.DFL.

```

REM *****
Public Sub WriteFile()
'----- Generate variables -----
FileBuffer$ = Space$(100000)      'Buffer for file
Dim digits As Long                'Number of digits of
'length information
Dim fileBytes As Long             'Length of file in bytes
fileSize$ = Space$(100)          'Length of file as a string
result$ = Space$(100)           'Buffer for simple results
'----- Default setting of status register -----
CALL SetupStatusReg              'Configure status register
'----- Prepare the definite length block data -----
fileBytes = FileLen("H:\work\vb\TEST1.R&S FSV.DFL")
'Determine length of file
fileSize$ = Str$(fileBytes)
digits = Len(fileSize$) - 1      'Determine number of digits of
fileSize$ = Right$(fileSize$, digits)  'length information
FileBuffer$ = "#" + Right$(Str$(digits), 1) + fileSize$
'Store length information in
'file buffer
'----- Read file from controller -----
Open "H:\work\vb\TEST1.R&S FSV.DFL" For Binary As #1
FileBuffer$ = FileBuffer$ + Left$(Input(fileBytes, #1), fileBytes)
Close #1
'----- Write file -----
CALL InstrWrite(analyzer, "SYST:COMM:GPIB:RTER EOI")      'Set receive
'terminator on the
'instrument

```

```
CALL InstrWrite(analyzer, "MMEM:DATA 'DUPLICAT.R&S FSV.DFL', " + FileBuffer$)
                        'Select file
END SUB
REM *****
```

7.1.12 Spectrum Emission Mask Measurement

You can configure Spectrum Emission Mask measurements via XML files provided for different standards or by defining ranges and parameters. For both ways an example is given.

7.1.12.1 Using Predefined Standard Wibro

In the following example, the Spectrum Emission Mask measurement is configured using a predefined standard XML file.

```
REM *****
'----- General settings of the instrument -----
CALL InstrWrite(analyzer, "*RST")      'Reset instrument
CALL InstrWrite(analyzer, "INIT:CONT OFF")  'Switch to single sweep
CALL InstrWrite(analyzer, ":SENSel:SWEep:MODE ESpectrum")
'Set measurement mode
Rem After preset 3 ranges are available where the middle one is
Rem the reference range for calculating the TX power
CALL InstrWrite(analyzer, ":SENSel:FREQuency:CENTer 2.2GHz")
'Center frequency 2.2 GHz
CALL InstrWrite(analyzer, ":SENSel:DETEctor1 RMS")
'Set RMS detector
'----- Setting up the gated trigger -----
CALL InstrWrite(analyzer, ":SENSel:SWEep:EGATE ON")
'Switch on the external gate mode
CALL InstrWrite(analyzer, ":SENSel:SWEep:EGATE:SOURce EXTErnal")
'Set external gate source
CALL InstrWrite(analyzer, ":SENSel:SWEep:EGATE:HOLDoff 0s")
'Set delay time to 0 s
CALL InstrWrite(analyzer, ":SENSel:SWEep:EGATE:LENGth 200 US")
'Set time interval
'----- Setting the standard -----
CALL InstrWrite(analyzer, "SENSel:ESpectrum:PRESet:STANdard
'WIBRO\DL\PowerClass_29_40.xml') 'Set WiBro standard
```

```

'----- Measuring -----
CALL InstrWrite(analyzer,"INIT;*WAI")      'Perform sweep, wait for sweep
'end

'----- Reading out results -----
CALL InstrWrite(analyzer,":TRACel:DATA? LIST")
'Query list results
CALL InstrWrite(analyzer,":CALCulate:LIMit:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM *****

```

7.1.12.2 Defining 5 Ranges with all Parameters

In the following example, the Spectrum Emission Mask measurement is configured by defining ranges and parameters.

```

REM *****
'----- General settings of the instrument -----
CALL InstrWrite(analyzer,"*RST")      'Reset instrument
CALL InstrWrite(analyzer,"INIT:CONT OFF")  'Switch to single sweep
CALL InstrWrite(analyzer,":SENSel:SWEep:MODE ESpectrum")
'Set measurement mode
Rem After preset 3 ranges are available where the middle one is
Rem the reference range for calculating the TX power
CALL InstrWrite(analyzer,":SENSel:FREQUENCY:CENTer 2.2GHz")
'Center frequency 2.2 GHz
CALL InstrWrite(analyzer,":SENSel:DETEctor1 RMS")
'Set RMS detector
CALL InstrWrite(analyzer,":TRIGger1:SEQUence:SOURce IMMEDIATE")
'Trigger setup

'----- Setting up the gated trigger -----
Rem If a free run trigger is not appropriate a gated trigger can
Rem the be set up (just comment in the following lines).
Rem CALL InstrWrite(analyzer,":SENSel:SWEep:EGATE ON")
Rem Switch on the external gate mode
Rem CALL InstrWrite(analyzer,":SENSel:SWEep:EGATE:SOURce EXTERNAL")
Rem Set external gate source
Rem CALL InstrWrite(analyzer,":SENSel:SWEep:EGATE:HOLDoff 0s")
Rem Set delay time to 0 s
Rem CALL InstrWrite(analyzer,":SENSel:SWEep:EGATE:LENGth 200 US")
Rem Set time interval

```

```

'----- Setting the span -----
CALL InstrWrite(analyzer,":SENSE1:FREQUENCY:SPAN 8 MHz")
'Set the span to 8 MHz
'----- Inserting new ranges -----
Rem Enlarge number of ranges to 5 by adding one at the end
Rem and one at the beginning. This ensures that the reference range
Rem remains in the middle
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE2:INSERT AFTER")
'Insert a range after range 2
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:INSERT BEFORE")
'Insert a range before range 1
'----- Defining the limit check for all ranges -----
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE:LIMIT:STATE AND")
'Set check for absolute and 'relative limit
'----- Defining the reference range settings -----
Rem The bandwidth of the reference range limits the minimum span
Rem of the reference range definition later in the script.
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RTYPE CPOWER")
'Set power reference type
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:BWID 2 MHz")
'Set bandwidth
'----- Defining the settings of range 1 -----
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:FREQUENCY:START -4MHz")
'Set the start frequency
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:FREQUENCY:STOP -2MHz")
'Set the stop frequency
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:BANDWIDTH:RESOLUTION
1 MHz")
'Set the resolution bandwidth
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:FILTER:TYPE CFILTER")
'Set the channel filters
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:BANDWIDTH:VIDEO 3 MHz")
'Set the video bandwidth to 3 MHz
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:SWEEP:TIME 20 ms")
'Set the sweep time to 20 ms
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:RLEVEL 5 DBM")
'Set the reference level to 5 dBm
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:INPUT:ATTENUATION 20 DB")
'Set the attenuation to 20 dB
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:LIMIT:ABSOLUTE:START
-50")
'Set an absolute limit of -50 dBm
CALL InstrWrite(analyzer,":SENSE1:ESPECTRUM:RANGE1:LIMIT:ABSOLUTE:STOP -50")
'Set an absolute limit of -50 dBm

```

Analyzer Measurements - Programming Examples

```

CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe1:LIMit:RELative:START
-70")
'Set a relative limit of -70 dBc
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe1:LIMit:RELative:STOP -60")
'Set a relative limit of -60 dBc
'----- Defining the settings of range 2 -----
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:FREQuency:START -2MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:FREQuency:STOP -1MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:BANDwidth:RESolution
100 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:FILTer:TYPE NORM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:BANDwidth:VIDeo 300 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:SWEep:TIME 50 ms")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:RLEVel 10 DBM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:INPut:ATTenuation 30 DB")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:LIMit:ABSolute:START
-40")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:LIMit:RELative:START
-60")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:LIMit:ABSolute:STOP -40")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe2:LIMit:RELative:STOP -40")
'----- Defining the settings of range 3 -----
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:FREQuency:START -1MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:FREQuency:STOP 1MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:BANDwidth:RESolution
30 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:FILTer:TYPE NORM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:BANDwidth:VIDeo 100 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:SWEep:TIME 5 ms")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:RLEVel 20 DBM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:INPut:ATTenuation 30 DB")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:LIMit:ABSolute:START 200")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:LIMit:ABSolute:STOP 200")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:LIMit:RELative:START 200")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe3:LIMit:RELative:STOP 200")
'----- Defining the settings of range 4 -----
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:FREQuency:START 1MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:FREQuency:STOP 2MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:BANDwidth:RESolution
100 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:FILTer:TYPE NORM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:BANDwidth:VIDeo 300 kHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:SWEep:TIME 50 ms")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:RLEVel 10 DBM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:INPut:ATTenuation 30 DB")

```

```

CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:LIMit:ABSolute:START
-40")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:LIMit:ABSolute:STOP -40")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:LIMit:RELative:START
-40")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe4:LIMit:RELative:STOP -60")
'----- Defining the settings of range 5 -----
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:FREQuency:START 2MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:FREQuency:STOP 4MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:BANDwidth:RESolution
1 MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:FILTer:TYPE CFILter")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:BANDwidth:VIDeo 3 MHz")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:SWEp:TIME 20 ms")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:RLEVel 5 DBM")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:INPut:ATTenuation 20 DB")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:LIMit:ABSolute:START
-50")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:LIMit:ABSolute:STOP -50")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:LIMit:RELative:START
-60")
CALL InstrWrite(analyzer,":SENSE1:ESpectrum:RANGe5:LIMit:RELative:STOP -70")
'----- Measuring -----
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep, wait for sweep
'end
'----- Reading out results -----
CALL InstrWrite(analyzer,":TRACel:DATA? LIST")
'Query list results
CALL InstrWrite(analyzer,":CALCulate:LIMit:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM *****

```

7.1.13 Spurious Emissions Measurement

In the following example, the Spurious Emissions measurement is configured by defining ranges and parameters.

```

REM *****
'----- General settings of the instrument -----
CALL InstrWrite(analyzer,"*RST")          'Reset instrument
Rem After preset 4 ranges are available. Range settings can be questioned
Rem independent from the set measurement mode.

```



```

'----- Deleting all ranges -----
Rem Delete all ranges to prepare for setting up a new measurement
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe4:DELeTe")
'Delete range 4
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe3:DELeTe")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe2:DELeTe")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:DELeTe")
'----- Defining the start frequency for all ranges -----
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:FREQuency:STARt 1000000")
Rem Setting the start frequency of range 1 will create the ranges and
Rem every other range value will be set to the default value.
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe2:FREQuency:STARt 2000000")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe3:FREQuency:STARt 3000000")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe4:FREQuency:STARt 4000000")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe5:FREQuency:STARt 5000000")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe:COUNT?")
'Queries the number of defined
'ranges
'----- Querying the parameters of range 1 -----
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:FREQuency:STARt?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:FREQuency:STOP?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:FILTer:TYPE?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:BANDwidth:RESolution?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:BANDwidth:VIDeo?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:SWEep:TIME:AUTO?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:DETEctor?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:RLEVel?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:INPut:ATTenuation:AUTO?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:INPut:GAIN:STATE?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:BRERak?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:TRANsducer?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:SWEep:TIME?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:INPut:ATTenuation?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:POINts?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:LIMit:STARt?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:LIMit:STOP?")
CALL InstrWrite(analyzer,"SENSEl:LIST:RANGe1:LIMit:STATE?")
'----- Changing into the Spurious Emissions measurement mode -----
CALL InstrWrite(analyzer,":SENSEl:SWEEP:MODE LIST")
Rem In continuous sweep mode, editing the ranges is not allowed.
Rem You have to stop the measurement first.
Rem In single sweep mode, you can edit the ranges at the end of the sweep.

```

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```

'----- Single sweep version -----
CALL InstrWrite(analyzer,"INIT:CONT OFF")      'Switch to single sweep
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:FREQuency:STARt 500000")
'Change the start frequency
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep, wait for sweep
'end

'----- Continuous sweep version -----
CALL InstrWrite(analyzer,"INIT:CONT ON")       'Switch to continuous sweep
CALL InstrWrite(analyzer,"ABORT")             'Stop the measurement
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:FREQuency:STARt 500000")
'Change the start frequency
CALL InstrWrite(analyzer,":INITiatel:SPURious") 'Restart the measurement
'----- Defining the range settings in single sweep mode -----
CALL InstrWrite(analyzer,"INIT:CONT OFF")      'Switch to single sweep
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep, wait for sweep
'end

Rem Edit one range at a time. Make sure to edit the ranges in a correct
Rem order to prevent limit violations. Ranges cannot overlap.
Rem The best way is to start with range 1.
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:FREQuency:STARt 500000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:FREQuency:STOP 550000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:FILTer:TYPE NORM")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:BANDwidth:RESolution 3000000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:BANDwidth:VIDeo 10000000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:SWEep:TIME:AUTO ON")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:DETEctor RMS")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:RLEVel -10")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:INPut:ATTenuation:AUTO ON")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:POINts 8001")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:INPut:GAIN:STATE OFF")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:BREak OFF")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:LIMit:STARt -20")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:LIMit:STOP -20")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGel:LIMit:STATE ON")
Rem Proceed with range 2.
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:FREQuency:STARt 1000000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:FREQuency:STOP 20000000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:FILTer:TYPE CFILter")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:BANDwidth:RESolution 5000000")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:DETEctor POS")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:RLEVel -20")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:INPut:ATTenuation 0")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:POINts 32001")
CALL InstrWrite(analyzer,"SENSEsel:LIST:RANGe2:INPut:GAIN:STATE ON")
Rem Proceed with range 3.

```

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```

CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE3:FREQUENCY:START 250000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE3:FREQUENCY:STOP 1000000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE3:FILTER:TYPE RRC")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE3:POINTS 32001")
Rem Proceed with range 4.
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE4:FREQUENCY:START 1200000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE4:FREQUENCY:STOP 4000000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE4:FILTER:TYPE PULSE")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE4:POINTS 251")
Rem Proceed with range 5.
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE5:FREQUENCY:START 5000000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE5:FREQUENCY:STOP 6000000000")
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE5:POINTS 7001")
'----- Defining the limit check for all ranges -----
CALL InstrWrite(analyzer,"SENSE1:LIST:RANGE1:LIMIT:STATE ON")
'Activate the limit check
'----- Setting the span to include all ranges -----
CALL InstrWrite(analyzer,":SENSE1:FREQUENCY:START 500000")
CALL InstrWrite(analyzer,":SENSE1:FREQUENCY:STOP 6000000000")
'----- Measuring -----
CALL InstrWrite(analyzer,"INIT;*WAI")          'Perform sweep, wait for sweep
'end
'----- Reading out results -----
CALL InstrWrite(analyzer,":TRAC1:DATA? LIST")
'Query list results
CALL InstrWrite(analyzer,":CALCulate1:PSEARCH[:IMMEDIATE]")
'Deactivate limit line and
'just look for peaks
Rem Or set margin to 200 in order to find all peaks
CALL InstrWrite(analyzer,":TRAC1:DATA? SPUR")
'Query just the peaks
CALL InstrWrite(analyzer,":CALCulate:LIMIT:FAIL?")
'Query result of limit check
CALL InstrRead(analyzer, result$)
REM *****

```


8 Maintenance

The following chapter contains information on the maintenance of the R&S FSV. The instrument does not need a periodic maintenance. What is necessary is essentially the cleaning of the instrument. However, it is recommended to check the rated data from time to time.

Follow the instructions in the service manual and the safety instructions when exchanging modules or ordering spares. The order no. for spare parts is included in the service manual. The service manual includes further information particularly on troubleshooting, repair, exchange of modules (including battery exchange, adjustment of the OCXO oscillator) and alignment.

The address of our support center and a list of all Rohde & Schwarz service centers can be found at the beginning of this manual.

8.1 Storing and Packing

The storage temperature range of the instrument is given in the data sheet. If the instrument is to be stored for a longer period of time, it must be protected against dust. Repack the instrument as it was originally packed when transporting or shipping. The two protective foam plastic parts prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

8.2 List of Available Power Cables

Table 26: List of power cables available

Stock No.	Earthed-contact connector	Preferably used in
DS 006.7013.00	BS1363: 1967' complying with IEC 83: 1975 standard B2	Great Britain
DS 006.7020.00	Type 12 complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 006.7036.00	Type 498/13 complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 006.7107.00	Type SAA3 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight	Europe (except Switzerland)

9 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTem:ERRor?`. The answer format of R&S FSV to the command is as follows:

```
<error code>, "<error text with queue query>;  
<remote control command concerned>"
```

The indication of the remote control command with prefixed semicolon is optional.

Example:

The command `"TEST:COMMAND"` generates the following answer to the query `SYSTem:ERRor?`

```
-113, "Undefined header;TEST:COMMAND"
```

The subsequent lists contain the description of error texts displayed on the instrument. Distinction is made between error messages defined by SCPI, which are marked by negative error codes, and the device-specific error messages for which positive error codes are used:

- ◆ ["SCPI-Specific Error Messages"](#)
- ◆ ["Device-Specific Messages"](#)

The right-hand column in the following tables contains the error text in bold which is entered in the error/event queue and can be read out by means of query `SYSTem:ERRor?`. A short explanation of the error cause is given below. The left-hand column contains the associated error code.

Additionally, option-specific warnings and error messages displayed in the status bar are explained.

9.1 SCPI-Specific Error Messages

Table 27: No Error

Error code	Error text in the case of queue poll Error explanation
0	No error This message is displayed if the error queue does not contain any entries.

Table 28: Command Error - Faulty command; sets bit 5 in the ESR register

Error code	Error text in the case of queue poll Error explanation
-100	Command Error The command is faulty or invalid.
-101	Invalid Character The command contains an invalid sign. Example: A header 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 invalid 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 <code>SENSe:FREQuency:CENTer</code> permits only one frequency indication.
-109	Missing parameter The command contains too few parameters. Example: The command <code>SENSe:FREQuency:CENTer</code> requires a frequency indication.
-110	Command header error The header of the command is faulty.
-111	Header separator error The header contains an invalid separator. Example: the header is not followed by a "White Space", "**ESE255"
-112	Program mnemonic too long The header contains more than 12 characters.
-113	Undefined header The header is not defined for the instrument. Example: *XYZ is undefined for every instrument.
-114	Header suffix out of range The header contains an invalid numeric suffix. Example: <code>SENSe3</code> does not exist in the instrument.
-120	Numeric data error The command contains a faulty numeric parameter.
-121	Invalid character in number A number contains an invalid character. Example: An "A" in a decimal number or a "9" in an octal number.
-123	Exponent too large The absolute value of the exponent is greater than 32000.
-124	Too many digits The number includes too many digits.
-128	Numeric data not allowed The command includes a number which is not allowed at this position. Example: The command <code>INPut:COUPling</code> requires indication of a text parameter.
-130	Suffix error The command contains a faulty suffix.

SCPI-Specific Error Messages

Error code	Error text in the case of queue poll Error explanation
-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 characters.
-138	Suffix not allowed A suffix is not allowed for this command or at this position of the command. Example: The command *RCL does not permit a suffix to be indicated.
-140	Character data error The command contains a faulty text parameter
-141	Invalid character data The text parameter either contains an invalid character or it is invalid for this command. Example: Write error with parameter indication; INPut:COUPling XC.
-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. Example: The command *RCL requires a number to be indicated.
-150	String data error The command contains a faulty string.
-151	Invalid string data The command contains a faulty string. Example: An END message has been received prior to the terminating apostrophe.
-158	String data not allowed The command contains an allowed string at an invalid position. Example: A text parameter is set in quotation marks, INPut:COUPling "DC"
-160	Block data error The command contains faulty block data.
-161	Invalid block data The command contains faulty block data. Example: An END message was received prior to reception of the expected number of data.
-168	Block data not allowed The command contains allowed block data at an invalid position. Example: The command *RCL requires a number to be indicated.
-170	Expression error The command contains an invalid mathematical expression.
-171	Invalid expression The command contains an invalid mathematical expression. Example: The expression contains mismatching parentheses.
-178	Expression data not allowed The command contains a mathematical expression at an invalid position.

Table 29: Execution Error - Error on execution of a command; sets bit 4 in the ESR register

Error code	Error text in the case of queue poll Error explanation
-200	Execution error Error on execution of the command.
-201	Invalid while in local The command is not executable while the device is in local due to a hard local control. Example: The device receives a command which would change the rotary knob state, but the device is in local so the command can not be executed.
-202	Settings lost due to rtl A setting associated with hard local control was lost when the device changed to LOCS from REMS or to LWLS from RWLS.
-210	Trigger error Error on triggering the device.
-211	Trigger ignored The trigger (GET, *TRG or trigger signal) was ignored because of device timing considerations. Example: The device was not ready to respond.
-212	Arm ignored An arming signal was ignored by the device.
-213	Init ignored Measurement initialization was ignored as another measurement was already in progress.
-214	Trigger deadlock The trigger source for the initiation of measurement is set to GET and subsequent measurement is received. The measurement cannot be started until a GET is received, but the GET would cause an interrupted-error)
-215	Arm deadlock The trigger source for the initiation of measurement is set to GET and subsequent measurement is received. The measurement cannot be started until a GET is received, but the GET would cause an interrupted-error.
-220	Parameter error The command contains a faulty or invalid parameter.
-221	Settings conflict There is a conflict between setting of parameter value and instrument state.
-222	Data out of range The parameter value lies out of the allowed range of the instrument.
-223	Too much data The command contains too many data. Example: The instrument does not have sufficient storage space.
-224	Illegal parameter value The parameter value is invalid. Example: The text parameter is invalid , TRIGger:SWEEp:SOURce TASTe
-230	Data corrupt or stale The data are incomplete or invalid. Example: The instrument has aborted a measurement.
-231	Data questionable The measurement accuracy is suspect.
-240	Hardware error The command cannot be executed due to problems with the instrument hardware.
-241	Hardware missing Hardware is missing. Example: An option is not fitted.
-250	Mass storage error A mass storage error occurred.

SCPI-Specific Error Messages

Error code	Error text in the case of queue poll Error explanation
-251	Missing mass storage The mass storage is missing. Example: An option is not installed.
-252	Missing media The media is missing. Example: There is no floppy in the floppy disk drive.
-253	Corrupt media The media is corrupt. Example: The floppy is bad or has the wrong format.
-254	Media full The media is full. Example: There is no room on the floppy.
-255	Directory full The media directory is full.
-256	File name not found The file name cannot be found on the media.
-257	File name error The file name is wrong. Example: An attempt is made to copy to a duplicate file name.
-258	Media protected The media is protected. Example: The write-protect tab on the floppy is present.
-260	Expression error The expression contains an error.

Table 30: Query Error - Error in data request; sets bit 2 in the ESR register

Error code	Error test in the case of queue poll Error explanation
-300	Device-specific error R&S FSV-specific error not defined in greater detail.
-310	System error This error message suggests an error within the instrument. Please inform the R&S Service.
-313	Calibration memory lost Loss of the non-volatile data stored using the *CAL? command. This error occurs when the correction data recording has failed.
-330	Self-test failed The self test could not be executed.
-350	Queue overflow This error code is entered in 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 31: Device Specific Error; sets bit 3 in the ESR register

Error code	Error text in the case of queue poll Error explanation
-400	Query error General error occurring when data are requested by a query.
-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 operation.
-440	Query UNTERMINATED after indefinite response A query is in the same command line after a query which requests an indefinite response.

9.2 Device-Specific Messages

Error code	Error text in the case of queue poll Error explanation
1052	Frontend LO is Unlocked This message is displayed when the phase regulation of the local oscillator fails in the RF front-end.
1060	Trigger-Block Gate Delay Error- gate length < Gate Delay This message is displayed when the gate signal length is not sufficient for the pull-in delay with a predefined gate delay.
1064	Tracking LO is Unlocked This message is displayed when the phase regulation of the local oscillator fails on the tracking generator module.
2028	Hardcopy not possible during measurement sequence This message is displayed when a printout is started during scan sequences that cannot be interrupted. Such sequences are for example: <ul style="list-style-type: none"> ◆ Recording the system error correction data (alignment) ◆ Instrument self test In such cases synchronization to the end of the scan sequence should be performed prior to starting the printout.
2033	Printer Not Available This message is displayed when the selected printer is not included in the list of available output devices. A possible cause is that the required printer driver is missing or incorrectly installed.
2034	CPU Temperature is too high This message is displayed when the temperature of the processor exceeds 70 °C.

10 Firmware Option Analog Demodulation R&S FSV-K7

10.1 Overview of Firmware Option R&S FSV-K7

This manual contains all information about the operation of an R&S FSV equipped with Application Firmware R&S FSV-K7. It covers operation via menus and the remote control commands for analog demodulation measurements.

This manual consists of 4 chapters:

Chapter 1.1	Gives a brief overview over the document structure.
Chapter 1.2	Describes the overall instrument functions and provides further information
Chapter 1.3	Shows all softkeys available in the analog demodulation menu. This chapter also presents the remote control commands associated with each softkey function.
Chapter 1.4	Describes all remote control commands defined for the power meter measurement.

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware R&S FSV-K7. For all other descriptions, please refer to the R&S FSV Analyzer operating manual.

10.2 Instrument Functions Analog Demodulation (Option R&S FSV-K7)

The digital signal processing in the R&S FSV, used in the analyzer mode for digital IF filters, is also ideally suited for demodulating AM, FM, or PM signals. The firmware option R&S FSV-K7 provides the necessary measurement functions.

The R&S FSV is equipped with a demodulator that is capable of performing AM, FM, and PM demodulation at a time. Additionally maximum, minimum and average or current values can be obtained parallel over a selected number of measurements. By sampling (digitization) already at the IF and digital down-conversion to the baseband (I/Q), the demodulator achieves maximum accuracy and temperature stability. There is no evidence of typical errors of an analog down-conversion and demodulation like AM to FM conversion and vice versa, deviation error, frequency response or frequency drift at DC coupling.

To open the analog demodulation menu

- ◆ If the "Analog Demodulation" mode is not the active measurement mode, press the "MODE" key and activate the "Analog Demodulation" option.
- ◆ If the "Analog Demodulation" mode is already active, press the "HOME" key. The analog demodulation menu is displayed.

Menu and softkey description

- ◆ ["Softkeys of the analog demodulation menu"](#) on page 673
- ◆ ["Softkeys of the frequency menu"](#) on page 682
- ◆ ["Softkeys of the span menu"](#) on page 684
- ◆ ["Softkeys of the amplitude menu"](#) on page 685
- ◆ ["Softkeys of the bandwidth menu"](#) on page 687
- ◆ ["Softkeys of the sweep menu"](#) on page 687
- ◆ ["Softkeys of the trigger menu"](#) on page 688

Apart from the power measurement menu that is not available in the "Analog Demodulation" mode, all other menus are provided as described for the base unit. For details refer to the corresponding menu descriptions.

To display help to a softkey, press the "HELP" key and then the softkey for which you want to display help. To close the help window, press the "ESC" key. For further information refer to section "How to use the Help System".

Further information

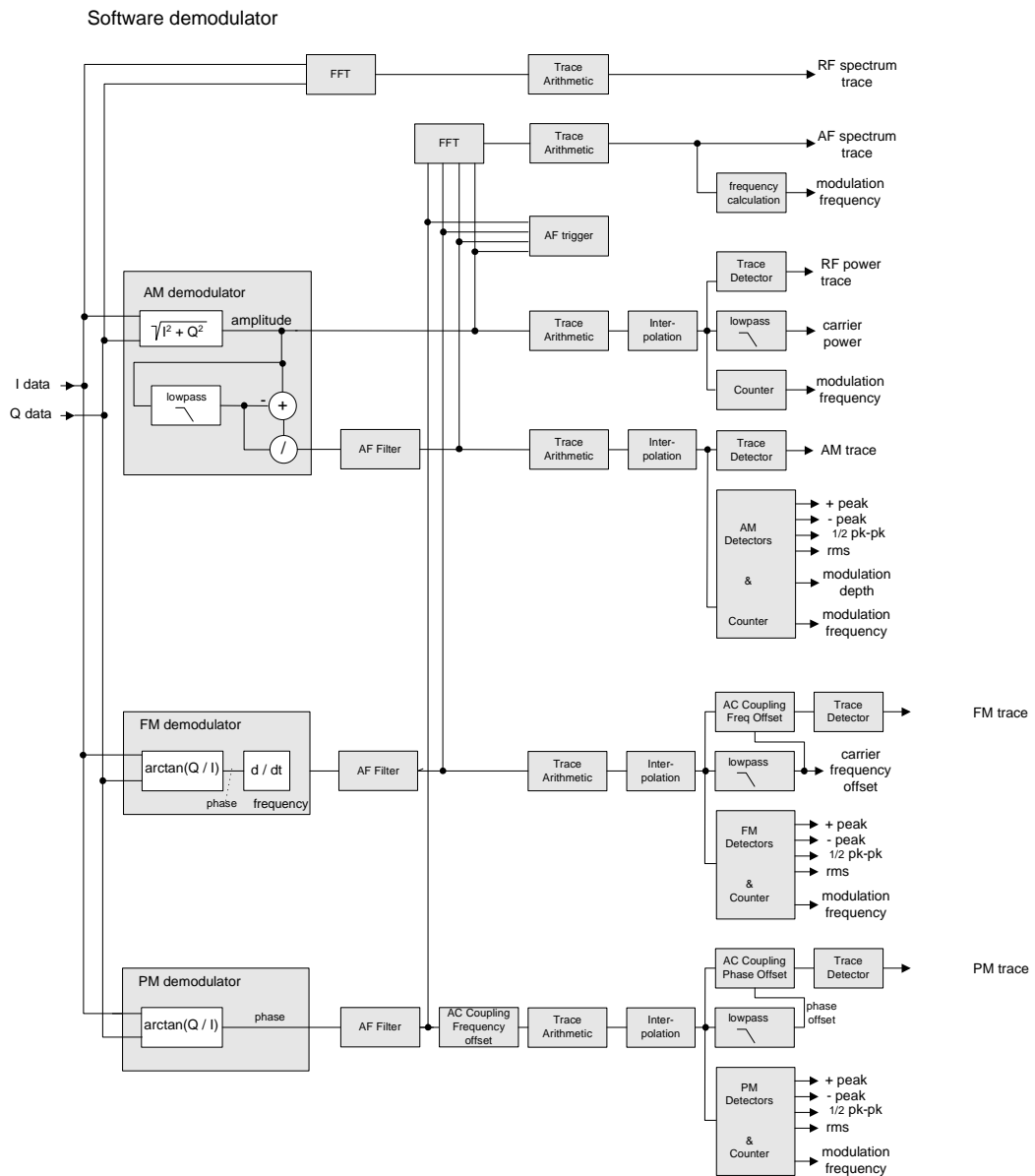
- ◆ ["Circuit description - block diagrams"](#) on page 671
- ◆ ["Demodulation bandwidth"](#) on page 672
- ◆ ["AF trigger"](#) on page 672
- ◆ ["Stability of measurement results"](#) on page 673
- ◆ ["Sample rate, measurement time and trigger offset"](#) on page 673

10.2.1 Circuit description - block diagrams

The software demodulator runs on the main processor of the analyzer. The demodulation process is shown in "Figure 1: Block diagram of software demodulator". All calculations are performed simultaneously with the same I/Q data set. Magnitude (= amplitude) and phase of the complex I/Q pairs are determined. The frequency result is obtained from the differential phase.

For details on the analyzer signal processing refer to chapter "Remote Control - Commands", section "TRACe:IQ Subsystem".

Figure 43: Block diagram of software demodulator



The AM DC, FM DC and PM DC raw data of the demodulators is fed into the `Trace Arithmetic` block that combines consecutive data sets. Possible trace modes are: Clear Write, Max Hold, Min Hold and Average (for details refer to section "[Trace mode overview](#)"). The output data of the `Trace Arithmetic` block can be read via remote control.

The collected measured values are evaluated by the selected detector (for details refer to chapter "Instrument Functions", section "[Detector overview](#)"). The result is displayed on the screen and can be read out via remote control.

In addition, important parameters are calculated:

- ◆ A counter determines the modulation frequency for AM, FM, and PM.
- ◆ average power = carrier power (RF power)
- ◆ average frequency = carrier frequency offset (FM)
- ◆ The modulation depth or the frequency or phase deviation is displayed.
- ◆ AC coupling is possible with FM and PM display. The deviations are determined from the trace data. +Peak, -Peak, ½ Peak-Peak and RMS are displayed.

10.2.2 Demodulation bandwidth

The demodulation bandwidth is not the 3 dB bandwidth but the useful bandwidth which is distortion-free with regard to phase and amplitude.

Therefore the following formulas apply:

- ◆ AM: demodulation bandwidth $\geq 2 \times$ modulation frequency
- ◆ FM: demodulation bandwidth $\geq 2 \times$ (frequency deviation + modulation frequency)
- ◆ PM: demodulation bandwidth $\geq 2 \times$ modulation frequency $\times (1 +$ phase deviation)

Note: *If the center frequency of the analyzer is not set exactly to the signal frequency, the demodulation bandwidth must be selected larger by the carrier offset, in addition to the requirement described above. This also applies if FM or PM AC coupling has been selected.*

In general, the demodulation bandwidth should be as narrow as possible to improve the S/N ratio. The residual FM caused by noise floor and phase noise increases dramatically with the bandwidth, especially with FM.

10.2.3 AF trigger

The analog demodulation option allows triggering to the demodulated signal. The display is stable if a minimum of five modulation periods are within the recording time. Triggering is always DC-coupled. Therefore triggering is possible directly to the point where a specific carrier level, phase or frequency is exceeded or not attained.

10.2.4 Stability of measurement results

Despite amplitude and frequency modulation, the display of carrier power and carrier frequency offset is stable.

This is achieved by a digital filter which sufficiently suppresses the modulation, provided, however, that the measurement time is $\geq 3 \times 1 / \text{modulation frequency}$, i.e. that at least three periods of the AF signal are recorded.

The mean carrier power for calculating the AM is also calculated with a digital filter that returns stable results after a measurement time of $\geq 3 \times 1 / \text{modulation frequency}$, i.e. at least three cycles of the AF signal must be recorded before a stable AM can be shown.

10.2.5 Sample rate, measurement time and trigger offset

Depending on the sample rate, the maximum demodulation bandwidths listed in the table can be obtained during the measurement. The permissible value range of the measurement time and trigger offset depends on the selected demodulation bandwidth. If the AF filter or the AF trigger are not active, the measurement time enlarges by 20%.

Demod. bandwidth	Sample rate	Measurement time			Trigger offset	
		Min.	Max. with AF filter or AF trigger active	Max. with AF filter and AF trigger deactive	Min.	Max.
40 MHz*	64 MHz	15.625 ns	6.25 ms	7.5 ms	-6.25 ms	253.9 ms
28 MHz	64 MHz	15.625 ns	6.25 ms	7.5 ms	-6.25 ms	253.9 ms
18 MHz	32 MHz	31.25 ns	12.5 ms	15 ms	-12.5 ms	507.9 ms
10 MHz	32 MHz	31.25 ns	12.5 ms	15 ms	-12.5 ms	507.9 ms
8 MHz	16 MHz	62.5 ns	25 ms	30 ms	-25 ms	1.015 s
5 MHz	8 MHz	125 ns	50 ms	60 ms	-50 ms	2.031 s
3 MHz	4 MHz	250 ns	100 ms	120 ms	-100 ms	4.063 s
1.6 MHz	2 MHz	500 ns	200 ms	240 ms	-200 ms	8.126 s
800 kHz	1 MHz	1 μ s	400 ms	480 ms	-400 ms	16.25 s
400 kHz	500 kHz	2 μ s	800 ms	960 ms	-800 ms	32.50 s
200 kHz	250 kHz	4 μ s	1.6 s	1.92 s	-1.6 s	65.00 s
100 kHz	125 kHz	8 μ s	3.2 s	3.84 s	-3.2 s	130.0 s
50 kHz	62.5 kHz	16 μ s	6.4 s	7.68 s	-6.4 s	260.0 s
25 kHz	31.25 kHz	32 μ s	12.8 s	15.36 s	-12.8 s	520.0 s
12.5 kHz	15.625 kHz	64 μ s	25.6 s	30.72 s	-25.6 s	1040 s
6.4 kHz	7,8125 kHz	128 μ s	51.2 s	61.44 s	-51.2 s	2080 s
3.2 kHz	3,90625 kHz	256 μ s	102.4 s	122.88 s	-102.4 s	4160 s
1.6 kHz	1,953125 kHz	512 μ s	204.8 s	245.76 s	-204.8 s	8321 s
800 Hz	976,5625 Hz	1.024 ms	409.6 s	491.52 s	-409.6 s	16643 s
400 Hz	488,28125 Hz	2.048 ms	819.2 s	983.04 s	-819.2 s	33287 s
200 Hz	244,140625 Hz	4.096 ms	1638.4 s	1966.08 s	-1638.4 s	66574 s
100 Hz	122,0703125 Hz	8.192 ms	3276.8 s	3932.16 s	-3276.8 s	133148 s

* only available with option B70

10.3 Softkeys of the analog demodulation menu (Option R&S FSV-K7)

The following table shows all softkeys available in the analog demodulation menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Submenu / Command	Command
Modulation AM/FM/PM		
Result Display	AF Time Domain	
	AF Spectrum	
	RF Time Domain	
	RF Spectrum	
	Select Trace	
Demod BW		
Meas Time		
AF Range >	Dev per Division/dB per Division	
	Reference Position	
	Reference Value	
	Deviation Lin/Log	
Demod Settings >	AF Coupling AC/DC	
	AF Filter >	Low Pass
		High Pass
		Deemphasis
		Weighting
	Zero Phase Reference Point	
	Phase Wrap On/Off	
	Phase Unit Rad/Deg	
Zoom		
More >		

Modulation AM/FM/PM

Selects the display of demodulated AM, FM, or PM signal. In single sweep mode, the data is determined from the current I/Q data set, i.e. a change to AM/FM/PM does not trigger a new measurement.

If FM is selected, the average value of the demodulated signal is mapped depending on the "[AF Coupling AC/DC](#)" softkey setting.

→ Remote: [CALC:FEED 'XTIM:FM'](#)

Result Display

Opens a submenu to select the measurement result to be displayed. The RF or AF signal in the zero span or the RF or AF frequency spectrum determined via FFT can be selected for display.

In order to display the measurement results, the screen is divided in two halves. In the upper half, the measurement results are displayed as a trace. In the lower half the results of additional evaluation functions are shown.

All displays are determined from the I/Q data set recorded for the measurement. In single sweep mode, the single data set recorded can be evaluated in all displays simply by switching the result display.

→ Remote: [DISP:FORM:SING](#)

AF Time Domain

Selects the AF display in zero span, calculated from the AM, FM, or PM signal.

→ Remote: [CALC:FEED 'XTIM:FM'](#)

AF Spectrum

Selects the display of the AF spectrum. The AF spectrum can be calculated from the AM, FM, or PM signal in zero span.

→ Remote: [CALC:FEED 'XTIM:FM:AFSP'](#)

RF Time Domain

Selects the display of the RF power in zero span. In contrast to normal analyzer operation, the level values are the magnitude of the I/Q data set.

→ Remote: [CALC:FEED 'XTIM:RFP'](#)

RF Spectrum

Selects the display of the RF signal in span > 0. In contrast to normal spectrum analyzer operation, the measured values are determined using FFT from the recorded I/Q data set.

→ Remote: [CALC:FEED 'XTIM:SPECTRUM'](#)

Select Trace

Opens an edit dialog box to enter the number of the trace for which the data is to be displayed in the lower half of the screen. Only activated traces can be selected.

Demod BW

Opens an edit dialog box to enter the demodulation bandwidth of the analog demodulation. The demodulation bandwidth determines the sampling rate for recording the signal to be analyzed. For details on the relation between demodulation bandwidth and sampling rate refer to "[Sample rate, measurement time and trigger offset](#)" on page 673.

→ Remote: [BAND:DEM 1MHz](#)

Meas Time

Opens an editor for entering the measurement time of the analog demodulation. For details on the measurement time values refer to "[Sample rate, measurement time and trigger offset](#)" on page 673.

→ Remote: [ADEM:MTIM 62.5US](#)

→ Remote: [SWE:TIME 10s](#)

AF Range

Opens a submenu for determining the diagram scaling for AF displays.

The range for RF displays is set via the amplitude menu. For details refer to "[Setting the Level Display and Configuring the RF Input – AMPT Key](#)"

Dev per Division

Opens an edit dialog box to set the modulation depth or the phase or frequency deviation per division:

AM display: 0.0001% to 1000%

FM display: 1 Hz/div to 100 MHz/div

PM display: 0.0001 rad/div to 1000 rad/div

The softkey is not available if logarithmic display is set ("[Deviation Lin/Log](#)" softkey).

→ Remote: [DISP:WIND:TRAC:Y:PDIV 50kHz](#)

dB per Division

Opens an edit dialog box to set the modulation depth or the FM or PM deviation to be displayed in the range 0.1 dB/div to 20 dB/div.

The softkey is not available if linear display is set ("[Deviation Lin/Log](#)" softkey).

→ Remote: [DISP:TRAC:Y:PDIV 5DB](#)

Reference Position

Determines the position of the reference line for the modulation depth or the phase or frequency deviation on the y-axis of the diagram. By default, this line is set to 0.

The position is entered as a percentage of the diagram height with 100 % corresponding to the upper diagram border. The default setting is 50 % (diagram center) for the display of the AM, FM, or PM signal, and 100% (upper diagram border) for the AF spectrum display of the AM, FM, or PM signal.

→ Remote: [DISP:TRAC:Y:RPOS 50PCT](#)

Reference Value

Determines the modulation depth or the frequency or phase deviation at the reference line of the y-axis. The reference value is set separately for each display of the AM, FM, and PM signal and the AF spectrum of the AM, FM, and PM signal.

◆ AM/FM/PM signal display

The trace display takes individual frequency/phase offsets into account (in contrast, the "[AF Coupling AC/DC](#)" softkey permits automatic correction by the average frequency/phase offset of the signal, and can therefore not be activated simultaneously).

Possible values: 0 and $\pm 10000\%$ (AM), 0 and ± 10 MHz (FM), 0 and ± 10000 rad (PM).

◆ AF spectrum display of the AM/FM/PM signal

In the default setting, the reference value defines the modulation depth or the FM/PM deviation at the upper diagram border.

Possible values: 0 and 10000% (AM), 0 and 10 MHz (FM), 0 and 10000 rad (PM).

→ Remote: [DISP:TRAC:Y:RVAL 0HZ](#)

Deviation Lin/Log

Switches between logarithmic and linear display of the modulation depth or the frequency or phase deviation.

→ Remote: [DISP:TRAC:Y:SPAC LOG](#)

Demod Settings

Opens a submenu for the demodulation settings.

AF Coupling AC/DC

Controls the automatic correction of the frequency offset and phase offset of the input signal:

◆ FM signal display

If DC is selected, the absolute frequency is displayed, i.e. an input signal with an offset relative to the center frequency is not displayed symmetrically with respect to the zero line.

If AC is selected, the frequency offset is automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

◆ PM signal display

If DC is selected, the phase runs according to the existing frequency offset. In addition, the DC signal contains a phase offset of $\pm\pi$.

If AC is selected, the frequency offset and phase offset are automatically corrected, i.e. the trace is always symmetric with respect to the zero line.

The softkey is not available with the AF spectrum display of the FM or PM signal.

→ Remote: [ADEM:AF:COUP DC](#)

AF Filter

Opens a submenu to select the appropriate filters. The bandwidth of the demodulated signal can be reduced by high pass or low pass filters and also a de-emphasis can be switched on. The selected filters are used for AM, FM and PM demodulation in common. Individual settings are not possible.

Low Pass

Opens the "Low Pass" submenu to select the filter type. Relative and absolute low pass filter are available.

◆ Absolute low pass filters:

The 3 kHz, 15 kHz, 23 kHz and 150 kHz softkeys switch on a absolute low pass filter. The filter are indicated by the 3 dB cutoff frequency. The 3 kHz, 15 kHz and 23 kHz filters are designed as 5th-order Butterworth filter (30 dB/octave). The 150 kHz filter is designed as 8th-order Butterworth filter (48 dB/octave).

The absolute low pass filters are active in the following demodulation bandwidth range:

3 kHz:	$6.4 \text{ kHz} \leq \text{demodulation bandwidth} \leq 3 \text{ MHz}$
15 kHz:	$50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 8 \text{ MHz}$
23 kHz:	$50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 8 \text{ MHz}$
150 kHz:	$400 \text{ kHz} \leq \text{demodulation bandwidth} \leq 8 \text{ MHz}$

◆ Relative low pass filters:

The filters (3 dB) can be selected in % of the demodulation bandwidth. The filters are designed as 5th-order Butterworth filter (30 dB/octave) and active for all demodulation bandwidths.

Softkeys of the analog demodulation menu (Option R&S FSV-K7)

"None" deactivates the AF low pass filter. Default is "None".

- Remote: [FILT:LPAS ON](#)
- Remote: [FILT:LPAS:FREQ 150kHz](#)
- Remote: [FILT:LPAS:FREQ 25PCT](#)

High Pass

Opens the "High Pass" submenu to switch on a high pass filter with the given limit to separate the DC component. The filters are indicated by the 3 dB cutoff frequency. The 50 Hz and 300 Hz filters are designed as 2nd-order Butterworth filter (12 dB/octave).

The 20 Hz filter is designed as 3rd-order Butterworth filter (18 dB/octave).

"None" deactivates the AF high pass filter. Default is "None".

Softkeys of the analog demodulation menu (Option R&S FSV-K7)

The high pass filters are active in the following demodulation bandwidth range:

- 20 Hz: 100 Hz ≤ demodulation bandwidth ≤ 1.6 MHz
- 50 Hz: 200 Hz ≤ demodulation bandwidth ≤ 3 MHz
- 300 Hz: 800 Hz ≤ demodulation bandwidth ≤ 8 MHz

- Remote: [FILT:HPAS ON](#)
- Remote: [FILT:HPAS:FREQ 300Hz](#)

Deemphasis

Opens the "Deemphasis" submenu to switch on a deemphasis with the given time constant.

The deemphasis is active in the following demodulation bandwidth range:

- 25 μs: 25 kHz ≤ demodulation bandwidth ≤ 18 MHz
- 50 μs: 6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
- 75 μs: 6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
- 750 μs: 800 Hz ≤ demodulation bandwidth ≤ 4 MHz

The following table shows the required demodulation bandwidth for an error less than 0.5 dB up to a maximum AF frequency.

deemphasis	25 μs	50 μs	75 μs	750 μs
max. AF frequency	25 kHz	12 kHz	8 kHz	800 Hz
required demodulation bandwidth	≥ 200 kHz	≥ 100 kHz	≥ 50 kHz	≥ 6.4 kHz

For higher AF frequencies the demodulation bandwidth must be increased.

- Remote: [FILT:DEMP ON](#)
- Remote: [FILT:DEMP:TCON 750us](#)

Weighting

Opens the "Weighting AF Filter" dialog box to select the weighting AF filter. CCIT (CCIT P.53) and CCIR (CCIR unweighted) switch on a weighting filter. The CCIR unweighted filter is the combination of the 20 Hz highpass and 23 kHz low pass filter. "None" deactivates the AF high pass filter. Default is "None".

The weighting filters are active in the following demodulation bandwidth range:

- CCIT 20 kHz ≤ demodulation bandwidth ≤ 3 MHz
- CCIR 50 kHz ≤ demodulation bandwidth ≤ 1.6 MHz

- Remote: `FILT:CCIT ON`
- Remote: `FILT:CCIR ON`

Zero Phase Reference Point

Defines the position at which the phase of the PM-demodulated signal is set to 0 rad. The entry is made with respect to time. In the default setting, the first measured value is set to 0 rad.

This softkey is only available in the PM display with DC coupling.

→ Remote: [ADEM:PM:RPO 500us](#)

Phase Wrap On/Off

Activates/deactivates the phase wrap.

On The phase will be displayed in the range $\pm 180^\circ$ ($\pm \pi$). For example, if the phase exceeds $+180^\circ$, 360° is subtracted from the phase value, with the display thus showing $>-180^\circ$.

Off The phase will not be wrapped.

This softkey is available in the PM signal displays.

→ Remote: [CALC:FORM PHAS](#)

Phase Unit Rad/Deg

Sets the phase unit to rad or deg for displaying PM signals.

→ Remote: [UNIT:ANGL RAD](#)

Zoom

Activates or deactivates the zoom function. The zoom function is not available if the number of measurement points falls below 650.

activated: A 1-to-1 allocation is selected, i.e. each measurement point corresponds to a measured value. The start of the zoom window can be determined in the associated field by entering the time.

deactivated: If more measured values than measurement points are available, several measured values are combined in one measurement point according to the method of the selected trace detector. For details on detectors refer to "[Detector overview](#)"

→ Remote: [ADEM:ZOOM ON](#)

→ Remote: [ADEM:ZOOM:START 30US](#)

10.3.1 Softkeys of the frequency menu - FREQ key (Option R&S FSV-K7)

The following table shows all softkeys available in the frequency menu in "Analog Demodulation" mode ("FREQ" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Command
Center	
CF Stepsize >	0.1*Span/0.1*Demod BW
	0.5*Span/0.5*Demod BW
	x*Span/x*Demod BW
	=Center
	Manual
AF Center	
AF Start	
AF Stop	

Center

For details refer to the "[Center](#)" softkey in the frequency menu of the base unit.

CF Stepsize

Opens a submenu to set the step size of the center frequency. In addition to the "[=Center](#)" and "[Manual](#)" softkeys, the other softkeys are displayed depending on the selected frequency span.

The step size can be coupled to the span (span > 0) or the demodulation bandwidth (span = 0) or it can be manually set to a fixed value.

The submenu contains the following commands:

0.1*Span/0.1*Demod BW
0.5*Span/0.5*Demod BW
x*Span/x*Demod BW
=Center
Manual

0.1*Span (RF Spectrum)

Sets the step size for the center frequency to 10% of the span.

- Remote: [FREQ:CENT:STEP:LINK SPAN](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 10PCT](#)

0.1*Demod BW (AF/RF Time Domain, AF Spectrum)

Sets the step size for the center frequency to 10% of the demodulation bandwidth. This is the default setting.

- Remote: [FREQ:CENT:STEP:LINK RBW](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 10PCT](#)

0.5*Span (RF Spectrum)

Sets the step size for the center frequency to 50% of the span.

- Remote: [FREQ:CENT:STEP:LINK SPAN](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 50PCT](#)

0.5*Demod BW (AF/RF Time Domain, AF Spectrum)

Sets the step size for the center frequency to 50% of the demodulation bandwidth.

- Remote: [FREQ:CENT:STEP:LINK RBW](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 50PCT](#)

x*Span (RF Spectrum)

Opens an edit dialog box to set the step size for the center frequency as % of the span.

- Remote: [FREQ:CENT:STEP:LINK SPAN](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 20PCT](#)

x*Demod BW (AF/RF Time Domain, AF Spectrum)

Opens an edit dialog box to set the step size for the center frequency as % of the demodulation bandwidth. Values between 1 and 100% in steps of 1% are allowed. The default setting is 10%.

- Remote: [FREQ:CENT:STEP:LINK RBW](#)
- Remote: [FREQ:CENT:STEP:LINK:FACT 20PCT](#)

=Center

Sets the step size to the value of the center frequency and removes the coupling of the step size to span or demodulation bandwidth. This function is especially useful during measurements of the signal harmonic content because by entering the center frequency each stroke of the arrow key selects the center frequency of another harmonic.

Manual

Opens an edit dialog box to enter a fixed step size for the center frequency.

- Remote: [FREQ:CENT:STEP 120MHZ](#)

AF Center (AF Spectrum)

Opens an edit box to enter the center frequency within the AF spectrum.

→ Remote: [ADEM:AF:CENT 1MHZ](#)

AF Start

Opens an edit box to define the start frequency within the AF spectrum.

→ Remote: [ADEM:AF:STAR 0HZ](#)

AF Stop

Opens an edit box to define the stop frequency within the AF spectrum.

The maximum AF stop frequency corresponds to half the demodulation bandwidth.

→ Remote: [ADEM:AF:STOP 2MHZ](#)

10.3.2 Softkeys of the span menu – SPAN key (Option R&S FSV-K7)

The following table shows all softkeys available in the span menu in "Analog Demodulation" mode ("SPAN" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Span Manual/AF Span Manual
Demod Bandwidth
Full Span/AF Full Span

Span Manual (RF Spectrum)

If the RF spectrum display is active, values between the sampling rate/1000 and the demodulation bandwidth are allowed.

For further details refer to the "[Span Manual](#)" softkey in the span menu of the base unit.

→ Remote: [ADEM:SPEC:SPAN:ZOOM 5 MHz](#)

AF Span Manual (AF Spectrum)

Opens an edit dialog box to enter the frequency range for the AF spectrum display. Values between the sampling rate/1000 and the demodulation bandwidth/2 are allowed.

→ Remote: [ADEM:AF:SPAN 2.5 MHz](#)

Demod Bandwidth

For details see "[Demod BW](#)" softkey in the analog demodulation menu.

Full Span (RF Spectrum)

If the RF spectrum display is active, the full frequency range corresponds to the demodulation bandwidth.

For further details refer to the "[Full Span](#)" softkey in the span menu of the base unit.

→ Remote: [ADEM:SPEC:SPAN:ZOOM MAX](#)

AF Full Span (AF Spectrum)

Sets the span to the maximum frequency range for the AF spectrum display. The maximum frequency range corresponds to the half demodulation bandwidth.

→ Remote: [ADEM:AF:SPAN:FULL](#)

10.3.3 Softkeys of the amplitude menu – AMPT key (Option R&S FSV-K7)

The following table shows all softkeys available in the amplitude menu in "Analog Demodulation" mode ("AMPT" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Command
Ref Level	
AF Range	Dev per Division/dB per Division
	Reference Position
	Reference Value
	Deviation Lin/Log
Preamp On / Off	
RF Atten Manual / Mech Att Manual	
RF Atten Auto / Mech Att Auto	
EL Atten State	
EL Atten Mode (Auto/Man)	
More >	
Ref Level Offset	
Input AC / DC	
Input 50 Ω / 75 Ω	

Ref Level

For details refer to the "[Ref Level](#)" softkey in the amplitude menu of the base unit.

AF Range

For details refer to the "[AF Range](#)" softkey of the main menu.

Preamp On / Off (option RF Preamplifier, B22)

For details refer to the "[Preamp On / Off](#)" softkey in the amplitude menu of the base unit.

RF Atten Manual / Mech Att Manual

For details refer to the "[RF Atten](#)" softkey in the amplitude menu of the base unit.

RF Atten Auto / Mech Att Auto

For details refer to the "[RF Atten Auto](#)" softkey in the amplitude menu of the base unit.

EL Atten State

For details refer to the "[EL Atten Auto On/Off](#)" softkey in the amplitude menu of the base unit.

EL Atten Mode (Auto/Man)

For details refer to the "[EL Atten Manual On/Off](#)" softkey in the amplitude menu of the base unit.

Ref Level Offset

For details refer to the "[Ref Level Offset](#)" softkey in the amplitude menu of the base unit.

Input AC / DC

For details refer to the "[Input AC/DC](#)" softkey in the amplitude menu of the base unit.

Input 50 Ω / 75 Ω

For details refer to the "[Input 50 \$\Omega\$ / 75 \$\Omega\$](#) " softkey in the amplitude menu of the base unit.

10.3.4 Softkeys of the bandwidth menu – BW key (Option R&S FSV-K7)

The following table shows all softkeys available in the bandwidth menu in "Analog Demodulation" mode ("BW" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Res BW
Demod BW
Meas Time

Res BW (span > 0)

Opens an edit dialog box to enter a value for the resolution bandwidth. The range is specified in the data sheet.

→ Remote: [ADEM:SPEC:BAND 10 kHz](#)

Demod BW

For details refer to the "[Demod BW](#)" softkey in the in the analog demodulation menu.

Meas Time

For details refer to the "[Meas Time](#)" softkey in the in the analog demodulation menu.

10.3.5 Softkeys of the sweep menu – SWEEP key (Option R&S FSV-K7)

The following table shows all softkeys available in the sweep menu in "Analog Demodulation" mode ("SWEEP" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Continuous Sweep
Single Sweep
Continue Sgl Sweep
Meas Time
Sweep Count

Continuous Sweep

For details refer to the "[Continuous Sweep](#)" softkey in the in the sweep menu of the base unit.

Single Sweep

For details refer to the "[Single Sweep](#)" softkey in the in the sweep menu of the base unit.

Continue Sgl Sweep

For details refer to the "[Continue Single Sweep](#)" softkey in the in the sweep menu of the base unit.

Meas Time

For details refer to the "[Meas Time](#)" softkey in the in the analog demodulation menu.

Sweep Count

For details refer to the "[Sweep Count](#)" softkey in the in the sweep menu of the base unit.

10.3.6 Softkeys of the trigger menu – TRIG key (Option R&S FSV-K7)

The following table shows all softkeys available in the trigger menu in "Analog Demodulation" mode ("TRIG" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command	
Trigger Source >	Free Run
	External
	IF Power
	FM (Offline)
	AM (Offline)
	PM (Offline)
	RF (Offline)
	Time
Trigger Level	
Trigger Polarity Pos/Neg	
Trigger Offset	

Trigger Source

Opens the "Trigger" dialog box to select the trigger mode. Additional to the trigger modes described in section "[Trigger mode overview](#)" the following trigger modes are available:

Selected option	Specified threshold
"AM" ("Offline")	modulation depth of the AM signal
"FM" ("Offline")	frequency of the FM signal
"PM" ("Offline")	phase of the PM signal
"RF" ("Offline")	level of the RF signal

In "Analog Demodulation" mode, the next measurement is triggered if the selected input signal exceeds the threshold specified using the "[Trg / Gate Level](#)" softkey. A periodic signal modulated onto the carrier frequency can be displayed in this way. It is recommended that the measurement time covers at least five periods of the audio signal. For further details refer to section "[Trigger mode overview](#)" and the "[Trg / Gate Source](#)" softkey in the trigger menu.

Note: For triggering with AM, FM, PM or RF trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

→ Remote: [TRIG:SOUR IMM | IFP | EXT | FM | PM | AM | RF](#) (Free Run, IF Power, Extern, FM (Offline), PM (Offline), AM (Offline), RF (Offline))

Trigger Level

For details refer to the "[Trg / Gate Level](#)" softkey in the in the trigger menu of the base unit.

Trigger Polarity Pos/Neg

For details refer to the "[Trg / Gate Polarity Pos/Neg](#)" softkey in the in the trigger menu of the base unit.

Trigger Offset

For details on the relation between demodulation bandwidth (option Analog Demodulation, R&S FSV-K7) and trigger offset refer to "[Sample rate, measurement time and trigger offset](#)" on page 673.

For more details on Trigger Offset refer to the "[Trg / Gate Offset](#)" softkey in the in the trigger menu of the base unit.

10.4 Remote Commands of the Analog Demodulation (Option R&S FSV-K7)

In this section all remote control commands for Analog Demodulation option are described in detail. The abbreviation ADEMODO stands for the Analog Demodulation operating mode. For details on conventions used in this chapter refer to chapter "Remote Control – Commands" section "[Notation](#)".

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in "[Remote Control – Description of Analyzer Commands](#)" or section "[Remote Control - Description of Basic Settings Commands](#)".

Subsystems of the Analog Demodulation option (K7)

- ◆ "[CALCulate Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 690
- ◆ "[DISPlay Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 700
- ◆ "[INSTrument Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 702
- ◆ "[SENSE Subsystem \(Analog Demodulation, K7\)](#)" on page 703
- ◆ "[TRACe Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 738
- ◆ "[TRIGger Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 738
- ◆ "[UNIT Subsystem \(Analog Demodulation, K7\)](#)" on page 741

10.4.1 CALCulate Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the SENSE subsystem.

The following subsystems are included:

- ◆ "[CALCulate:DELTamarker Subsystem](#)" on page 690
- ◆ "[CALCulate:FEED Subsystem](#)" on page 691
- ◆ "[CALCulate:FORMat Subsystem](#)" on page 692
- ◆ "[CALCulate:MARKer Subsystem](#)" on page 693
- ◆ "[CALCulate:UNIT Subsystem](#)" on page 700

10.4.1.1 CALCulate:DELTamarker Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:DELTamarker subsystem controls the delta marker functions of the instrument.

Commands of the CALCulate:DELTamarker Subsystem

- ◆ "[CALCulate<1|2>:DELTamarker<1...16>:Y?](#)"

CALCulate<1|2>:DELTamarker<1...16>:Y?

Depending on the unit defined with "[CALCulate<1|2>:UNIT:POWer](#)" or on the activated measuring functions, the query result is output in the units below:

Result display	Output unit
AM result display R&S FSV-K7)	% (lin) dB (log)
FM result display R&S FSV-K7)	Hz (lin) dB (log)
PM result display (R&S FSV-K7)	rad deg (lin) dB (log)
RF result display (R&S FSV-K7)	dB (Range Log or Range Linear %) % (Range Linear %)

For further details refer to "[CALCulate<1|2>:DELTamarker<1...16>:Y?](#)".

10.4.1.2 CALCulate:FEED Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:FEED subsystem selects the evaluation method of the measured data. This corresponds to the selection of the result display in manual mode.

Commands of the CALCulate:FEED Subsystem

◆ "[CALCulate<1|2>:FEED](#)"

CALCulate<1|2>:FEED

This command selects the measured data that are to be displayed. The numeric suffixes <1|2> are irrelevant.

Parameter

XTIM:AM:RELative[:TDOMain]	Demodulated AM signal in standardized display
XTIM:AM:RELative:AFSPectrum<1...6>	AF spectrum of the demodulated AM signal in standardized display, results referenced to traces 1 to 6
XTIM:AM[:ABSolute][:TDOMain]	Demodulated AM signal in level display Same as 'XTIM:RFPower'
XTIM:RFPower[:TDOMain]	RF power of the signal
XTIM:FM[:TDOMain]	Demodulated FM signal
XTIM:FM:AFSPectrum<1...6>	AF spectrum of the demodulated FM signal, results referenced to traces 1 to 6
XTIM:PM[:TDOMain]	Demodulated PM signal
XTIM:PM:AFSPectrum<1...6>	AF spectrum of the demodulated PM signal, results referenced to traces 1 to 6
XTIM:AMSummary<1...6>[:ABSolute]	AM results in level display, referenced to traces 1 to 6
XTIM:AMSummary<1...6>:RELative	AM results in standardized display, referenced to traces 1 to 6
XTIM:FMSummary<1...6>	FM results, referenced to traces 1 to 6
XTIM:PMSummary<1...6>	PM results, referenced to traces 1 to 6
XTIM:SPECTrum	RF spectrum of the signal determined from the measured data via FFT

Example

```
INST:SEL ADEM
Activates analog demodulator.
CALC:FEED 'XTIM:FM'
Selects the display of the FM signal.
```

Characteristics

*RST value: -
SCPI: conform

Mode

ADEMOD

10.4.1.3 CALCulate:FORMat Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:FORMat subsystem defines the conversion of measured data.

Commands of the CALCulate:FORMat Subsystem

◆ "[CALCulate<1|2>:FORMat](#)"

CALCulate<1|2>:FORMat

This command activates the limitation to $\pm 180^\circ$.
The numeric suffixes <1|2> are irrelevant.

Parameter

PHASe Limitation to $\pm 180^\circ$
UPHase Unwrapped

Example

```
CALC:FORM PHAS
Activates the limitation to  $\pm 180^\circ$ .
```

Characteristics

*RST value: UPHase
SCPI: conform

Mode

ADEMOD

10.4.1.4 CALCulate:MARKer Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:MARKer subsystem checks the marker functions of the instrument. The following subsystem is included:

"[CALCulate:MARKer:FUNCTION:ADEMod Subsystem \(Analog Demodulation, |variable=K7\)](#)" on page 694

Commands of the CALCulate:MARKer Subsystem

- ◆ "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)"
- ◆ "[<1|2>:MARKer<1...16>:Y?](#)"

CALCulate<1|2>:MARKer<1...16>:PEXCursion

The unit depends on the active display.

Example

```
CALC:MARK:PEXC 100 HZ
Defines peak excursion 100 Hz
```

Characteristics

*RST value:

6dB	RF displays
5 PCT	AM displays
50 kHz	FM displays
0.5 RAD	PM displays

For further details refer to "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Calculate<1|2>:MARKer<1...16>:Y?

If the analog demodulator (option Analog Demodulation, R&S FSV-K7) is activated, the query result is output in the following units:

Result display	Output unit
AM	%
FM	Hz
PM	rad/deg (defined with CALCulate<1 2>:UNIT:ANGLE)
RF	dB (Range Log or Range Linear %)
	% (Range Linear dB)

For further details refer to "[CALCulate<1|2>:MARKer<1...16>:Y?](#)".

10.4.1.5 CALCulate:MARKer:FUNCTION:ADEMod Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:MARKer:FUNCTION:ADEMod subsystem contains the marker functions for the option Analog Demodulation, R&S FSV-K7.

Commands of the CALCulate:MARKer:FUNCTION:ADEMod Subsystem

- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:AFRequency\[:RESult<1...6>?\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:AM\[:RESult<1...6>?\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:CARRier\[:RESult<1...6>?\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:FERRor\[:RESult<1...6>?\]](#)"
- ◆ "[<1|2>:MARKer:FUNCTION:ADEMod:FM\[:RESult<1...6>?\]](#)"
- ◆ "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:PM\[:RESult<1...6>?\]](#)"
- ◆ "[<1|2>:MARKer:FUNCTION:ADEMod:SINad:RESult<1...6>?](#)"
- ◆ "[<1|2>:MARKer:FUNCTION:ADEMod:THD:RESult<1...6>?](#)"

CALCulate<1|2>:MARKer:FUNCTION:ADEMod:AFRequency[:RESult<1...6>?]

This command queries the audio frequency with analog demodulation. The numeric suffix (:RESult<1...4>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

Note: If several demodulation modes are activated simultaneously (e.g. with the "[SENSe:ADEMod:FM:TDOMain\[:TYPE\]](#)") command, the audio frequency of the display mode selected with "[CALCulate<1|2>:FEED](#)" is returned.

Example

```

ADEM ON
Switches on analog demodulator
CALC:FEED 'XTIM:AM:TDOM'
Switches on AM result display.
or
CALC:FEED 'XTIM:FM:TDOM'
Switches on FM result display.
or
CALC:FEED 'XTIM:FM:AFSP'
DISP:TRAC ON
Switches on AF spectrum result display of FM and trace.
CALC:MARK:FUNC:ADEM:AFR?
Queries the audio frequency.

```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

CALCulate<1|2>:MARKer:FUNCtion:ADEMod:AM[:RESult<1...6>?]

This command queries the results of the AM modulation measurement. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

Parameter

PPEak	Result of measurement with detector +PK
MPEak	Result of measurement with detector -PK
MIDDLE	Result of averaging \pm PK/2
RMS	Result of rms measurement

Example

```
ADEM ON
Switches on the analog demodulator.
CALC:FEED 'XTIM:AM:REL:TDOM'
Switches on the AM result display.
DISP:TRAC ON
Switches on the trace.
CALC:MARK:FUNC:ADEM:AM? PPE
Queries the peak value.
```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

CALCulate<1|2>:MARKer:FUNCtion:ADEMod:CARRier[:RESult<1...6>?]

This command queries the carrier power. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

With RF Power result display, the carrier power is determined from trace 1 to 6 indicated in the numeric suffix. With all other result displays, the carrier power is determined from the current trace data (CLR/WRITE trace).

This command is only a query and therefore has no *RST value.

Example

```
ADEM ON
Switches on analog demodulator
CALC:FEED 'XTIM:RFP'
Switches on RF power result display
CALC:MARK:FUNC:ADEM:CARR?
Queries the carrier power
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

CALCulate<1|2>:MARKer:FUNCtion:ADEMod:FERRor[:RESult<1...6>?]

This command queries the frequency error with FM and PM demodulation. With FM demodulation, trace 1 to 6 is selected with the numeric suffix (:RESult<1...6>). With PM demodulation, the frequency error is determined from the current measurement data (CLR/WRITE trace). The numeric suffixes <1|2> are irrelevant.

The offset thus determined differs from that calculated in the "[SENSe:|ADEMod:FM:OFFSet?](#)" command since, for determination of the frequency deviation, the modulation is removed by means of low pass filtering, producing results that are different from those obtained by averaging with the SENSE command.

This command is only available for traces in the FM and PM result display. If another result display is selected, the command is disabled.

Example

```

ADEM ON
Switches on analog demodulator
CALC:FEED 'XTIM:FM:TDOM'
Switches on FM result display
CALC:MARK:FUNC:ADEM:FERR?
Queries the frequency error of trace 1

```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

Calculate<1|2>:MARKer:FUNCTION:ADEMod:FM[:RESult<1...6>?]

This command queries the results of FM modulation measurement. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

Parameter

PPEak	Result of measurement with detector +PK
MPEak	Result of measurement with detector -PK
MIDDLE	Result of averaging \pm PK/2
RMS	Result of rms measurement

Example

```

ADEM ON
Switches on the analog demodulator.
CALC:FEED 'XTIM:FM:TDOM'
Switches on the FM result display.
CALC:MARK:FUNC:ADEM:FM? PPE
Queries the peak value.

```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

CALCulate<1|2>:MARKer:FUNCtion:ADEMod:PM[:RESult<1...6>?]

This command queries the results of PM modulation measurement of analog demodulation. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

Parameter

PPEak	Result of measurement with detector +PK
MPEak	Result of measurement with detector -PK
MIDDLE	Result of averaging \pm PK/2
RMS	Result of rms measurement

Example

```
ADEM ON
Switches on the analog demodulator.
CALC:FEED 'XTIM:PM:TDOM'
Switches on the FM result display.
CALC:MARK:FUNC:ADEM:PM? PPE
Queries the peak value.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

Calculate<1|2>:MARKer:FUNCtion:ADEMod:SINad:RESult<1...6>?

This command queries the result of the SINAD measurement. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

This command is a query only and thus has no *RST value.

Example

```
ADEM ON
Switches on analog demodulator
CALC:FEED 'XTIM:FM:AFSP'
DISP:TRAC ON
Switches on AF spectrum of FM and trace
CALC:MARK:FUNC:ADEM:SIN:RES?
Queries SINAD value
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

Calculate<1|2>:MARKer:FUNCtion:ADEMod:THD:RESult<1...6>?

This command queries the result of the THD measurement. The numeric suffix (:RESult<1...6>) indicates whether trace 1, 2, 3, 4, 5 or 6 is selected. The numeric suffixes <1|2> are irrelevant.

This command is a query only and thus has no *RST value.

Example

```
ADEM ON  
Switches on analog demodulator  
CALC:FEED 'XTIM:FM:AFSP'  
Switches on AF spectrum of FM and trace  
DISP:TRAC ON  
Switches on the trace  
CALC:MARK:FUNC:ADEM:THD:RES?  
Queries THD result
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

10.4.1.6 CALCulate:UNIT Subsystem (Analog Demodulation, R&S FSV-K7)

The CALCulate:Unit subsystem defines the units for the parameters that can be set and the measurement results.

Commands of the CALCulate:UNIT Subsystem

- ◆ "[CALCulate<1|2>: UNIT:ANGLE](#)"

CALCulate<1|2>: UNIT:ANGLE

This command selects the unit for angles.

Parameter

DEG | RAD

Example:

```
CALC:UNIT:ANGL DEG
```

Characteristics:

*RST value: RAD

SCPI: device-specific

Mode

ADEMODO

10.4.2 DISPLAY Subsystem (Analog Demodulation, R&S FSV-K7)

The DISPLAY subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

Commands of the DISPLAY Subsystem

- ◆ "[DISPLAY\[:WINDow<1|2>\]:SIZE](#)"
- ◆ "[\[:WINDow<1|2>\]:TRACe<1...6>:Y\[:SCALe\]:PDIVision](#)"
- ◆ "[DISPLAY\[:WINDow<1|2>\]:TRACe<1...6>:Y\[:SCALe\]:RPOSition](#)"
- ◆ "[\[:WINDow<1|2>\]:TRACe<1...6>:Y\[:SCALe\]:RVALue](#)"
- ◆ "[\[:WINDow<1|2>\]:TRACe<1...6>:Y:SPACing](#)"

DISPLAY[:WINDow<1|2>]:SIZE

This command switches the measurement window for active analog demodulation to full screen or half screen.

For further details refer to "[DISPLAY\[:WINDow<1|2>\]:SIZE](#)".

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALe]:PDIVision

This command defines the scaling of the y-axis in the current unit. The numeric suffix in TRACe<1...6> is irrelevant. The numeric suffixes <1|2> are irrelevant.

Parameter

<numeric_value>

Example

```
DISP:TRAC:Y:PDIV +10kHz
```

Sets the Y scale to 10 kHz/div.

Characteristics

*RST value:

20 PCT	linear AM display
50 kHz	linear FM display
2 rad	linear PM display
10 dB	logarithmic AF spectrum display

SCPI: conform

Mode

ADEMODO

DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALe]:RPOSition

This command defines the position of the reference value in the selected measurement window.

The numeric suffixes <1|2> are irrelevant.

The numeric suffix in TRACe<1...6> is irrelevant.

Characteristics

*RST value:

100 PCT	AF spectrum display of AM, FM, or PM
50 PCT	AM, FM, or PM display

For further details refer to

"DISPlay[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALe]:RPOSition (models 13, 16)".

Display[:WINDow<1|2>]:TRACe<1...6>:Y[:SCALe]:RVALue

This command defines the reference value assigned to the reference position. Separate reference values are maintained for the various displays.

Example

```
DISP:TRAC:Y:RVAL 0
```

Sets the value assigned to the reference position to 0 Hz (analog demodulation)

Characteristics

*RST value:

0 PCT	AM display
0 Hz	FM display
0 rad	PM display
100 PCT	AF spectrum display of AM signal
250 kHz	AF spectrum display of FM signal
10 rad	AF spectrum display of PM signal

For further details refer to

"[DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y\[:SCALe\]:RPOSition \(models 13, 16\)](#)".

Display[:WINDow<1|2>]:TRACe<1...6>:Y:SPACing

This command switches between linear and logarithmic display in the selected window.

In the case of linear RF displays, it is also possible to switch between unit % (command `DISP:WIND:TRAC:Y:SPAC LIN`) and unit dB (command `DISP:WIND:TRAC:Y:SPAC LDB`).

In the case of AF spectrum displays, only the parameters `LINear` and `LOGarithmic` are permitted.

For further details refer to "[DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y:SPACing](#)".

10.4.3 INSTRument Subsystem (Analog Demodulation, R&S FSV-K7)

The INSTRument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

Commands of the INSTRument Subsystem

- ◆ "[INSTRument\[:SElect\]](#)"
- ◆ "[INSTRument:NSElect](#)"

INSTrument[:SElect]

Parameter

ADEMod (Analog Demodulation option, R&S FSV-K7)

For further details refer to section "Remote Control - Description of Basic Settings Commands", "[INSTrument subsystem](#)".

INSTrument:NSElect

Parameter

3 (Analog Demodulation option, R&S FSV-K7)

For further details refer to section "Remote Control - Description of Basic Settings Commands", "[INSTrument subsystem](#)".

10.4.4 SENSE subsystem (Analog Demodulation, K7)

The SENSE subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSE subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSE" is optional for this reason, which means that it is not necessary to include the SENSE node in command sequences.

The following subsystems are included:

- ◆ "[SENSE:ADEMod Subsystem](#)" on page 704
- ◆ "[SENSE:BANDwidth Subsystem](#)" on page 732
- ◆ "[SENSE:FILTer Subsystem](#)" on page 733
- ◆ "[SENSE:FREQuency Subsystem](#)" on page 737
- ◆ "[SENSE:SWEEp Subsystem](#)" on page 737

10.4.4.1 SENSE:ADEMod Subsystem (Analog Demodulation, K7)

The SENSE:ADEMod Subsystem contains commands to set up the instrument for the measurement of analog demodulated signals and query the result at the end of the measurement.

Commands of the SENSE:ADEMod Subsystem

- ◆ "[SENSe:|ADEMod:|STATe](#)"
- ◆ "[SENSe:|ADEMod:AF:CENTer](#)"
- ◆ "[SENSe:|ADEMod:AF:COUPling](#)"
- ◆ "[SENSe:|ADEMod:AF:SPAN](#)"
- ◆ "[SENSe:|ADEMod:AF:SPAN:FULL](#)"
- ◆ "[SENSe:|ADEMod:AF:STARt](#)"
- ◆ "[SENSe:|ADEMod:AF:STOP](#)"
- ◆ "[SENSe:|ADEMod:AM:|ABSolute|:TDOMain|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:AM:|ABSolute|:TDOMain:RESult?](#)"
- ◆ "[SENSe:|ADEMod:AM:RELative:TDOMain|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:AM:RELative:TDOMain:RESult?](#)"
- ◆ "[SENSe:|ADEMod:AM:RELative:AFSPectrum|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:AM:RELative:AFSPectrum:RESult?](#)"
- ◆ "[SENSe:|ADEMod:BANDwidth|BWIDth:DEModulation](#)"
- ◆ "[SENSe:|ADEMod:FM:TDOMain|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:FM:TDOMain:RESult?](#)"
- ◆ "[SENSe:|ADEMod:FM:AFSPectrum|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:FM:AFSPectrum:RESult?](#)"
- ◆ "[SENSe:|ADEMod:FM:OFFSet?](#)"
- ◆ "[SENSe:|ADEMod:MTIME](#)"
- ◆ "[SENSe:|ADEMod:PM:TDOMain|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:PM:TDOMain:RESult?](#)"
- ◆ "[SENSe:|ADEMod:PM:AFSPectrum|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:PM:AFSPectrum:RESult?](#)"
- ◆ "[SENSe:|ADEMod:PM:RPOint\[:X\]](#)"
- ◆ "[SENSe:|ADEMod:RENGth?](#)"
- ◆ "[SENSe:|ADEMod:SET](#)"
- ◆ "[SENSe:|ADEMod:SPECtrum|:TYPE](#)"
- ◆ "[SENSe:|ADEMod:SPECtrum:BANDwidth|BWIDth:RESolution](#)"
- ◆ "[SENSe:|ADEMod:SPECtrum:RESult?](#)"
- ◆ "[SENSe:|ADEMod:SPECtrum:SPAN:MAXimum](#)"
- ◆ "[SENSe:|ADEMod:SPECtrum:SPAN:ZOOM](#)"
- ◆ "[SENSe:|ADEMod:SRATE?](#)"
- ◆ "[SENSe:|ADEMod:ZOOM:STATe](#)"
- ◆ "[SENSe:|ADEMod:ZOOM:STARt](#)"

Further information

- ◆ ["Trace mode result types"](#)
- ◆ ["Formats for returned values: ASCII format and binary format"](#)

10.4.4.2 Trace mode result types

The following result types can be set:

WRITe	The current trace results will be obtained
AVERAge	The trace results will be averaged over the given # of measurements
MAXHold	The maximum trace result values will be obtained over the given # of measurements
MINHold	The minimum trace result values will be obtained over the given # of measurements
VIEW	The trace results are frozen and displayed, i.e. they are not calculated for subsequent measurements. Traces in this mode cannot be queried.
OFF	The result type will not be used.

Note: It is not possible to query trace data when result type VIEW is selected.

Each value besides OFF can only be assigned to one result type at a time.

If all result types are set to OFF, the AM, FM, or PM demodulator will be deactivated.

10.4.4.3 Formats for returned values: ASCII format and binary format

- ◆ ASCII Format (FORMat ASCII):
The command reads out a list of comma separated values (CSV) of the measured values in floating point format.
- ◆ Binary Format (FORMat REAL,32):
The command reads out binary data (Definite Length Block Data according to IEEE 488.2), each measurement value being formatted in 32 Bit IEEE 754 Floating-Point-Format. The schematics of the result string will be as follows:
#41024<value1><value2>...<value n> with

#4	number of digits (= 4 in the example) of the following number of data bytes
1024	number of following data bytes (= 1024 in the example)
<value>	4-byte floating point value

[SENSe:]ADEMod[:STATe]

This command activates the analog demodulator of the instrument. The instrument will be set to zero span at the current center frequency.

Parameter

ON | OFF

Example

```
ADEM ON
```

Switches the analog demodulator on.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:CENTer

This command sets the center frequency for AF spectrum result display.

Parameter

<numeric_value>

Example

```
ADEM ON
```

Switches on the analog demodulator

```
CALC:FEED 'XTIM:FM:AFSP'
```

Switches on AF spectrum result display of FM

```
ADEM:BAND 5 MHz
```

Sets the measurement bandwidth to 5 MHz

```
ADEM:AF:CENT 500kHz
```

Sets the AF center frequency to 500 kHz

```
ADEM:AF:SPAN 200kHz
```

Sets the AF span to 200 kHz

Characteristics

*RST value: 1.25 MHz

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:COUPling

This command selects the coupling of the AF path of the analyzer.

Parameter

AC | DC

Example

```
ADEMod:AF:COUPling DC
```

Switches on DC coupling.

Characteristics

*RST value: AC (PM); DC (FM)

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:SPAN

This command sets the span for AF spectrum result display.

The span is limited to half the measurement bandwidth of analog demodulation ("[\[SENSe:\]ADEMod:BANDwidth|BWIDth:DEModulation](#)").

Parameter

<numeric_value>

Example

```
ADEMod ON
```

Switches on the analog demodulator

```
CALC:FEED 'XTIM:FM:AFSP'
```

Switches on AF spectrum result display of FM

```
ADEMod:BAND 5 MHz
```

Sets the measurement bandwidth to 5 MHz

```
ADEMod:AF:CENt 500kHz
```

Sets the AF center frequency to 500 kHz

```
ADEMod:AF:SPAN 200kHz
```

Sets the AF span to 200 kHz

Characteristics

*RST value: 2.5 MHz

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:SPAN:FULL

This command sets the maximum span for AF spectrum result display. The maximum span corresponds to half the measurement bandwidth of analog demodulation ("[SENSe:\]ADEMod:BANDwidth\[BWIDth:DEModulation](#)").

Example

```
ADEM ON
Switches on the analog demodulator
CALC:FEED 'XTIM:FM:AFSP'
Switches on AF spectrum result display of FM
ADEM:BAND 5 MHz
Sets the measurement bandwidth to 5 MHz
ADEM:AF:SPAN:FULL
Sets the AF span to 2.5 MHz
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:STARt

This command sets the start frequency for AF spectrum result display.

Parameter

<numeric_value>

Example

```
ADEM ON
Switches on analog demodulator
CALC:FEED 'XTIM:FM:AFSP'
Switches on AF spectrum result display of FM
ADEM:BAND 5 MHz
Sets the measurement bandwidth to 5 MHz
ADEM:AF:STAR 0kHz
Sets the AF start frequency to 0 kHz
ADEM:AF:STOP 500kHz
Sets the AF stop frequency to 500 kHz
```

Characteristics

*RST value: 0 MHz
SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AF:STOP

This command sets the stop frequency for AF spectrum result display. The stop frequency is limited to half the measurement bandwidth of analog demodulation ("[SENSe:\]ADEMod:BANDwidth|BWIDth:DEModulation](#)").

Parameter

<numeric_value>

Example

ADEM ON

Switches on the analog demodulator

CALC:FEED 'XTIM:FM:AFSP'

Switches on AF spectrum result display of FM

ADEM:BAND 5 MHz

Sets the measurement bandwidth to 5 MHz

ADEM:AF:STAR 0kHz

Sets the AF start frequency to 0 kHz

ADEM:AF:STOP 500kHz

Sets the AF stop frequency to 500 kHz

Characteristics

*RST value: 2.5 MHz

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AM[:ABSolute][:TDOMain][:TYPE]

This command selects the result types of the RF signal to be measured simultaneously in zero span.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Example

ADEM:AM AVER,MAXH,MINH

Determines average, max hold and min hold values at a time.

ADEM:AM WRIT,OFF,OFF

Determines only the current measurement values.

ADEM:AM OFF,OFF,OFF

Switches AM demodulation off.

Characteristics

*RST value: WRITe,OFF,OFF

SCPI: device-specific

Mode

ADEM0D

[SENSe:]ADEM0d:AM[:ABSolute][:TDOMain]:RESult?

This command reads the result data of the RF signal in zero span for the specified result type. The data format of the output data block is defined by the `FORMat` command.

Parameter

<result type>: WRITe, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The result type indicated must be one of those configured by "[SENSe:\]ADEM0d:AM\[:ABSolute\]\[:TDOMain\]\[:TYPE\]](#)". Otherwise a query error will be generated.

Return values

ASCII Format (`FORMat ASCII`) or Binary Format (`FORMat REAL,32`); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705.

The output units are described in

"[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters

```
ADEM:AM AVER,MAXH,MINH
```

Sets up AM results to be measured

```
ADEM ON
```

Switches on demodulator

```
INIT;*WAI
```

Starts measurement and waits for sync

```
FORM ASC
```

Selects output format

```
ADEM:AM:RES? AVER
```

Reads AM average results

```
ADEM:AM:RES? MAXH
```

Reads AM max hold results

```
ADEM:AM:RES? MINH
```

Reads AM min hold results

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE]

This command selects the result types to be measured simultaneously by AM demodulation.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Example

```
ADEM:AM:REL AVER,MAXH,MINH
```

Determines average, max hold and min hold values simultaneously.

```
ADEM:AM:REL WRIT,OFF,OFF
```

Determines only the current measurement values.

```
ADEM:AM:REL OFF,OFF,OFF
```

Switches AM demodulation off.

Characteristics

*RST value: OFF,OFF,OFF
 SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AM:RELative[:TDOMain]:RESult?

This command reads the result data obtained by AM demodulation for the specified result type. The data format of the output data block is defined by the FORMat command.

Parameter

<result type>: WRITe, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The result type indicated must be one of those configured by "[\[SENSe:\]ADEMod:AM:RELative\[:TDOMain\]\[:TYPE\]](#)". Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705. The output units are described in "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters

```
ADEM:FM AVER,MAXH,MINH
```

Selects FM results to be measured

```
ADEM:AM:REL WRIT,OFF,OFF
```

Selects AM results to be measured

```
ADEM ON
```

Switches on demodulator

```
INIT;*WAI
```

Starts measurement and waits for sync

```
FORM ASC
```

Selects output format

```
ADEM:FM:RES? AVER
```

Reads FM average results

```
ADEM:FM:RES? MAXH
```

Reads FM max hold results

```
ADEM:FM:RES? MINH
```

Reads FM min hold results

```
ADEM:AM:REL:RES? WRIT
```

Reads current AM result data

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE]

This command selects the AF spectrum result types of the AM-demodulated signal to be measured simultaneously.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Note: The result type "AF spectrum of AM-demodulated signal" cannot be activated at the same time as "AF spectrum of FM or PM demodulated signal".

Example

```
ADEMod:AM:REL:AFSP AVER,MAXH,MINH
```

Determines average, maximum and minimum value simultaneously

```
ADEMod:AM:REL:AFSP WRIT,OFF,OFF
```

Determines only current measurement results

```
ADEMod:AM:REL:AFSP OFF,OFF,OFF
```

Switches off calculation of the AF spectrum

Characteristics

*RST value: OFF,OFF,OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:AM:RELative:AFSPectrum:RESult?

This command reads out the AF spectrum result data of the AM-demodulated signal for the specified result type. The data format of the output data is determined with the FORMat command.

Parameter

<result type>: WRITe, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The specified result type must be one of those configured with the "[\[SENSe:\]ADEMod:AM:RELative:AFSPectrum\[:TYPE\]](#)" command. Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705.

The output units are described in section "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets the demodulator

```
ADEM:FM AVER,MAXH,MINH
```

Selects the FM results to be measured

```
ADEM:AM:REL WRIT,OFF,OFF
```

Selects the AM results to be measured

```
ADEM:AM:REL:AFSP WRIT,OFF,OFF
```

Selects the AF spectrum results of the demodulated AM signal to be measured

```
ADEM ON
```

Switches on the demodulator

```
INIT;*WAI
```

Starts the measurement and waits for the termination

```
FORM ASC
```

Selects the output format

```
ADEM:FM:RES? AVER
```

Reads the FM average result data

```
ADEM:FM:RES? MAXH
```

Reads the FM Maxhold result data

```
ADEM:FM:RES? MINH
```

Reads the FM Minhold result data

```
ADEM:AM:REL:RES? WRIT
```

Reads the current AM result data

```
ADEM:AM:REL:AFSP:RES? WRIT
```

Reads the current AF spectrum result data of the demodulated AM signal

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:BANDwidth|BWIDth:DEModulation

This command defines the demodulation bandwidth used for analog demodulation. The required sampling rate is automatically set depending on the selected demodulation bandwidth. The available demodulation bandwidths are determined by the existing sampling rates. For details on the relation between demodulation bandwidth and sampling rate refer to "[Sample rate, measurement time and trigger offset](#)" on page 673.

Parameter

<numeric_value>

For details on the correlation of bandwidth and sample rate refer to chapter "Instrument Functions", section "Analog Demodulation (Option K7)" - "[Sample rate, measurement time and trigger offset](#)".

Example

```
ADEMod:BAND:DEM 1MHz
```

Sets the demodulation bandwidth to 1 MHz.

Characteristics

*RST value: 5 MHz

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:FM[:TDOMain][:TYPE]

This command selects the result types to be measured simultaneously by FM demodulation.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Example

```
ADEMod:FM AVER,MAXH,MINH
```

"Creates average, max hold and min hold values simultaneously

```
DEMod:FM WRIT,OFF,OFF
```

Only creates the current measurement values

```
ADEMod:FM OFF,OFF,OFF
```

Switches analog demodulator off

Characteristics

*RST value: WRITe,OFF,OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:FM[:TDOMain]:RESult?

This command reads the result data obtained by analog demodulation for the specified result type. The data format of the output data block is defined by the FORMat command.

Parameter

<result type>: WRITe, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The result type indicated must be one of those configured by "[SENSe:\]ADEMod:FM\[:TDOMain\]:TYPE\]](#)". Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705.

The output units are described in "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters

```
ADEM:FM AVER,MAXH,MINH
```

Selects FM results to be measured

```
ADEM:AM WRIT,OFF,OFF
```

Selects AM results to be measured

```
ADEM ON
```

Switches on demodulator

```
INIT;*WAI
```

Starts measurement and waits for sync

```
FORM ASC
```

Selects output format

```
ADEM:FM:RES? AVER
```

Reads FM average results

```
ADEM:FM:RES? MAXH
```

Reads FM max hold results

```
ADEM:FM:RES? MINH
```

Reads FM min hold results

Remote Commands of the Analog Demodulation (Option R&S FSV-K7)

```
ADEM:AM:RES? WRIT
```

Reads current AM results

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:FM:AFSPectrum[:TYPE]

This command selects the AF spectrum result types of the FM demodulated signal to be measured simultaneously.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Note: The result type "AF spectrum of the FM demodulated signal" cannot be activated at the same time as "AF spectrum of AM or PM demodulated signal".

Example

```
ADEM:FM:AFSP AVER,MAXH,MINH
```

Determines average, maximum and minimum value simultaneously

```
ADEM:FM:AFSP WRIT,OFF,OFF
```

Determines only current measurement results

```
ADEM:FM:AFSP OFF,OFF,OFF
```

Switches calculation of AF spectrum off

Characteristics

*RST value: OFF,OFF,OFF

SCPI: device-specific

Mode

A

[SENSe:]ADEMod:FM:AFSPectrum:RESult?

This command reads out the AF spectrum result data of the FM demodulated signal for the specified result type. The data format of the output data is determined with the FORMat command.

Parameter

<result type>: WRITe, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The specified result type must be one of those configured with the "[SENSe:JADEMod:FM:AFSPectrum\[:TYPE\]](#)" command. Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705. The output units are described in "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```

ADEM:SET 8MHz,32000,EXT,POS,-500,30
Sets demodulator
ADEM:FM AVER,MAXH,MINH
Selects the FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF
Selects the AM results to be measured
ADEM:FM:AFSP WRIT,OFF,OFF
Selects the AF spectrum results of the demodulated FM signal to be measured
ADEM ON
Switches the demodulator on
INIT;*WAI
Starts the measurement and waits for termination
FORM ASC
Selects output format
ADEM:FM:RES? AVER
Reads FM average result data
ADEM:FM:RES? MAXH
Reads FM maxhold result data
ADEM:FM:RES? MINH
Reads FM minhold result data
ADEM:AM:RES? WRIT
Reads current AM result data
ADEM:FM:AFSP:RES? WRIT
Reads current AF spectrum result data of demodulated FM signal

```

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:FM:OFFSet?

This command calculates the FM offset of the currently available measurement data set.

If averaging has been activated before acquiring the data set (using "[SENSe:\]ADEMod:FM:TDOMain\[:TYPE\]](#)", the averaged FM offset over several measurements can also be obtained by setting <result type> = AVERAge.

The offset thus determined differs from the one calculated by the "[CALCulate<1|2>:MARKer:FUNCTION:ADEMod:FERRor\[:RESult<1...6>?\]](#)" command since, for determination of the frequency deviation, the modulation is removed by means of low pass filtering, producing results that are different from those obtained by averaging.

Parameter

<result type>

IMMediate The current measurement results will be used for calculating the FM offset

AVERAge The measurement results that were averaged over the given # of measurements will be used for calculating the FM offset

Note: If no average measurement was active during the last measurement sequence only the "[SENSe:\]ADEMod:FM:OFFSet?](#)" IMMediate command will return a correct result (data to calculate the offset are taken from the last measured data set).

[SENSe:\]ADEMod:FM:OFFSet?](#) AVERAge will cause a query error in this case.

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters to execute 30 measurements

```
ADEM:FM AVER,OFF,OFF
```

Selects FM results to perform averaging

```
ADEM:AM OFF,OFF,OFF
```

Switches off AM demodulation

```
ADEM ON
```

Switches on analog demodulator

```
INIT;*WAI
```

Starts measurement and waits for sync

```
ADEM:FM:OFFS? IMM
```

Reads FM offset of last measurement of the sequence of 30

```
ADEM:FM:OFFS? AVER
```

Reads FM offset averaged over 30 measurements

Characteristics

*RST values: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:MTIME

This command defines the measurement time for analog demodulation.

Parameter

<numeric_value>

Example

ADEM:MTIM 62.5us

Sets the measurement time to 62.5 µs.

Characteristics

*RST value: 62.5us

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:PM[:TDOMain][:TYPE]

This command selects the result types of the PM-demodulated signal to be created simultaneously.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERage, MAXHold, MINHold, VIEW; for details see "[Trace mode result types](#)" on page 705.

Example

ADEM:PM AVER,MAXH,MINH

Determines average, maximum and minimum value simultaneously

ADEM:PM WRIT,OFF,OFF

Determines only current measurement results

ADEM:PM OFF,OFF,OFF

Switches the PM demodulator off.

Characteristics

*RST value: OFF,OFF,OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:PM[:TDOMain]:RESult?

This command reads the result data of the PM demodulation for the specified result type. The data format of the output data is determined with the `FORMat` command.

Parameter

<result type>: `WRITe`, `AVERage`, `MAXHold`, `MINHold`; for details see "[Trace mode result types](#)" on page 705.

Note: The specified result type must be one of those configured with the "[SENSe:\]ADEMod:PM\[:TDOMain\]:TYPE\]](#)" command. Otherwise a query error will be generated.

Return values

ASCII Format (`FORMat ASCII`) or Binary Format (`FORMat REAL,32`); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705. The output units are described in "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets the demodulator parameters.

```
ADEM:PM AVER,MAXH,MINH
```

Selects the PM results to be measured.

```
ADEM:AM WRIT,OFF,OFF
```

Selects the AM results to be measured.

```
ADEM ON
```

Switches on the demodulator.

```
INIT;*WAI
```

Starts the measurement and waits for termination.

```
FORM ASC
```

Selects the output format.

```
ADEM:PM:RES? AVER
```

Reads the PM average result data.

```
ADEM:PM:RES? MAXH
```

Reads the PM maxhold result data.

```
ADEM:PM:RES? MINH
```

Reads the PM minhold result data.

```
ADEM:AM:RES? WRIT
```

Reads the current AM result data.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:PM:AFSPectrum[:TYPE]

This command selects the AF spectrum result types of the PM-demodulated signal to be measured simultaneously.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERAge, MAXHold, MINHold, VIEW; for details see "[Trace mode result types](#)" on page 705.

Note: The result type "AF spectrum of the PM demodulated signal" cannot be activated at the same time as "AF spectrum of AM or FM demodulated signal".

Example

```
ADEMod:PM:AFSP AVER,MAXH,MINH
```

Determines average, maximum and minimum value simultaneously

```
ADEMod:PM:AFSP WRIT,OFF,OFF
```

Determines only current measurement results

```
ADEMod:PM:AFSP OFF,OFF,OFF
```

Switches calculation of AF spectrum off

Characteristics

*RST value: OFF,OFF,OFF
 SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:PM:AFSPectrum:RESult?

This command reads out the AF spectrum result data of the PM-demodulated signal for the specified result type. The data format of the output data is determined with the FORMat command.

Parameter

<result type>: WRITe, AVERAge, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The specified result type must be one of those configured with the "[SENSe:ADEMod:PM:AFSPectrum:TYPE\]](#)" command. Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705.

The output units are described in section

["CALCulate<1|2>:MARKer<1...16>:PEXCursion"](#).

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets demodulator

```
ADEM:PM AVER,MAXH,MINH
```

Selects the PM results to be measured

```
ADEM:AM:REL WRIT,OFF,OFF
```

Selects the AM results to be measured

```
ADEM:PM:AFSP WRIT,OFF,OFF
```

Selects the AF spectrum results of the demodulated PM signal to be measured

```
ADEM ON
```

Switches the demodulator on

```
INIT;*WAI
```

Starts the measurement and waits for termination

```
FORM ASC
```

Selects output format

```
ADEM:PM:RES? AVER
```

Reads PM average result data

```
ADEM:PM:RES? MAXH
```

Reads PM maxhold result data

```
ADEM:PM:RES? MINH
```

Reads PM minhold result data

```
ADEM:AM:RES? WRIT
```

Reads current AM result data

```
ADEM:PM:AFSP:RES? WRIT
```

Reads current AF spectrum result data of demodulated PM signal

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:PM:RPOint[:X]

This command determines the position where the phase of the PM-demodulated signal is set to 0 rad. The maximum possible value depends on the measurement time selected in the instrument; this value is output in response to the query

ADEM:PM:RPO:X? MAX.

Parameter

0 s to measurement time

Example

ADEM:PM:RPO 500us

Sets the position where the phase to 0 rad setting to 500 µs.

Characteristics

*RST value: 0 s

SCPI: conform

Mode

ADEMOD

[SENSe:]ADEMod:RLEnGth?

This command returns the record length set up for the current analog demodulation measurement.

Example

ADEM:RLEN?

Returns the current record length.

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SET

This command configures the analog demodulator of the instrument.

Parameter

<sample rate>	The frequency at which measurement values are taken from the A/D-converter and stored in I/Q memory. Allowed range: refer to chapter " Instrument Functions Analog Demodulation (Option variable=K7) " – " Sample rate, measurement time and trigger offset ".
<record length>	Number of samples to be stored in I/Q memory. Allowed range: 1 to 400001 with AF filter or AF trigger active 1 to 480001 with both AF filter and AF trigger deactive
<trigger source>	Selection of the trigger source to use for the demodulator. Allowed values: IMMEDIATE EXTernal IFPower RFPower AF AM AMRelative FM PM (see note below)
<trigger slope>	Used slope of the trigger signal. Allowed values: POSitive NEGative
<offset samples>	The value indicated here will be ignored for <trigger source> = IMMEDIATE. Number of samples to be used as an offset to the trigger signal. For details refer to " Sample rate, measurement time and trigger offset " on page 673
<# of meas>	The value indicated here will be ignored for <trigger source> = IMMEDIATE. Number of repetitions of the measurement to be executed. The value indicated here is especially necessary for the average/maxhold/minhold function. Allowed range: 0 to 32767

Note: After selecting IF Power, the trigger threshold can be set with the "[TRIGger<1|2>\[:SEQUENCE\]:LEVel:IFPower](#)" command.

Example

```
ADEMod:SET 8MHz,32000,EXT,POS,-500,30
```

Performs a measurement at:

```
sample rate      8 MHz
record length    32000
trigger source    EXTernal
trigger slope     POSitive
offset samples    -500 (500 samples before trigger occurred)
# of meas        30
```

Characteristics

*RST value:

sample rate	8 MHz
record length	501
trigger source	IMMediate
trigger slope	POSitive
offset samples	0
# of meas	0

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SPECtrum[:TYPE]

This command selects the result types to be created in parallel by the RF spectrum measurement with active analog demodulation.

Parameter

<result type 1|2|3|4|5|6>: WRITe, AVERAge, MAXHold, MINHold, VIEW, OFF; for details see "[Trace mode result types](#)" on page 705.

Example

```
ADEM:SPEC AVER,MAXH,MINH
```

Creates average, max hold and min hold values at a time

```
ADEM:SPEC WRIT,OFF,OFF
```

Only creates the current measurement values

```
ADEM:SPEC OFF,OFF,OFF
```

Switches analog demodulator off

Characteristics

*RST value: OFF,OFF,OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SPECTrum:BANDwidth|BWIDth[:RESolution]

This command sets the resolution bandwidth for spectrum representation that was determined from the analog demodulation data.

The recording time required is calculated from the sampling rate indirectly set via "[\[SENSe:\]ADEMod:SPECTrum:SPAN\[:MAXimum\]](#)" or "[SENSe:\]ADEMod:BANDwidth|BWIDth:DEModulation](#)". If the available recording time is not sufficient for the given bandwidth, the recording time is set to its maximum and the resolution bandwidth is enlarged to the resulting bandwidth.

Parameter

refer to data sheet

Example

```
ADEM ON
```

Switches on the analog demodulator

```
CALC:FEED 'XTIM:SPEC'
```

Switches on the RF spectrum result display

or

```
CALC:FEED 'XTIM:FM:AFSP'
```

Switches on the AF spectrum result display of FM signal

```
ADEM:SPEC:BAND 61.2kHz
```

Sets the resolution bandwidth to 61.2 kHz.

Characteristics

*RST value: 61.2 kHz

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SPECTrum:RESult?

This command reads out the RF spectrum result data for the specified result type. The data format of the output data block is defined by the `FORMat` command.

Parameter

<result type>: WRITE, AVERage, MAXHold, MINHold; for details see "[Trace mode result types](#)" on page 705.

Note: The result type indicated must be one of those configured by "[SENSe:\]ADEMod:SPECTrum\[:TYPE\]](#)". Otherwise a query error will be generated.

Return values

ASCII Format (FORMat ASCII) or Binary Format (FORMat REAL,32); for details see "[Formats for returned values: ASCII format and binary format](#)" on page 705. The output units are described in "[CALCulate<1|2>:MARKer<1...16>:PEXCursion](#)".

Example

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30
```

Sets up demodulator parameters

```
ADEM:SPEC AVER,MAXH,MINH
```

Selects RF spectrum results to be measured

```
ADEM:SPEC WRIT,OFF,OFF
```

Selects AM results to be measured

```
ADEM ON
```

Switches on demodulator

```
INIT;*WAI
```

Starts measurement and waits for sync

```
FORM ASC
```

Selects output format

```
ADEM:SPEC:RES? AVER
```

Reads RF spectrum average results

```
ADEM:SPEC:RES? MAXH
```

Reads RF spectrum max hold results

```
ADEM:SPEC:RES? MINH
```

Reads RF spectrum min hold results

```
ADEM:SPEC:RES? WRIT
```

Reads spectrum current results

Characteristics

*RST value: -

SCPI: device-specific

Mode

ADEMOD

[SENSe:JADEMod:SPECTrum:SPAN[:MAXimum]

This command sets the maximum frequency range for displaying the RF spectrum that was determined from the FM demodulation data. The maximum span corresponds to the measurement bandwidth of analog demodulation (for details refer to "[SENSe:JADEMod:BANDwidth|BWIDth:DEModulation](#)"). For details refer on the relation of bandwidth and sample rate refer to chapter "[Instrument Functions Analog Demodulation \(Option |variable=K7\)](#)" – "[Sample rate, measurement time and trigger offset](#)".

Parameter

<numeric_value>

Example

```
ADEM ON
Switches on the analog demodulator
CALC:FEED 'XTIM:SPEC'
Switches on RF spectrum result display.
ADEM:SPEC:SPAN:MAX 5 MHz
Sets the max. span to 5 MHz
ADEM:SPEC:SPAN:ZOOM 1 MHz
Sets the displayed span to 1 MHz
```

Characteristics

*RST value: 5 MHz
SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SPECTrum:SPAN:ZOOM

This command sets the frequency range for the RF spectrum result display determined from analog demodulation data. The frequency range for result display is limited to the maximum span ("[\[SENSe:\]ADEMod:SPECTrum:SPAN\[:MAXimum\]](#)") or to the measurement bandwidth of analog demodulation ("[\[SENSe:\]ADEMod:BANDwidth|BWIDth:DEModulation](#)").

Parameter

<numeric_value>

Example

```
ADEM ON
Switches on the analog demodulator
CALC:FEED 'XTIM:SPEC'
Switches on RF spectrum result display"
ADEM:SPEC:SPAN:MAX 5 MHz
Sets the maximum span to 5 MHz
ADEM:SPEC:SPAN:ZOOM 1 MHz
Sets displayed span to 1 MHz
```

Characteristics

*RST value: 5 MHz
SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:SRATe?

This command returns the sample rate set up for the current analog demodulation measurement.

Example

```
ADEM:SRAT?
Returns the current sample rate.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:ZOOM[:STATe]

The command enables or disables the zoom function for the analog-demodulated measurement data. Depending on the selected measurement time and the demodulation bandwidth, the number of recorded test points may be greater than that shown on the display.

If the zoom function is enabled, the default number of sweep points in Spectrum Analyzer mode of the result memory are displayed from the specified start time with "[SENSe:\]ADEMod:ZOOM:STARt](#)".

If the zoom function is disabled, data reduction is used to adapt the test points to the number of points available on the display.

Parameter

ON | OFF

Example

```
ADEMod:ZOOM ON
```

Switches on the zoom function

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe:]ADEMod:ZOOM:STARt

The command selects the start time for the display of individual measured values of the analog demodulation. The maximum possible value depends on the measurement time, which is set in the instrument and can be queried with the "[SENSe:\]ADEMod:MTIME](#)" command.

If the zoom function is enabled, the default number of sweep points in Spectrum Analyzer mode of the result memory are displayed from the specified start time with "[SENSe:\]ADEMod:ZOOM:STARt](#)".

Parameter

0 s to measurement time - (default number of sweep points in Spectrum Analyzer mode – 1 * 1/sample rate)

Example

```
ADEM: ZOOM ON
Switches on the zoom function
ADEM: ZOOM: STAR 500us
Sets the starting point of the display to 500 µs.
```

Characteristics

*RST value: 0 s
 SCPI: device-specific

Mode

ADEMOD

10.4.4.4 SENSE:BANDwidth Subsystem (Analog Demodulation, R&S FSV-K7)

This subsystem controls the setting of the instruments filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

Commands of the SENSE:BANDwidth Subsystem

◆ "[SENSe<1|2>:]BANDwidth|BWIDth:DEMod"

[SENSe<1|2>:]BANDwidth|BWIDth:DEMod

This command sets the bandwidth for analog demodulation. Depending on the selected demodulation bandwidth, the instrument selects the required sampling rate.

The available values of the demodulation bandwidths are determined by the sampling rates. For details on the correlation between demodulation bandwidth and sampling rate refer to chapter "[Instrument Functions Analog Demodulation \(Option |variable=K7\)](#)" – "[Sample rate, measurement time and trigger offset](#)".

Parameter

<numeric_value>

Example:

```
BAND: DEM 1MHz
Sets test bandwidth to 1 MHz
```

Characteristics:

*RST value: 5 MHz
 SCPI: device-specific

Mode

A-F, ADEMOD

10.4.4.5 SENSE:FILTer Subsystem (Analog Demodulation, R&S FSV-K7)

The SENSE:FILTer subsystem selects the filters to reduce the bandwidth of the demodulated signal. The selected filters are used for AM, FM and PM demodulation in common.

Commands of the SENSE:FILTer subsystem

- ◆ "[SENSe<1|2>:]FILTer:DEMPHasis[:STATe]"
- ◆ "[SENSe<1|2>:]FILTer:DEMPHasis:TCONstant"
- ◆ "[SENSe<1|2>:]FILTer:HPASs[:STATe]"
- ◆ "[SENSe<1|2>:]FILTer:HPASs:FREQuency"
- ◆ "[SENSe<1|2>:]FILTer:LPASs[:STATe]"
- ◆ "[SENSe<1|2>:]FILTer:LPASs:FREQuency[:ABSolute]"
- ◆ "[SENSe<1|2>:]FILTer:LPASs:FREQuency:RELative"

[SENSe<1|2>:]FILTer:DEMPHasis[:STATe]

This command activates/deactivates the selected deemphasis.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[Deemphasis](#)" on page 680

Parameter

ON | OFF

Example

```
FILT:DEMP ON
```

Activates the selected deemphasis.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

ADEMODO

[SENSe<1|2>:]FILTer:DEMPHasis:TCONstant

This command selects the deemphasis. For details on deemphasis refer to the "[Deemphasis](#)" softkey.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[Deemphasis](#)" on page [680](#)

Parameter

25 us | 50 us | 75 us | 750 us

Example

```
FILT:DEMP:TCON 750us
```

Selects the deemphasis for the demodulation bandwidth range from 800 Hz to 4 MHz with a time constant of 750 µs.

Characteristics

*RST value: 50 us

SCPI: device-specific

Mode

ADEMOD

[SENSe<1|2>:]FILTer:HPASs[:STATE]

This command activates/deactivates the selected high pass filter.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[High Pass AF Filter](#)" on page [679](#)

Parameter

ON | OFF

Example

```
FILT:HPAS ON
```

Activates the selected high pass filter.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe<1|2>:]FILTer:HPASs:FREQuency

This command selects the high pass filter type. For details on filters refer to "[High Pass AF Filter](#)" softkey.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[High Pass AF Filter](#)" on page 679

Parameter

50Hz | 300Hz

Example

```
FILT:HPAS:FREQ 300Hz
```

Selects the high pass filter for the demodulation bandwidth range from 800 Hz to 16 MHz.

Characteristics

*RST value: 300Hz

SCPI: device-specific

Mode

ADEMOD

[SENSe<1|2>:]FILTer:LPASs[:STATE]

This command activates/deactivates the selected low pass filter.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[Low Pass AF Filter](#)" on page 678.

Parameter

ON | OFF

Example

```
FILT:LPAS ON
```

Activates the selected low pass filter.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

ADEMOD

[SENSe<1|2>:]FILTer:LPASs:FREQuency[:ABSolute]

This command selects the absolute low pass filter type. For details on filters refer to "[Low Pass AF Filter](#)" softkey.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[Low Pass AF Filter](#)" on page 678.

Parameter

3kHz | 15kHz | 150kHz

Example

```
FILT:LPAS:FREQ 150kHz
```

Selects the low pass filter for the demodulation bandwidth range from 400 kHz to 16 MHz.

Characteristics

*RST value: 15kHz

SCPI: device-specific

Mode

ADEMODO

[SENSe<1|2>:]FILTer:LPASs:FREQuency:RELAtive

This command selects the relative low pass filter type. For details on filters refer to "[Low Pass AF Filter](#)" softkey.

The numeric suffixes <1|2> are irrelevant.

For details about the demodulation bandwidth range refer to "[Low Pass AF Filter](#)" on page 678.

Parameter

5PCT | 10PCT | 25PCT

Example

```
FILT:LPAS:FREQ 25PCT
```

Selects the low pass filter as 25% of the demodulation bandwidth.

Characteristics

*RST value: 25PCT

SCPI: device-specific

Mode

ADEMODO

10.4.4.6 SENSE:FREQUENCY Subsystem (Analog Demodulation, R&S FSV-K7)

The SENSE:FREQUENCY subsystem defines the frequency axis of the active display. The frequency axis can either be defined via the start/stop frequency or via the center frequency and span.

Commands of the SENSE:FREQUENCY Subsystem

◆ "[\[SENSe<1|2>:FREQUENCY:CENTer:STEP:LINK](#)"

[\[SENSe<1|2>:FREQUENCY:CENTer:STEP:LINK](#)

Parameter

SPAN	coupling to frequency display range (for RF spectrum result display)
RBW	coupling to demodulation bandwidth (for all result displays except RF spectrum)
OFF	manual input, no coupling

For further details refer to "[\[SENSe<1|2>:FREQUENCY:CENTer:STEP:LINK](#)" in the description of the base unit.

10.4.4.7 SENSE:SWEEP Subsystem (Analog Demodulation, R&S FSV-K7)

The SENSE:SWEEP subsystem controls the sweep parameters.

Commands of the SENSE:SWEEP Subsystem

◆ "[\[SENSe<1|2>:SWEEP:TIME](#)"

[\[SENSe<1|2>:SWEEP:TIME](#)

Parameter

Refer to chapter "[Instrument Functions Analog Demodulation \(Option variable=K7\)](#)" – "[Sample rate, measurement time and trigger offset](#)".

For further details refer to "[\[SENSe<1|2>:SWEEP:TIME](#)".

10.4.5 TRACe Subsystem (Analog Demodulation, R&S FSV-K7)

The TRACe subsystem controls access to the instruments internal trace memory.

Commands of the TRACe Subsystem

- ◆ "[TRACe<1|2>\[:DATA\]](#)"

TRACe<1|2>[:DATA]

If the analog demodulator (option Analog Demodulation, R&S FSV-K7) is active, only the displayed trace data is read out and recalled. A portion of the measurement data that can be called by means of a marker, however, is calculated from the raw measurement data. These results are no longer available after recalling a trace; the associated queries generate a query error.

For further information refer to "[TRACe<1|2>\[:DATA\]](#)".

10.4.6 TRIGger Subsystem (Analog Demodulation, R&S FSV-K7)

The TRIGger subsystem is used to synchronize instrument actions with events. It is thus possible to control and synchronize the start of a sweep.

Commands of the TRIGger Subsystem

- ◆ "[TRIGger<1|2>\[:SEQuence\]:LEVel:AM\[:ABSolute\]](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:LEVel:AM:RELative](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:LEVel:FM](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:LEVel:PM](#)"
- ◆ "[TRIGger<1|2>\[:SEQuence\]:SOURce](#)"

TRIGger<1|2>[:SEquence]:LEVel:AM[:ABSolute]

The command sets the level when RF power signals are used as trigger source.

Note: For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameter

-100 to +30 dBm

Example

```
TRIG:LEV:AM -30 dBm
```

Sets the RF power signal trigger threshold to -30 dBm

Characteristics

*RST value: -20 dBm

SCPI: device-specific

Mode

ADEMODO

TRIGger<1|2>[:SEquence]:LEVel:AM:RELative

The command sets the level when AM-modulated signals are used as trigger source.

Note: For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameter

-100 to +100 %

Example

```
TRIG:LEV:AM:REL -20 %
```

Sets the AM trigger threshold to -20 %

Characteristics

*RST value: 0 %

SCPI: device-specific

Mode

ADEMODO

TRIGger<1|2>[:SEQuence]:LEVel:FM

The command sets the level when FM-modulated signals are used as trigger source.

Note: For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameter

-10 to +10 MHz

Example

```
TRIG:LEV:FM 10 kHz
```

Sets the FM trigger threshold to 10 kHz

Characteristics

*RST value: 0 Hz

SCPI: device-specific

Mode

ADEMODO

TRIGger<1|2>[:SEQuence]:LEVel:PM

The command sets the level when PM-modulated signals are used as trigger source.

Note: For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Parameter

-1000 to +1000 RAD | DEG

Example

```
TRIG:LEV:PM 1.2 RAD
```

Sets the PM trigger threshold to 1.2 rad

Characteristics

*RST value: 0 RAD

SCPI: device-specific

Mode

ADEMODO

TRIGger<1|2>[:SEQuence]:SOURce

Parameter

IMMediate (Free Run) | EXTern | IFPower | AF | FM | AM | AMRelative | PM

The parameter AM corresponds to the RF power signal, the parameter AMRelative corresponds to the AM signal.

For details on trigger modes refer to "[Trigger Source](#)" softkey.

Note: For triggering with AF, AM, AMRelative, FM, and PM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

For further details refer to "[TRIGger<1|2>\[:SEQuence\]:SOURce](#)".

10.4.7 UNIT Subsystem (Analog Demodulation, K7)

The UNIT subsystem sets the basic unit of the setting parameters.

Commands of the UNIT Subsystem

◆ "[UNIT:ANGLE](#)"

UNIT:ANGLE

This command selects the unit for angles.

Parameter

DEG | RAD

Example

```
UNIT:ANGL DEG
```

Characteristics

*RST value: RAD

SCPI: conform

Mode

ADEM0D

11 Firmware Option Power Sensor R&S FSV-K9

11.1 Overview of Firmware Option R&S FSV-K9

This manual contains all information about the operation of an R&S FSV equipped with Application Firmware R&S FSV-K9. It covers operation via menus and the remote control commands for power sensor measurements.

This manual consists of 5 chapters:

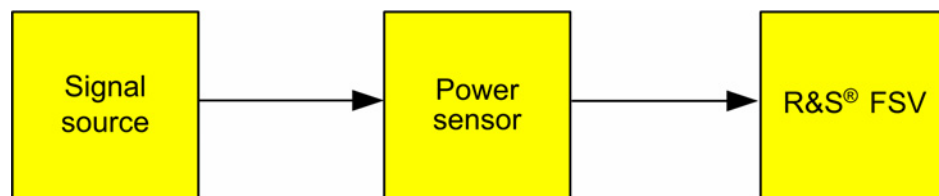
Chapter 1.1	Gives a brief overview over the document structure.
Chapter 1.2	Describes the overall instrument functions and provides further information
Chapter 1.3	Shows all softkeys available in the power sensor menu. This chapter also presents the remote control commands associated with each softkey function.
Chapter 1.4	Describes all remote control commands defined for the power sensor measurement.
Chapter 1.5	Contains device-specific error messages for R&S FSV-K9.

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware R&S FSV-K9. For all other descriptions, please refer to the R&S FSV Analyzer operating manual.

11.2 Instrument Functions Power Sensor (R&S FSV-K9)

For precise power measurement a power sensor is connected to the instrument via the front panel (USB connector) or the rear panel (power sensor, option R&S FSV-B5). The Power Sensor Support firmware option provides the power measurement functions for this test setup (see "[Figure 1: Power sensor support - standard test setup](#)"). Both manual operation and remote control are supported. The functions of this firmware option are described in this section. For details on the connectors and compatible power sensors refer to the Quick Start Guide, chapter 1, "Front and Rear Panel".

Figure 44: Power sensor support - standard test setup



To open the power sensor menu

The power sensor option R&S FSV-K9 is integrated within the "INPUT / OUTPUT" menu.

- ◆ Press the "INPUT / OUTPUT" key.
- ◆ Press the "Power Sensor" softkey.
The power sensor menu is displayed.

Menu and softkey description

- ◆ "[Softkeys of the power sensor menu](#)" on page 746

All other menus are provided as described for the base unit. For details refer to the corresponding menu descriptions.

To display help to a softkey, press the "HELP" key and then the softkey for which you want to display help. To close the help window, press the "ESC" key. For further information refer to section "[How to use the Help System](#)".

11.2.1 Tasks

- ◆ ["To zero the power sensor"](#)
- ◆ ["To use the power sensor"](#)

11.2.1.1 To zero the power sensor

1. Press the ["Zero"](#) softkey.
A dialog box is displayed that prompts you to disconnect all signals from the input of the power sensor.
2. Disconnect all signals from the input of the power sensor and press "ENTER" to continue.
3. Wait until zeroing is complete.
A corresponding message is displayed.

11.2.1.2 To use the power sensor

1. Press the ["Frequency Coupling"](#) softkey to select the coupling option.
2. If you have selected the "Manual" coupling option, press the ["Frequency Manual"](#) softkey to enter the frequency of the signal which power you want to measure.
3. Press the ["Unit/Scale"](#) softkey to set the unit for the power result display.
4. If you have selected dB or % as units (relative display), define a reference value:

<ul style="list-style-type: none">– To set the currently measured power as a reference value, press the "Meas->Ref" softkey.– To enter a reference value, press the "Reference Value" softkey.
--
5. Press the ["Meas Time / Average"](#) softkey to select the measurement time. For recommendations refer to the ["Meas Time / Average"](#) softkey description.

11.3 Softkeys of the power sensor menu (R&S FSV-K9)

The following table shows all softkeys available in the power sensor menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Power Sensor On/Off
Frequency Manual
Frequency Coupling
Unit/Scale
Zero
Meas Time / Average
Meas->Ref
More
Reference Value
Use Ref Lev Offset
Number of Readings
Ext Power Trigger
Trigger Level

Power Sensor On/Off

Switches the power measurement on or off.

→ Remote: [PMET ON](#)

Frequency Manual

Opens an edit dialog box to enter the frequency of the signal to be measured. The power sensor has a memory with frequency-dependent correction factors. This allows extreme accuracy for signals of a known frequency.

→ Remote: [PMET:FREQ 1GHZ](#)

Frequency Coupling

Opens the "Frequency Coupling" dialog box to select the coupling option. The frequency can be coupled automatically to the center frequency of the instrument or to the frequency of marker 1.

→ Remote: [PMET:FREQ:LINK CENT](#)

Unit/Scale

Opens the "Unit"/"Scale" dialog box to select the unit with which the measured power is to be displayed. Available units are dBm, dB, W and %.

If dB or % is selected, the display is relative to a reference value that is defined with either the "[Meas->Ref](#)" softkey or the "[Reference Value](#)" softkey.

→ Remote: [UNIT:PMET:POW DBM](#)

→ Remote: [UNIT:PMET:POW:RAT DB](#)

Zero

Starts zeroing of the power sensor. For details on the zeroing process refer to "[To zero the power sensor](#)" on page 745.

→ Remote: [CAL:PMET:ZERO:AUTO ONCE;*WAI](#)

Meas Time / Average

Opens the "Meas Time" dialog box to select the measurement time or to switch to manual averaging mode. In general, results are more precise with longer measurement times. The following settings are recommended for different signal types to obtain stable and precise results:

- | | |
|----------|---|
| "Short" | Stationary signals with high power (> -40dBm), because they require only a short measurement time and short measurement time provides the highest repetition rates. |
| "Normal" | Signals with lower power or of modulated signals |
| "Long" | Signals at the lower end of the measurement range (<-50 dBm) or signals with lower power to minimize the influence of noise. |
| "Manual" | Switches to manual averaging mode. The average count is set with the " Number of Readings " softkey. |

→ Remote: [PMET:MTIM SHOR](#)

→ Remote: [PMET:MTIM:AVER ON](#)

Meas->Ref

Sets the currently measured power as a reference value for the relative display. The reference value can also be set manually via the "[Reference Value](#)" softkey.

→ Remote: [CALC:PMET:REL:AUTO ONCE](#)

Reference Value

Opens an edit dialog box to enter a reference value for relative measurements in the unit dBm.

→ Remote: [CALC:PMET:REL -30DBM](#)

Use Ref Lev Offset

If activated, takes the reference level offset set for the analyzer ([Ref Level Offset](#) softkey) into account for the measured power. If deactivated, takes no offset into account.

→ Remote: [PMET:ROFF OFF](#)

Number of Readings

Opens an edit dialog box to enter the number of readings (averagings) to be performed after a single sweep has been started. This softkey is only available if manual averaging is selected ("[Meas Time / Average](#)" softkey).

The values for the average count range from 0 to 256 in binary steps (1, 2, 4, 8, ...).

For average count = 0 or 1, one reading is performed. The averaging and sweep count of the trace menu are independent from this setting.

Results become more stable with extended average, particularly if signals with low power are measured. This setting can be used to minimize the influence of noise in the power sensor measurement.

→ Remote: [PMET:MTIM:AVER:COUN 8](#)

Ext Power Trigger

Activates the creation of a trigger signal in the power sensor. When pressing the softkey, the following softkeys of the power meter menu become unavailable:

Unit/Scale, Reference Value, Use Ref Lev Offset and Number of Readings.

Pressing the softkey causes the transmission of the following remote commands to the power sensor:

```
*RST
ENS:AVER:STAT OFF
RIG:MAST:STAT ON
Remote: RIG:SOUR INT
Remote: RIG:SLOP POS
Remote: RIG:DTIM 100e-6
Remote: NIT:CONT ON
```

This softkey is only available in conjunction with a NRP-Z81 power sensor.

→ Remote: [SENS:PMET:TRIG ON](#)

Trigger Level

Opens an edit dialog box to enter the trigger level.

This softkey is only available in conjunction with a NRP-Z81 power sensor.

→ Remote: [SENS:PMET:TRIG:LEV -10 dBm](#)

11.4 Remote Commands of the power sensor option (R&S FSV-K9)

In this section all remote control commands for Power Sensor option are described in detail. The abbreviation PSM stands for the power sensor operating mode. For details on conventions used in this chapter refer to section "[Notation](#)" of the base unit. For further information on analyzer or basic settings commands, refer to the corresponding subsystem in "[Remote Control – Description of Analyzer Commands](#)" or section "[Remote Control - Description of Basic Settings Commands](#)".

Subsystems of the Power Sensor option (K9)

- "[CALCulate Subsystem \(Power Sensor, K9\)](#)" on page 749
- "[CALibration Subsystem \(Power Sensor, K9\)](#)" on page 752
- "[FETCh Subsystem \(Power Sensor, K9\)](#)" on page 753
- "[READ Subsystem \(Power Sensor, K9\)](#)" on page 753
- "[SENSe Subsystem \(Power Sensor, K9\)](#)" on page 754
- "[UNIT Subsystem \(Power Sensor, K9\)](#)" on page 760

11.4.1 CALCulate Subsystem (Power Sensor, K9)

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the SENSe subsystem.

The following subsystems are included:

["CALCulate:PMETer Subsystem"](#) on page 750

11.4.1.1 CALCulate:PMETer Subsystem (Power Sensor, K9)

This subsystem controls the instrument settings for power sensor measurements.

Commands of the CALCulate:PMETer Subsystem

- ◆ "[CALCulate<1|2>:PMETer:RELative\[:MAGNitude\]](#)"
- ◆ "[CALCulate<1|2>:PMETer:RELative\[:MAGNitude\]:AUTO](#)"
- ◆ "[CALCulate<1|2>:PMETer:RELative:STATe](#)"

CALCulate<1|2>:PMETer:RELative[:MAGNitude]

This command sets the reference value for relative measurements.
The numeric suffixes <1|2> are irrelevant.

Parameter

-200 to 200

Example

```
CALC:PMET:REL -30
```

Sets the reference value for relative measurements to -30 dBm.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

PSM

CALCulate<1|2>:PMETer:RELative[:MAGNitude]:AUTO

This command takes the current measurement value as reference value for relative measurements.

The numeric suffixes <1|2> are irrelevant.

Parameter

ONCE

Example

```
CALC:PMET:REL:AUTO ONCE
```

Takes the current measurement value as reference value for relative measurements.

Characteristics

*RST value: -

SCPI: device-specific

Mode

PSM

CALCulate<1|2>:PMETer:RELative:STATe

This command switches between relative and absolute display of the measured power.

The numeric suffixes <1|2> are irrelevant.

Parameter

ON | OFF

Example

```
CALC:PMET:REL:STAT ON
```

Activates the relative display of the measured value.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

PSM

11.4.2 CALibration Subsystem (Power Sensor, K9)

The CALibration subsystem determines the data for system error correction in the instrument.

The following subsystem is included:

["CALibration:PMETer Subsystem"](#) on page 752

11.4.2.1 CALibration:PMETer Subsystem (Power Sensor, K9)

The CALibration:PMETer Subsystem determines the error correction data for measurements in the power meter mode.

Commands of the CALibration:PMETer Subsystem

◆ ["CALibration:PMETer:ZERO:AUTO"](#)

CALibration:PMETer:ZERO:AUTO

This command starts zeroing of the power sensor.

Note: Before starting the zeroing process disconnect all signals from the input of the power sensor.

Parameter

ONCE

Example

```
:CAL:PMET:ZERO:AUTO ONCE;*WAI
```

Starts zeroing and delays the execution of further commands until zeroing is concluded.

Characteristics

*RST value: -

SCPI: device-specific

Mode

PSM

11.4.3 FETCh Subsystem (Power Sensor, K9)

The FETCh subsystem contains commands for reading out results of complex measurement tasks.

The following subsystem is included:

["FETCh:PMETer Subsystem"](#) on page 753

11.4.3.1 FETCh:PMETer Subsystem (Power Sensor, K9)

The FETCh:PMETer subsystem contains commands to read measurement results of power sensor measurements without starting the measurement itself.

Commands of the FETCh:PMETer Subsystem

◆ ["FETCh<1|2>:PMETer?"](#)

FETCh<1|2>:PMETer?

This command reads the result of the power sensor measurement.

If no measurement has been performed, this command will lead to a query error.

This command is a query and therefore has no *RST value.

Example

```
FETC:PMET?
```

Reads the result of the power sensor measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

PSM

11.4.4 READ Subsystem (Power Sensor, K9)

The READ subsystem contains commands for starting complex measurement tasks, and for querying the results subsequently.

The following subsystem is included:

["READ:PMETer Subsystem"](#) on page 754

11.4.4.1 READ:PMETer Subsystem

This subsystem contains commands to start power sensor measurements and to read the results after the measurement is concluded.

Commands of the READ:PMETer Subsystem

◆ ["READ<1|2>:PMETer?"](#)

READ<1|2>:PMETer?

This command starts a power sensor measurement and reads the result after the measurement is concluded.

This command is a query and therefore has no *RST value.

Example

```
READ:PMET?
```

Starts a measurement and read the result.

Characteristics

*RST value: -

SCPI: device-specific

Mode

PSM

11.4.5 SENSE Subsystem (Power Sensor, K9)

The SENSE subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSE subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSE" is optional for this reason, which means that it is not necessary to include the SENSE node in command sequences.

The following subsystems are included:

["SENSe:PMETer Subsystem"](#) on page 755

11.4.5.1 SENSE:PMETer Subsystem (Power Sensor, K9)

This subsystem controls the device settings for power sensor measurements.

Commands of the SENSE:PMETer Subsystem

- ◆ "[SENSe<1|2>:]PMETer:STATe]"
- ◆ "[SENSe<1|2>:]PMETer:FREQuency]"
- ◆ "[SENSe<1|2>:]PMETer:FREQuency:LINK]"
- ◆ "[SENSe<1|2>:]PMETer:MTIMe]"
- ◆ "[SENSe<1|2>:]PMETer:MTIMe:AVERage:STATe]"
- ◆ "[SENSe<1|2>:]PMETer:MTIMe:AVERage:COUNt]"
- ◆ "[SENSe<1|2>:]PMETer:ROFFset:STATe]"

[SENSe<1|2>:]PMETer[:STATe]

This command switches the power sensor measurements on or off.

The numeric suffixes <1|2> are irrelevant.

Parameter

ON | OFF

Example

```
PMET ON
```

Switches the power sensor measurements on.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:FREQuency

This command sets the frequency of the power sensor. The limits f_{\min} and f_{\max} are defined by the power sensor.

The numeric suffixes <1|2> are irrelevant.

Parameter

f_{\min} ... f_{\max}

Example

```
PMET:FREQ 1GHZ
```

Sets the frequency of the power sensor to 1 GHz.

Characteristics

*RST value: 50 MHz

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:FREQuency:LINK

This command sets the frequency coupling of the power sensor.

The numeric suffixes <1|2> are irrelevant.

Parameter

CENTER couples the frequency to the center frequency of the analyzer

MARKer1 couples the frequency to the position of marker 1

OFF switches the frequency coupling off

Example

```
PMET:FREQ:LINK CENT
```

Couples the frequency to the center frequency of the analyzer

Characteristics

*RST value: CENT

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:MTIME

This command sets the measurement duration of the power sensor.

The numeric suffixes <1|2> are irrelevant.

Parameter

SHORt | NORMal | LONG

Example

```
PMET:MTIM SHOR
```

Sets a short measurement duration for measurements of stationary high power signals.

Characteristics

*RST value: NORM

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:MTIME:AVERage[:STATE]

This command activates or deactivates manual averaging. The average count is set with the "[\[SENSe<1|2>:\]PMETer:MTIME:AVERage:COUNt](#)" command.

Parameter

ON | OFF

Example

```
PMET:MTIM:AVER ON
```

Activates manual averaging.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

PSM

[SENSe<1|2>]:PMETer:MTIME:AVERAge:COUNT

This command defines the number of readings (averagings) to be performed after a single sweep has been started. This command is only available if the "[\[SENSe<1|2>\]:PMETer:MTIME:AVERAge:STATe](#)" command is set to ON. Results become more stable with extended average, particularly if signals with low power are measured. This setting can be used to minimize the influence of noise in the power meter measurement.

Parameter

0 to 256 in binary steps (1, 2, 4, 8,...)

For average count = 0 or 1, one reading is performed.

Example

```
PMET:MTIM:AVER ON
```

Activates manual averaging.

```
PMET:MTIM:AVER:COUN 8
```

Sets the number of readings to 8.

Characteristics

*RST value:

SCPI: device-specific

Mode

PSM

[SENSe<1|2>]:PMETer:ROFFset[:STATe]

This command defines whether the reference level offset set for the analyzer is taken into account for the measured power or not. The numeric suffixes <1|2> are irrelevant.

Parameter

ON Adds the offset defined by the "[DISPlay:WINDow<1|2>:TRACe<1...6>:Y:SCALE:RLEVel:OFFSet](#)" command to the measured level.

OFF Takes no offset into account.

Example

```
PMET:ROFF OFF
```

Takes no offset into account for the measured power.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:TRIGger[:STATe]

This command switches the external power trigger on or off.

The numeric suffixes <1|2> are irrelevant.

This command is only available in conjunction with a NRP-Z81 power sensor.

Parameter

ON | OFF

Example

```
PMET:TRIG ON
```

Switches the external power trigger on

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

PSM

[SENSe<1|2>:]PMETer:TRIGger:LEVel

This command sets the power level for the external power trigger.

The numeric suffixes <1|2> are irrelevant.

This command is only available in conjunction with a NRP-Z81 power sensor.

Parameter

-20 to +20 dBm

Example

```
PMET:TRIG:LEV -10 dBm
```

Sets the level of the trigger

Characteristics

*RST value: -10 dBm

SCPI: device-specific

Mode

PSM

11.4.6 UNIT Subsystem (Power Sensor, K9)

The UNIT subsystem sets the basic unit of the setting parameters.

The following subsystems are included:

["UNIT:PMETer Subsystem"](#) on page 760

11.4.6.1 UNIT:PMETer Subsystem (Power Sensor, K9)

The UNIT:PMETer subsystem sets the basic unit for power sensor measurement.

Commands of the UNIT:PMETer Subsystem

- ◆ ["UNIT<1|2>:PMETer:POWer"](#)
- ◆ ["UNIT<1|2>:PMETer:POWer:RATio"](#)

UNIT<1|2>:PMETer:POWer

This command selects the unit for absolute power sensor measurement.

Parameter

DBM | WATT | W

Example

```
UNIT:PMET:POW DBM
```

Characteristics

*RST value: DBM

SCPI: conform

Mode

PSM

UNIT<1|2>:PMETer:POWer:RATio

This command selects the unit for relative power sensor measurement.

Parameter

DB | PCT

Example

```
UNIT:PMET:POW:RAT DB
```

Characteristics

*RST value: DB

SCPI: conform

Mode

PSM

11.5 Error messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTEM:ERRor?`. A short explanation of the device-specific error messages for R&S FSV-K9 is given below.

Status bar message	Description
Zeroing could not be performed	Zeroing could not be performed because the RF power applied is too high.
Power sensor zero failed	

12 Firmware Option 3GPP BS Measurement R&S FSV-K72

12.1 Overview of Firmware Option R&S FSV-K72

This manual contains all information about the operation of an R&S FSV equipped with Application Firmware R&S FSV-K72. It covers operation via menus and the remote control commands for the 3GPP FDD base station test.

This manual consists of 9 chapters:

Chapter 1.1	Gives a brief overview over the document structure
Chapter 1.2	Explains some basic 3GPP°FDD base station tests.
Chapter 1.3	Describes the measurement setup for base station tests.
Chapter 1.4	Gives an overview over the test models with different channel configurations.
Chapter 1.5	Describes the instrument functions of 3GPP Base Station Measurements
Chapter 1.6	Contains a detailed description of the possible base station test measurements as a reference for manual operation. This chapter also presents a list of remote control commands associated with each function.
Chapter 1.7	Describes all remote control commands defined for the code domain measurement. An alphabetic list of all remote control commands and a table of softkeys with the assignment of commands are provided at the end of this chapter.
Chapter 1.8	Contains device-specific error messages for R&S FSV-K72.
Chapter 1.9	Contains an explanation of terms related to measured quantities of the code domain measurement.

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware R&S FSV-K72. For all other descriptions, please refer to the R&S FSV Analyzer operating manual.

12.2 Getting Started

This chapter explains some basic 3GPP®FDD base station tests. It describes how operating and measurement errors can be avoided using correct presetting. The measurements are performed with an R&S FSV analyzer equipped with option R&S FSV-K72.

The measurement screen is presented in chapter ?? for each measurement.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown. The following measurements are performed:

- ◆ Measurement 1: Measurement of the spectrum
- ◆ Measurement 2: Measurement of the spectrum emission mask
- ◆ Measurement 3: Measurement of the relative code domain power
Setting: Analyzer center frequency set to the DUT frequency
Setting: Scrambling code of signal
- ◆ Measurement 4: Triggered measurement of the relative code domain power
Setting: Trigger offset
- ◆ Measurement 5: Measurement of the composite EVM
- ◆ Measurement 6: Measurement of the peak code domain error

The measurements are performed using the following units and accessories:

- ◆ The R&S FSV Analyzer with Application Firmware R&S FSV-K72: 3GPP FDD base station test
- ◆ The Vector Signal Generator R&S SMIQ with option R&S SMIQB45: digital standard 3GPP (options R&S SMIQB20 and R&S SMIQB11 required)
- ◆ 1 coaxial cable, 50 Ω , approx. 1 m, N connector
- ◆ 1 coaxial cable, 50 Ω , approx. 1 m, BNC connector

12.2.1 Measurement Examples (Option R&S FSV-K72)

12.2.1.1 Basic Settings in Code Domain Measurement Mode

In the default mode after a PRESET, the R&S Analyzer is in the analyzer mode. The following default settings of the code domain measurement are activated provided that the code domain analyzer mode is selected.

Parameter	Setting
Digital standard	W-CDMA 3GPP FWD
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
Trigger settings	FREE RUN
Trigger offset	0
Scrambling code	0
Threshold value	-60 dB
Symbol rate	15 ksps
Code number	0
Slot number	0
Display	Screen A: CODE DOMAIN POWER Screen B: RESULT SUMMARY

12.2.1.2 Measurement 1: Measurement of the Signal Channel Power

The R&S Analyzer measures the unweighted RF signal power in a bandwidth of:

$$f_{BW} = 5 \text{ MHz} \geq (1 + \alpha) \cdot 3.84 \text{ MHz} \quad | \quad \alpha = 0.22$$

The power is measured in the zero span mode (time domain measurement) using a digital channel filter of 5 MHz in bandwidth. According to the 3GPP standard, the measurement bandwidth is 5 MHz.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the RF input of the R&S Analyzer (coaxial cable with N connectors).
2. Setting on the R&S SMU	<p>[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz] [Baseband] [3GPP FDD] [Test Setup] [Test_Model_1_32channels] STATE: ON</p>
3. Setting on the R&S Analyzer	<p>[PRESET] [CENTER: 2.1175 GHz] [AMPT: 0 dBm] [MODE: 3G FDD BS] [MEAS: POWER]</p>
4. Measurement on the R&S Analyzer	<p>The following is displayed:</p> <ul style="list-style-type: none"> – Time domain trace of the WCDMA signal. – Signal channel power within a bandwidth of 5 MHz (in the marker info field)

12.2.1.3 Measurement 2: Measurement of the Spectrum Emission Mask

The 3GPP specification defines a measurement that monitors compliance with a spectral mask in a range of at least ± 12.5 MHz around the WCDMA carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier by means of a 30 kHz filter, and in the ranges far away from the carrier by means of a 1 MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the RF input of the R&S Analyzer (coaxial cable with N connectors).
2. Setting on the R&S SMU	<p>[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz] [Baseband] [3GPP FDD] [Test Setup] [Test_Model_1_32channels] STATE: ON</p>
3. Setting on the R&S Analyzer	<p>[PRESET] [CENTER: 2.1175 GHz] [AMPT: 0 dBm] [MODE: 3G FDD BS] [MEAS: Spectrum Emission Mask]</p>
4. Measurement on the R&S Analyzer	<p>The following is displayed:</p> <ul style="list-style-type: none"> – Spectrum of the 3GPP FDD signal – Limit line defined in the standard – Information on limit line violations (passed/failed)

12.2.1.4 Measurement 3: Measurement of the Relative Code Domain Power

A code domain power measurement on one of the test models (model 1 with 32 channels) is shown in the following. To demonstrate the effects, the basic parameters of the CDP measurements permitting an analysis of the signal are changed one after the other from values adapted to the measurement signal to non-adapted values.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the RF input of the R&S Analyzer (coaxial cable with N connectors). – Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to
---------------	--

	the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).
2. Setting on the R&S SMIQ	[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz] [Baseband] [3GPP FDD] [Test Setup] [Test_Model_1_32channels] STATE: ON
3. Setting on the R&S Analyzer	[PRESET] [CENTER: 2.1175 GHz] [AMPT: 10 dBm] [MODE: 3G FDD BS] [SETTINGS: SCRAMBLING CODE 0]
4. Measurement on the R&S Analyzer	The following is displayed: <ul style="list-style-type: none"> – Screen A: Code domain power of signal (test model 1 with 32 channels) – Screen B: Numeric results of CDP measurement

Setting: Synchronization of the Reference Frequencies

Synchronization of the reference oscillators both of the DUT and the analyzer strongly reduces the measured frequency error.

1. Test setup	<ul style="list-style-type: none"> – Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors).
2. Setting on the R&S SMIQ	see measurement 2
3. Setting on the R&S Analyzer	see measurement 2 plus: SETUP: REFERENCE EXT
4. Measurement on the R&S Analyzer	<ul style="list-style-type: none"> – The displayed frequency error should be < 10 Hz

**Note**

The reference frequencies of the analyzer and of the DUT should be synchronized.

Setting: Behaviour with Deviating Center Frequency Setting

In the following, the behaviour of the DUT and the analyzer with an incorrect center frequency setting is shown.

1. Test setup	<ul style="list-style-type: none"> – Tune the center frequency of the signal generator in 0.5 kHz steps and watch the analyzer screen:
2. Measurement on the R&S Analyzer	<ul style="list-style-type: none"> – A CDP measurement on the analyzer is still possible with a frequency error of up to approx. 1 kHz. Up to 1 kHz, a frequency error causes no apparent difference in the accuracy of the code domain power measurement. – Above a frequency error of 1 kHz, the probability of impaired synchronization increases. With continuous measurements, all channels are at times displayed in blue with almost the same level. – Above a frequency error of approx. 2 kHz, a CDP measurement cannot be performed. The R&S Analyzer displays all possible codes in blue with a similar level.
3. Setting on the R&S SMIQ	<ul style="list-style-type: none"> – Set the signal generator center frequency to 2.1175 GHz again: FREQ: 2.1175 GHz

**Note**

The analyzer center frequency should not differ from the DUT frequency by more than 2 kHz.

Setting: Behaviour with Incorrect Scrambling Code

A valid CDP measurement can be carried out only if the scrambling code set on the analyzer is identical to that of the transmitted signal.

1. Test setup	SELECT BS/MS BS 1: ON SCRAMBLING CODE: 0001 (the scrambling code is set to 0000 on the analyzer)
2. Setting on the R&S SMIQ	– The CDP display shows all possible codes with approximately the same level.
3. Setting on the R&S Analyzer	– Set scrambling code to new value [MEAS CONFIG] [Sync/Scrambling Settings] [Scrambling Code 01]
4. Measurement on the R&S Analyzer	The CDP display again shows the test model

**Note**

The scrambling code setting of the analyzer must be identical to that of the measured signal.

12.2.1.5 Measurement 4: Triggered Measurement of Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of approximately 20 ms of the test signal is recorded at an arbitrary moment to detect the start of a 3GPP FDD frame in this section. Depending on the position of the frame start, the required computing time can be quite long. Applying an external (frame) trigger can reduce the computing time.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the input of the R&S Analyzer. – Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S Analyzer to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors). – Connect the external trigger input on the rear panel of the R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMIQ (TRIGOUT1 of PAR DATA).
2. Setting on the R&S SMIQ	– See measurement 3
3. Setting on the R&S Analyzer	See measurement 3 plus [TRIG EXTERN]
4. Measurement on the R&S Analyzer	<p>The following is displayed:</p> <ul style="list-style-type: none"> – Screen A: Code domain power of signal (test model 1 with 32 channels) – Screen B: Numeric results of CDP measurement – Trigger to Frame: Offset between trigger event and start of 3GPP FDD frame <p>The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without an external trigger.</p>

Setting: Trigger Offset

A delay of the trigger event referenced to the start of the 3GPP FDD frame can be compensated by modifying the trigger offset.

1. Settings on the R&S Analyzer:	[TRIG] -> [TRIGGER OFFSET] -> 100 μ s
2. Measurement on the R&S Analyzer:	The Trigger to Frame parameter in the numeric results table (screen B) changes: Trigger to Frame -> -100 μ s

**Note**

A trigger offset compensates analog delays of the trigger event.

12.2.1.6 Measurement 5: Measurement of the Composite EVM

The 3GPP specification defines the composite EVM measurement as the average square deviation of the total signal:

An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the input of the R&S Analyzer. – Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S Analyzer to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors). – Connect the external trigger input on the rear panel of the R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).
2. Setting on the R&S SMIQ	<p>[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz]</p> <ul style="list-style-type: none"> – [Baseband] – [3GPP FDD] – [Test Setup] – [Test_Model_1_32channels] <p>STATE: ON</p>
3. Setting on the R&S Analyzer	<p>[PRESET] [CENTER: 2.1175 GHz] [REF: 10 dBm] [MODE: 3G FDD BS] [TRIG EXTERN] [RESULTS COMPOSITE EVM] [MEAS CONFIG] [Result Diagrams] [Screen B: Composite EVM]</p>

4. Measurement on the R&S Analyzer	The following is displayed: <ul style="list-style-type: none"> – Screen A: Code domain power of signal – Screen B: Composite EVM (EVM for total signal)
------------------------------------	---

12.2.1.7 Measurement 6: Measurement of Peak Code Domain Error

The peak code domain error measurement is defined in the 3GPP specification for WCDMA signals.

An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The difference of the two signals is projected onto the classes of the different spreading factors. The peak code domain error measurement is obtained by summing the symbols of each difference signal slot and searching for the maximum error code.

1. Test setup	<ul style="list-style-type: none"> – Connect the RF output of the R&S SMU to the input of the R&S Analyzer. – Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S Analyzer to the reference input (REF) on the rear panel of the R&S SMU (coaxial cable with BNC connectors). – Connect the external trigger input on the rear panel of the R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMU (TRIGOUT1 of PAR DATA).
2. Setting on the R&S SMIQ	[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz] [Baseband] [3GPP FDD] [Test Setup] [Test_Model_1_32channels] [STATE: ON]
3. Setting on the R&S Analyzer	[PRESET] [CENTER: 2.1175 GHz] [REF: 0 dBm] [3G FDD BS] [TRIG EXTERN] [MEAS CONFIG] [Result Diagrams] [Screen B: Composite EVM]

4. Measurement on the R&S Analyzer	<p>The following is displayed:</p> <ul style="list-style-type: none"> – Screen A: Code domain power of signal (Test model 1 with 32 channels) – Screen B: Peak code domain error (projection of error onto the class with spreading factor 256)
------------------------------------	---

12.2.1.8 Measurement 7: Measurement of the Trigger To Frame Time

The trigger to frame (TTF) time measurement yields the time between an external trigger event and the start of the 3GPP WCDMA frame. The result is displayed in the result summary. The trigger event is expected in a time range of one slot (667 μ s) before the frame start. The resolution and absolute accuracy depend on the analyzer type and the measurement mode.

Resolution of the TTF time measurement

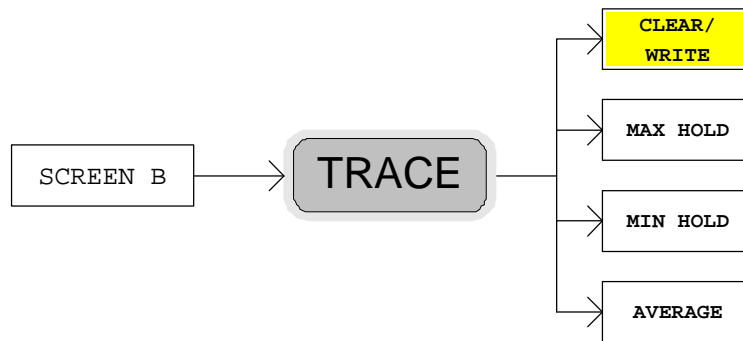
The resolution of the TTF time depends on the analyzer type that is used and the applied trace statistic mode. By using an average mode, the resolution can be increased. The higher the number of sweeps is, the higher is the resolution at the expense of measurement time. In the average mode, the TTF time is averaged for a number of sweeps (TRACE -> SWEEP COUNT). If the TTF time of the applied signal does not change during for this number of sweeps, the trigger resolution can be improved.

Absolute accuracy of the TTF time measurement

The absolute accuracy of the TTF time measurement depends on the level of the trigger pulse. The analyzer is calibrated to display the minimum deviation at a trigger pulse level of 4 V. The trigger threshold for an external trigger event is 1.4 V. Due to an internal lowpass between the back panel and the trigger detector, the trigger pulse is delayed in correlation to its own level.

Trace statistic in the result summary display

The trace statistic functions can be enabled by selecting SCREEN B. After screen B is selected, the trace menu can be called (press hardkey TRACE). In the trace menu, the kind of trace statistic can be selected.



The parameter SWEEP COUNT determines the number of sweeps. If measured with the trace statistic, the channel table is automatically switched to predefined mode. The last measured channel table is used and stored to "RECENT". In this case, any change in the signal channel configuration does not influence the displayed channel table.

<p>1. Test setup</p>	<ul style="list-style-type: none"> - Connect the RF output of the R&S SMIQ to the input of the R&S Analyzer. - Connect the reference input (EXT REF IN/OUT) on the rear panel of the R&S Analyzer to the reference input (REF) on the rear panel of the R&S SMIQ (coaxial cable with BNC connectors). - Connect the external trigger input on the rear panel of the R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of the R&S SMIQ (TRIGOUT1 of PAR DATA).
<p>2. Setting on the R&S SMU</p>	<p>[PRESET] [LEVEL: 0 dBm] [FREQ: 2.1175 GHz] Baseband 3GPP FDD Test Setup Test_Model_1_32channels STATE: ON</p>
<p>3. Setting on the R&S Analyzer</p>	<p>[PRESET] [CENTER: 2.1175 GHz] [REF: 0 dBm] [3G FDD BS] [TRIG EXTERN] [Result Diagrams] [Screen B: Result Summary [Change Focus to Screen B]] [TRACE AVERAGE]</p>

	[SWEEP COUNT <numeric value>
4. Measurement on the R&S Analyzer	The following is displayed: <ul style="list-style-type: none">– Screen A: Code domain power of signal (Test model 1 with 32 channels)– Screen B: Result summary with trace statistic evaluation

12.3 Setup for Base Station Tests

ATTENTION



Damaging to the instrument

Before turning the instrument on, the following conditions must be met:

- ◆ Instrument covers are in place and all fasteners are tightened
- ◆ Fan openings are free from obstructions
- ◆ Signal levels at the input connectors are all below specified maximum values
- ◆ Signal outputs are correctly connected and not overloaded

Noncompliance with these instructions may cause damage to the instrument.

This section describes how to set up the analyzer for 3GPP FDD base station tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, application firmware module R&S FSV-K72 must be properly installed following the instructions provided in the operating manual for the analyzer.

Standard Test Setup

- ◆ Connect antenna output (or TX output) of BTS to RF input of the analyzer via a power attenuator of suitable attenuation.

The following values are recommended for the external attenuator to ensure that the RF input of the analyzer is protected and the sensitivity of the analyzer is not reduced too much.

Max. power	Recommended ext. attenuation
≥55 to 60 dBm	35 to 40 dB
≥50 to 55 dBm	30 to 35 dB
≥45 to 50 dBm	25 to 30 dB
≥40 to 45 dBm	20 to 25 dB
≥35 to 40 dBm	15 to 20 dB
≥30 to 35 dBm	10 to 15 dB
≥25 to 30 dBm	5 to 10 dB
≥20 to 25 dBm	0 to 5 dB
<20 dBm	0 dB

- ◆ For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (EXT REF IN/OUT).
- ◆ To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on base stations. For instance, a rubidium frequency standard may be used as a reference source.
- ◆ If the base station is provided with a trigger output, connect this output to the rear trigger input of the analyzer (EXT TRIG GATE).

Presetting

- ◆ Enter external attenuation (REF LVL OFFSET)
- ◆ Enter reference level
- ◆ Enter center frequency
- ◆ Set the trigger
- ◆ Select standard and measurement

12.4 3GPP FDD Test Models

For measurements on base-station signals in line with 3GPP, test models with different channel configurations are specified in the document "Base station conformance testing (FDD)" (3GPP TS 25.141 V5.7.0). An overview of the test models is provided in this chapter.

Test model 1

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
SCCPCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 total	see TS 25.141	see TS 25.141	see TS 25.141

Test model 2

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
SCCPCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10, 1 x 50	2 x -10, 1 x -3	24, 72, 120	1, 7, 2

Test model 3

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	12.6/7.9	-9 / -11	1	0
Primary CPICH	1	12.6/7.9	-9 / -11	0	0
PICH	1	5/1.6	-13 / -18	16	120
SCCPCH (SF=256)	1	5/1.6	-13 / -18	3	0
DPCH (SF=256)	16/32	63,7/80,4 total	see TS 25.141	see TS 25.141	see TS 25.141

Test model 4

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH*	1	10	-10	0	0

Test model 5

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256Tchip)
PCCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
SCCPCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=256)	30/14/6	14/14.2/14.4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_SCCH	2	4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_PDSCH (16QAM)	8/4/2	63.6/63.4/63.2 total	see TS 25.141	see TS 25.141	see TS 25.141

12.5 Instrument Functions 3GPP Base Station Measurements

The R&S FSV equipped with the 3GPP Base Station Measurement option R&S FSV-K72 performs code domain power measurements on downlink signals according to the 3GPP standard (Third Generation Partnership Project, FDD mode). Signals that meet the conditions for channel configuration of 3GPP standard test models 1 to 5 can be measured, including HSDPA and HSUPA signals (test model 5). In addition to the code domain power measurements specified by the 3GPP standard, the 3GPP Base Station Measurements option offers measurements with predefined settings in the frequency domain, e.g. power measurements.

To open the settings menu

- ◆ If the 3G FDD BTS mode is not the active measurement mode, press the MODE key and activate the 3G FDD BTS option.
- ◆ If the 3G FDD BTS mode is already active, press the MENU key.

The settings menu is displayed.

12.5.1 Menu and softkey description

- ◆ "[Configuration of 3GPP FDD](#)" on page 785
- ◆ "[Softkeys of the frequency menu – FREQ key](#)" on page 812
- ◆ "[Softkeys of the amplitude menu – AMPT key](#)" on page 812
- ◆ "[Softkeys of the sweep menu – SWEEP key](#)" on page 814
- ◆ "[Softkeys of the trigger menu – TRIG key](#)" on page 815
- ◆ "[Softkeys of the marker menu – MKR key](#)" on page 816
- ◆ "[Softkeys of the marker to menu – MKR-> key](#)" on page 817

The span, bandwidth, and marker function menus are not available in the 3G FDD BTS mode. All other menus are provided as described for the base unit. For details refer to the corresponding menu descriptions.

To display help to a softkey, press the HELP key and then the softkey for which you want to display help. To close the help window, press the ESC key. For further information refer to section "How to use the Help System".

12.5.2 Measurements and result diagrams

The 3GPP Base Station Measurement option provides Code Domain Measurements and RF measurements listed below:

Code Domain Measurements

The Code Domain Measurement option provides the following test measurement types and result diagrams which are available via the "Result" softkey:

- ◆ Code Domain Power (see [Code Domain Power](#) on page 799)
- ◆ Code Domain Channel Table (see [Code Domain Channel Table](#) on page 800)
- ◆ Code Domain Result Summary (see [Code Domain Result Summary](#) on page 803)
- ◆ Trace Statistics(Avg, Min, Max) in Code Domain Analyzer Mode (see [Trace Statistics](#) on page 805)
- ◆ Composite EVM (see [Composite EVM](#) on page 805)
- ◆ Peak Code Domain Error (see [Peak Code Domain Error](#) on page 806)
- ◆ Power vs Slot (see [Power vs Slot](#) on page 806)
- ◆ Composite Const (see [Composite Const](#) on page 806)
- ◆ Code Domain Error (see [Code Domain Error](#) on page 806)
- ◆ Power vs Symbol (see [Power vs Symbol](#) on page 806)
- ◆ Symbol Const (see [Symbol Const](#) on page 807)
- ◆ Symbol EVM (see [Symbol EVM](#) on page 807)
- ◆ Symbol Magnitude Error (see [Symbol Magnitude Error](#) on page 807)
- ◆ Symbol Phase Error (see [Symbol Phase Error](#) on page 807)
- ◆ Freq Err vs Slot (see [Freq Err vs Slot](#) on page 807)
- ◆ Phase Discont (see [Phase Discont](#) on page 808)

The code domain power measurements are performed as specified by the 3GPP standards. A signal section of approx. 20 ms is recorded for analysis and then searched through to find the start of a 3GPP FDD frame. If a frame start is found in the signal, the code domain power analysis is performed for a complete frame starting from slot 0. The different result diagrams are calculated from the recorded IQ data set. Therefore it is not necessary to start a new measurement in order to change the result diagram. Common settings for these measurements are performed via the settings menu (MENU key). For details refer to "[Settings Overview](#)" dialog box.

RF measurements

The RF Measurement option provides the following test measurement types and result displays:

- ◆ Output Power (see [Output Power Measurements](#) on page 808)
- ◆ Spectrum Emission Mask (see [Spectrum Emission Mask](#) on page 808)
- ◆ Adjacent Channel Power (ACP) (see [Adjacent Channel Power \(ACP\)](#) on page 808)
- ◆ Occupied Bandwidth (see [Occupied Bandwidth](#) on page 810)
- ◆ CCDF (see [CCDF](#) on page 810)

All these measurements are accessed via the MEAS key (measurement menu). Some parameters are set automatically according to the 3GPP standard. A list of these parameters is given with each measurement type. A set of parameters is passed on from the 3GPP Base Station Measurements option to the base unit and vice versa in order to provide a quick swap (see the following table).

Transferred parameters
center frequency
reference level
attenuation
reference level offset
center frequency step size
trigger source
trigger offset

12.5.3 Further information

- ◆ •"[Short list of abbreviations](#)" on page 782
- ◆ •"[Channels of the Code Domain Channel Table and their usage](#)" on page 783

12.5.3.1 Short list of abbreviations

Term or abbreviation	Description
BTS	base transmission station
CPICH	common pilot channel
DPCH	dedicated physical channel, data channel
FDD	frequency division duplexing
PCCPCH	primary common control physical channel
PICH	paging indication channel
SCH	synchronization channel, divided into P-SCH (primary synchronization channel) and S-SCH (secondary synchronization channel)

12.5.3.2 Channels of the Code Domain Channel Table and their usage

The channel assignment table contains the following (data) channels:

◆ CPICH

The common pilot channel is used to synchronize the signal in the case of CPICH synchronization. It is expected at code class 8 and code number 0.

◆ PSCH

The primary synchronization channel is used to synchronize the signal in the case of SCH synchronization. It is a non-orthogonal channel. Only the power of this channel is determined.

◆ SSCH

The secondary synchronization channel is a non-orthogonal channel. Only the power of this channel is determined.

◆ PCCPCH

The primary common control physical channel is used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1.

◆ SCCPCH

The secondary common control physical channel is a QPSK-modulated channel without any pilot symbols. In the 3GPP test models, this channel can be found in code class 8 and code number 3. However, the code class and code number need not to be fixed and can vary. For this reason, the following rules are used to indicate SCCPCH.

"HSDPA / HSUPA On / Off" softkey set to Off

- Only one QPSK-modulated channel without pilot symbols is detected and displayed as the SCCPCH. Any further QPSK-modulated channels without pilot symbols are not detected as active channels.
- If the signal contains more than one channel without pilot symbols, the channel that is received in the highest code class and with the lowest code number is displayed as the SCCPCH. It is expected that only one channel of this type is included in the received signal. According to this assumption, this channel is probably the SCCPCH.

"HSDPA / HSUPA On / Off" softkey set to On

- All QPSK-modulated channels without pilot symbols are detected. If one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN. QPSK-modulated channels without pilot symbols and a code class lower than 7 are marked with channel type HSPDSCH.

◆ PICH

The paging indication channel is expected at code class 8 and code number 16.

◆ DPCH

The dedicated physical channel is a data channel that contains pilot symbols. The displayed channel type is DPCH. The status is inactive (channel is not active), active (channel is active and all pilot symbols are correct), or pilotf (channel is active but it contains incorrect pilot symbols).

◆ HS-PDSCH (HSDPA)

The high speed physical downlink shared channel does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7: HSPDSCH(QPSK)_ (QPSK-modulated slot of an HS-PDSCH channel), HSPDSCH(16QAM)_ (16QAM-modulated slot of an HS-PDSCH channel), HSPDSCH(NONE)_ (slot without power of an HS-PDSCH channel). The modulation type of these channels can be varied depending on the selected slot. The status is inactive (channel is not active) or active (channel is active and all pilot symbols are correct).

◆ HS-SSCH (HSDPA)

The high speed shared control channel does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7. The modulation type should always be QPSK. The channel does not contain any pilot symbols. The status is inactive (channel is not active) or active (channel is active and all pilot symbols are correct).

◆ CHAN

Any arbitrary channel that does not carry a valid pilot symbol sequence is displayed as an arbitrary channel. It is not possible to decide which channel type is transmitted. The only prerequisite is that the channel carries symbols of a sufficient signal to noise ratio.

- Chan Type: CHAN (QPSK-modulated channel without any pilot symbols)
- Status: inactive if the channel is not active; active if the channel is active

◆ E-HICH

Enhanced HARQ hybrid acknowledgement indicator channel

Carries hybrid ARQ ACK/NACK

E-RGCH Enhanced relative grant channel Carries relative grant allocation for a UE

E-AGCH Enhanced absolute grant channel Carries absolute grant allocation for a UE

12.6 Configuration of 3GPP FDD Measurements

The R&S FSV-K72 option appears in the "Select Mode" menu (MODE key) as "3G°FDD°BTS". This softkey can be used to start the R&S FSV-K72 options. The R&S FSV-K72 option will normally be left by choosing any application other than "3G°FDD°BTS".

The most important parameters for the 3GPP FDD base station tests are summarized in the root menu of the R&S FSV-K72 option and explained below using the softkey functions. The root menu is available by pressing the softkey "3G FDD BTS" in the "Select Mode" menu, the MEAS key or the HOME key.

The CODE DOMAIN ANALYZER softkey activates the code domain analyzer measurement mode and opens the submenus for setting the measurement.

The POWER, ADJACENT CHANNEL POWER, SPECTRUM EMISSION MASK, OCCUPIED BANDWIDTH, CCDF and RF COMBI softkeys activate base station tests in the analyzer mode. Pressing the associated softkey performs the settings required by 3GPP specifications. A subsequent modification of settings is possible. The other menus of the R&S Analyzer correspond to the menus of this mode and are described in the operating manual for the R&S Analyzer.

It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Code Domain Analyzer	The CODE DOM POWER softkey activates the code domain measurement mode and opens another submenu for selecting and configuring the parameters. All other menus of the R&S Analyzer are adapted to the functions of the code domain measurement mode.
Power	The POWER softkey activates the channel power measurement with defined settings in the analyzer mode.
Adjacent Channel Power	The ACP softkey activates the adjacent-channel power measurement with defined settings in the analyzer mode.
Spectrum Emission Mask	The SPECTRUM EMISSION MASK softkey compares the signal power in different carrier offset ranges with the maximum values specified by 3GPP.
Occupied Bandwidth	The OCCUPIED BANDWIDTH softkey activates the measurement of the occupied bandwidth (analyzer mode).
CCDF	The CCDF softkey evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).

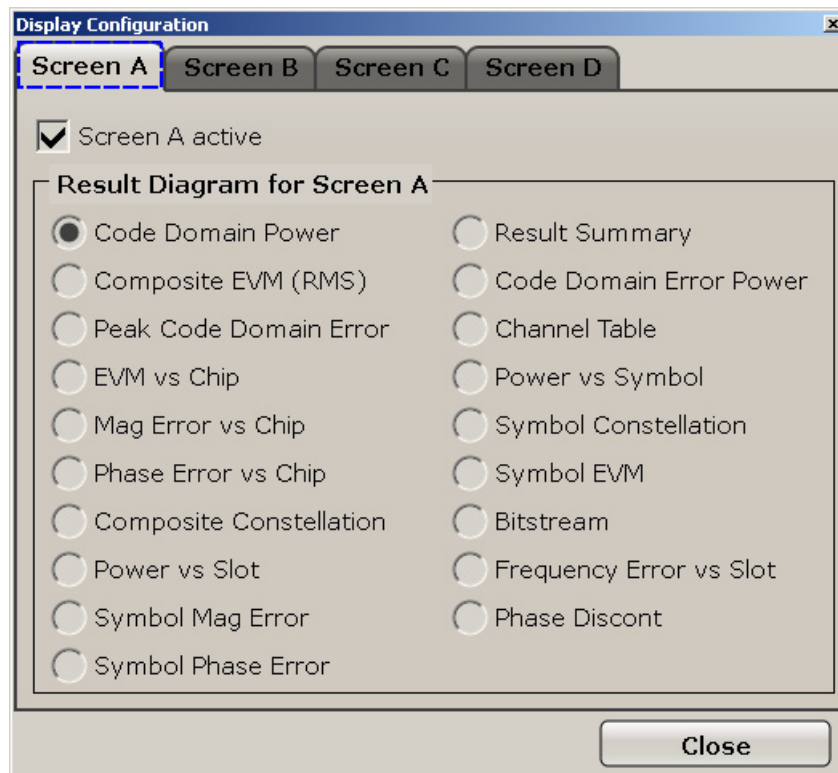
The following softkeys are available for R&S FSV 3GPP Base Station Measurement:

Code Domain Analyzer	Settings Overview	
	Frontend Settings	
	IQ-Capture Settings	
	Sync / Scrambling Settings	
	Channel Detection Settings	
	Demod Settings	
	Display Config	Code Domain Power
		Code Domain Channel Table
		Code Domain Result Summary
		Trace Statistics
		Composite EVM
		Peak Code Domain Error
		Power vs Slot
		Composite Const
		Code Domain Error
		Power vs Symbol
		Symbol Const
		Symbol EVM
		Symbol Magnitude Error
		Symbol Phase Error
		_D2HLink_418598
		Freq Err vs Slot
		Phase Discont
	Select Channel/Slot	
Power		
Spectrum Emission Mask		
Adjacent Channel Power		
Occupied Bandwidth		
CCDF		

12.6.1 Code Domain Analyzer measurements

12.6.1.1 Display Concept

The Code Domain Analyzer can show up to four result diagrams at one time. To change the result diagrams, press the MEAS CONFIG key and afterwards press the softkey "Result Diagrams" which opens the following dialog:



Tabbar:	In the Tabbar, the Screen to be configured can be chosen
Screen X active:	Each Screen can be activated or deactivated. If a new screen is activated, the other screens change the size. If all four screens are activated, each screen takes a quarter of the available screen size.
Result Diagram for Screen X	For each screen, the result diagram can be chosen separately.
Screen Focus:	One of the Screens has a blue frame indicating the focus. The screen focus can be changed just like in the base system. The settings for trace statistics and marker can only be changed for the focused screen. Just like in the base system, the focused screen can be set to full screen.

For more information about the display configuration refer to "[Display Configuration](#)"

12.6.1.2 Softkeys of the Code Domain Analyzer menu

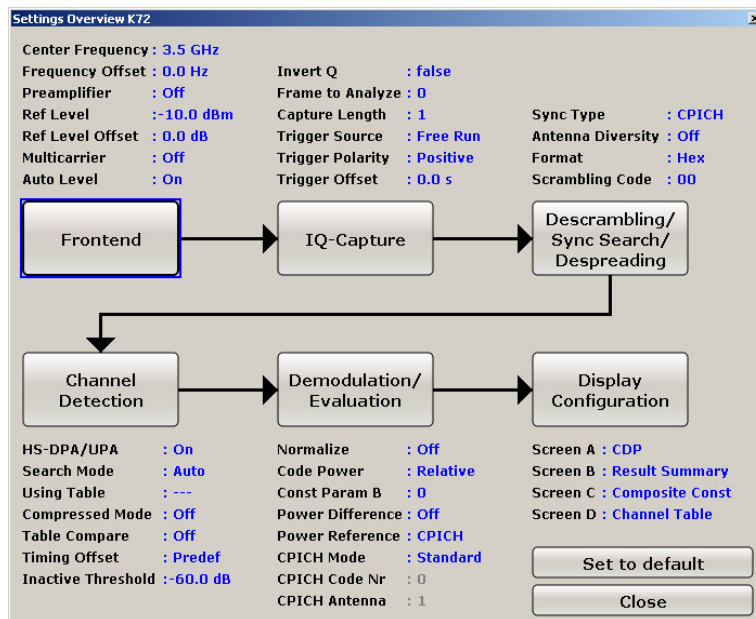
The Code Domain Analyzer softkey opens the "Code Domain Analyzer" submenu.

Settings Overview
Frontend Settings
IQ-Capture Settings
Sync / Scrambling Settings
Channel Detection Settings
Demod Settings
Display Config
Select Channel/Slot

Settings Overview

The "Settings Overview" softkey opens the "Settings Overview K72" dialog box that visualizes the data flow of the Code Domain Analyzer and summarizes the current settings. In addition, the current settings can be changed via the Settings Overview dialog box.

To change the settings, either use the rotary knob or the cursor keys to change the focus to another button and press the ENTER key to open the corresponding dialog box. To open the dialog boxes displayed in the "Settings Overview" dialog box, you can also press the particular softkey in the "Code Domain Analyzer" submenu.



Frontend	refer to Frontend Settings
IQ-Capture	refer to IQ-Capture Settings
Descrambling / Sync Search / Despreading	refer to Sync / Scrambling Settings
Channel Detection	refer to Channel Detection Settings
Demodulation / Evaluation	refer to Demod Settings
Display Configuration	refer to Display Concept

Frontend Settings

The "Frontend Settings" dialog box can be opened via the "Frontend Settings" softkey or via the "Frontend" button in the "Overview Settings" dialog box.

The following parameter groups are available:

Frequency Settings	
Center Frequency	Enter a value to change the center frequency (CF) → Remote: SENS:FREQ:CENT <numeric value>
Frequency Offset	Enter a frequency offset that shifts the displayed frequency range by the specific offset. → Remote: SENS:FREQ:OFFS <numeric value>
Level Settings	
Ref Level	Enter a value for the average signal power. This parameter consists of two parameters. The signal level value is represents the assumed average signal power of the signal. → Remote: DISP:TRAC:Y:RLEV <numeric value>
Ref Level Offset	Enter the value for a level offset, which is added to the measured level. → Remote: DISP:WIND:TRAC:Y:RLEV:OFFS <numeric value>
Preamplifier On / Off	Switches the internal preamplifier (if option available) on and off. Invisible if option is not available. → Remote: INP:GAIN:STAT ON OFF
Adjust Ref Level	Adjusts the reference level according to the signal level → Remote: SENSE:CDP:LEV:ADJ

IQ-Capture Settings

The "IQ-Capture Settings" dialog box can be opened via the "IQ-Capture Settings" softkey or via the "IQ-Capture" button in the "Overview Settings" dialog box.

The following parameter groups are available:

Common Settings	
Invert Q On / Off	If the option is set, the sign of the Q-component of the signal is inverted. → Remote: SENS:CDP:QINV OFF ON
Data Capture Settings	
Frame To Analyze	Enter the Frame to analyze and to be displayed. → Remote: SENS:CDP:FRAM:VAL <numeric value>
Capture Length	Enter the capture length (amount of IQ data to record). → Remote: SENS:CDP:IQL <numeric value>
Trigger Settings	
Trigger Source External / Free Run	Select the source of the trigger. For the R&S FSV-K72 the values "External" and "Free Run" are available. → Remote: TRIG:SOUR EXT IMM
Trigger Polarity Positiv / Negative	Change the polarity of the trigger. The available values are "Negative" and "Positive". → Remote: TRIG:SLOP POS NEG
Trigger Offset	Change the trigger offset value to compensate the delay between the trigger event and the start of the sweep. → Remote: TRIG HOLD <numeric value>

Sync / Scrambling Settings

The "Descrambling / Sync Search Settings" dialog box can be opened via the "Sync / Scrambling Settings" softkey or via the "Descrambling / Sync Search / Despreading" button in the "Overview Settings" dialog box.

The screenshot shows the 'Descrambling / Sync Search Settings' dialog box with the following configuration:

- Antenna Settings:**
 - Antenna Diversity: On, Off
 - Antenna Number: 1, 2
- Sync Search Settings:**
 - Synchronisation Typ: SCH, CPICH
- Scrambling Code Settings:**
 - Scrambling Code: 00
 - Format: Hex, Dec

Buttons: Autosearch, Export, Close

The following parameter groups are available:

Antenna Settings	
Antenna Diversity On / Off	This option switches the antenna diversity mode on and off. → Remote: SENS:CDP:ANT ON OFF
Antenna Number 1 / 2	This option switches between diversity antennas 1 and 2. Depending on the softkey settings, R&S FSV-K72 synchronizes to the CPICH of antenna 1 or antenna 2. → Remote: SENS:CDP:ANT 1 2

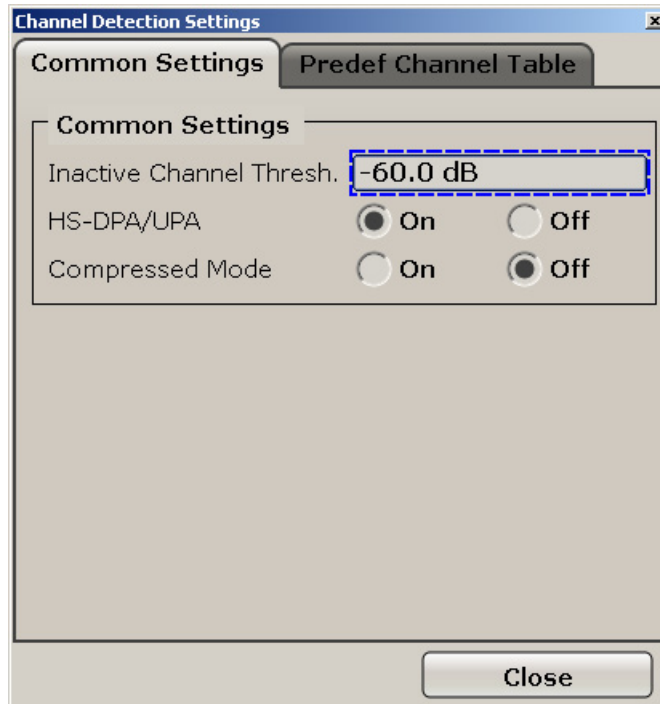
Sync Search Settings	
Synchronization Type SCH / CPICH	<p>The option "Synchronisation Type" allows the user to choose between synchronization with or without CPICH. If "CPICH" is selected, R&S FSV-K72 assumes that the CPICH control channel is present in the signal and attempts to synchronize to this channel. If the signal does not contain CPICH, synchronization fails. If "SCH" is selected, R&S FSV-K72 synchronizes to the signal without assuming the presence of a CPICH. This setting is required for measurements on test model 4 without CPICH. While this setting can also be used with other channel configurations, it should be noted that the probability of synchronization failure increases with the number of data channels.</p> <p>➔ Remote: SENS:CDP:STYP SCH CPIC</p>
Scrambling Code Settings	
Scrambling Code	<p>Enter the scrambling code. The scrambling codes are used to distinguish between different base stations. Each base station has its own scrambling code.</p> <p>➔ Remote: SENS:CDP:LCOD:DVAL</p>
Format Hex / Dec	<p>Switch the display format of the scrambling codes between hexadecimal and decimal.</p> <p>➔ Remote: SENS:CDP:LCOD:DVAL <numeric value></p> <p>➔ Remote: SENS:CDP:LCOD <hex value></p>
Output table "Scrambling Codes"	<p>This table includes all found scrambling codes from the last autosearch sequence. In the first column each row has a radio button to select a found scrambling code.</p> <p>➔ Remote: SENS:CDP:LCOD:SEAR:LIST?</p>
Autosearch	<p>Push this button to start a calculation on the recorded signal with all scrambling codes. The scrambling code that leads to the highest signal power is chosen as the new scrambling code.</p> <p>➔ Remote: SENS:CDP:LCOD:SEAR?</p>
Export	<p>Writes the Detected Scrambling Codes together with their powers into a textfile in the R&S user directory (c:\R_S\Instr\User\ScrCodes.txt)</p> <p>➔ Remote: --</p>

Channel Detection Settings

The "Channel Detection Settings" dialog box can be opened via the "Channel Detection Settings" softkey or via the "Channel Detection" button in the "Overview Settings" dialog box.

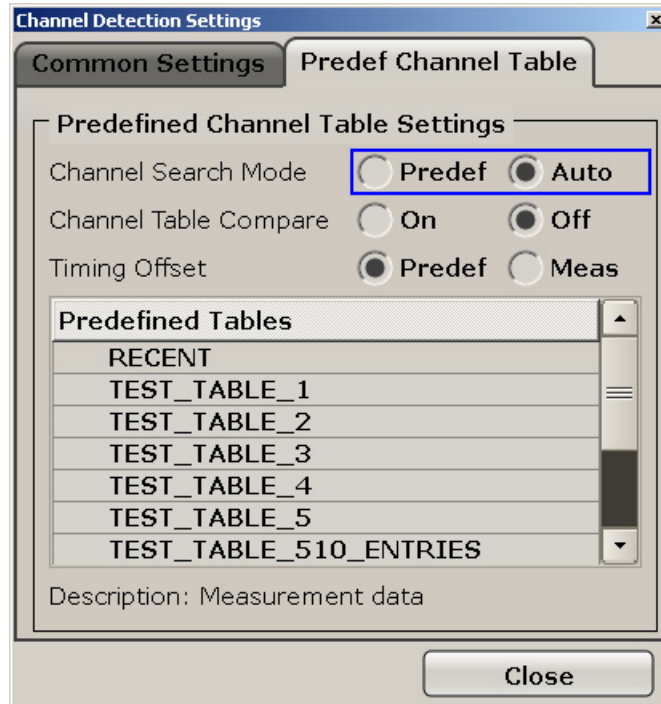
The "Channel Detection Settings" dialog box comprises two tabs: the "Common Settings" tab and the "Predefined Channel Table" tab.

The following parameters are available for the "Common Settings" tab:



Inactive Channel Threshold	Set the minimum power that a single channel must have compared to the total signal in order to be recognized as an active channel. → Remote: SENS:CDP:ICTR <numeric value>
HS-DPA/UPA On / Off	If this option is selected, it enables the application to detect HSUPA/DPA-channels and shows them in the channel table. → Remote: SENS:CDP:HSDP ON OFF
Compressed Mode	If compressed mode is switched on, some slots of a channel are suppressed. To keep the overall data rate, the slots just before or just behind a compressed gap can be sent with half spreading factor (SF/2). → Remote: SENS:CDP:PCON SLOT PIL

The following parameters are available for the "Predefined Channel Table" tab:



Channel Search Mode Predefined / Auto	Select the channel search mode. Either select "Predefined" to use predefined tables or "Auto" for a automatic detection of the channels. → Remote: CONF:WCDP:CTAB ON OFF → Remote: CONF:WCDP:CTAB:SEL <channel table name>
Channel Table Compare On / Off	If the radio button "On" is selected the R&S FSV-K72 uses predefined tables and not the standard mode for comparing. → Remote: CONF:WCDP:BTS:CTAB:COMP ON OFF
Timing Offset Predefined / Meas	If the option "Predefined" is select the R&S FSV-K72 uses a timing offset from a predefined table. If the option "Meas" is selected the measurement values are used. → Remote: CONF:WCDP:CTAB:TOFF PRED MEAS
List "Predefined Tables"	The list shows all available channel tables and marks the current active table or the table to edit. → Remote: CONF:WCDP:CTAB:CAT?

Demod Settings

The "Demodulation Settings" dialog box can be opened via the "Demod Settings" softkey or via the "Demodulation" button in the "Overview Settings" dialog box.

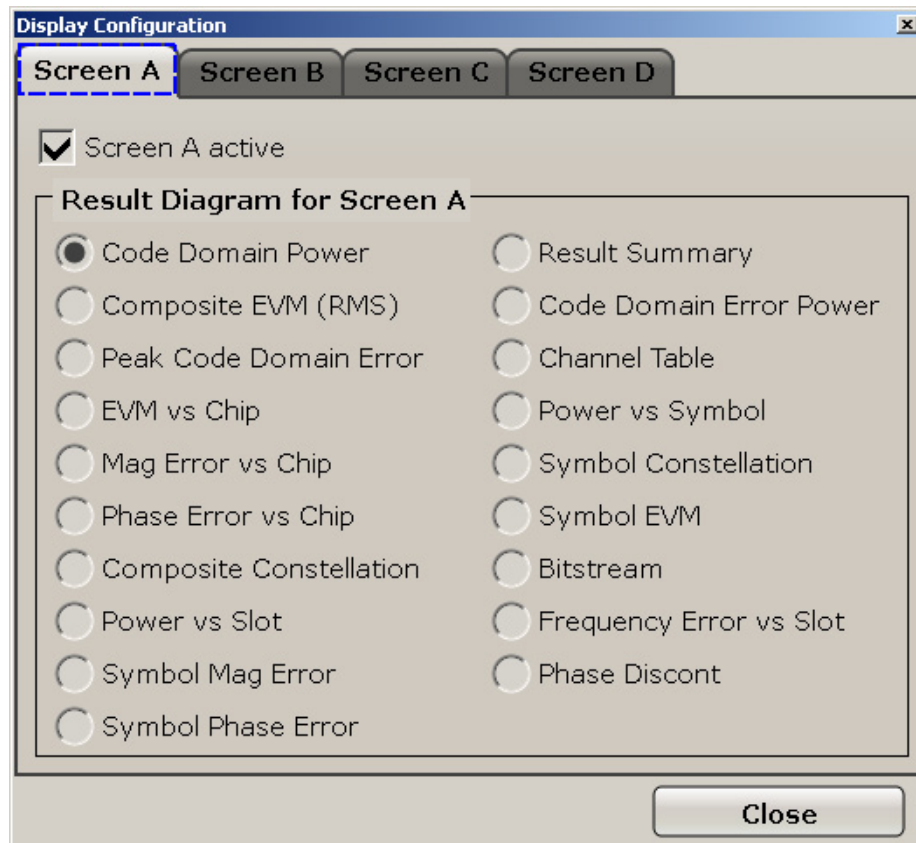
The following parameters are available:

Common Settings	
Code Power Display Absolute / Relative	Switch between showing the absolute power or the power relative to the chosen Reference. This Parameter only affects the display mode "Code Domain Power". → Remote: SENS:POW:ACH:MODE ABS
Normalize On / Off	Change the Elimination of the DC-Offset. If the radio button "On" is selected, the DC-Offset is eliminated. Otherwise the DC-Offset is not eliminated. → Remote: SENS:CDPower:NORM ON OFF
Power Reference Total / CPICH	Switch the power reference for the Code Domain Power display mode between the total power and the power of the CPICH. → Remote: SENS:CDP:REF TOT CPIC
Power vs Slot Settings	
Power Difference On / Off	The radio buttons "Power Difference" selects the indication of the slot power difference between the actual slot and the previous slot. To get the results it is necessary to activate the power versus slot measurement in the result display. → Remote: SENS:CDP:PDIF O

HSPA+ Settings	
CPICH Mode Standard / User defined	This is setting for the HSPA+ extension. Choose between the standard configuration (CPICH is always on channel 0) or choose a different position for the CPICH. If the radio button "User defined" is selected, enter the CPICH code number in the field "CPICH Code Nr" → Remote: SENS:CDPower:UCP ON OFF
CPICH Code Nr	The user can enter the code of the CPICH based on the spreading factor 256. Possible values: 0...255. → Remote: SENS:CDP:UCP:CODE <numeric value>
CPICH Antenna Pattern	Available states are "Pattern 1", "Pattern 2", "OFF". If pattern "OFF" is selected, then the standard pattern is used by the DSP-Code. → Remote: SENS:CDP:UCP:PATT OFF 1 2

Display Configuration

The "Display Configuration" dialog box can be opened via the "Display Config" softkey or via the "Display Config" button in the "Overview Settings" dialog box.



The following parameters are:

Screen A/B/C/D active	Activates/deactivates the screen. → Remote: DISPLAY:WINDOW<1..4>:STATE ON OFF
Result Diagram for Screen A/B/C/D	Choose the result display for this screen. The available display modes and measurement are described in chapter " Measurement modes in Code Domain Analyzer " on page 799. → Remote: CALCulate<1 2>:FEED <string>

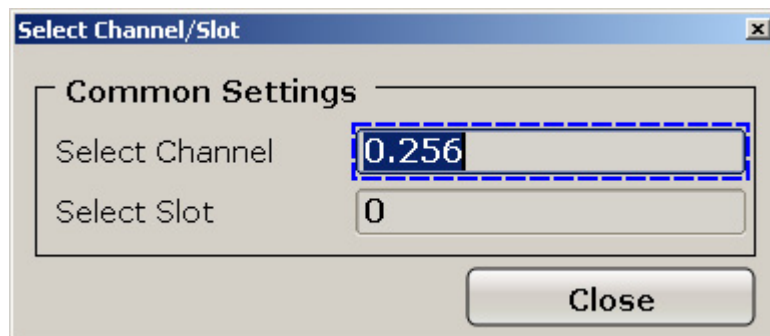
For more information about the display configuration refer to "[Display Concept](#)"

The different display modes can be shown in up to 4 windows. Calculate different display modes with the same dataset of the recorded signal. It is not necessary to restart the measurement for switching the display mode.

The next chapter explains the different display modes and measurements specified by the 3GPP standard and available in Code Domain Analyzer mode.

Select Channel/Slot

The "Select Channel/Slot" dialog box can be opened via the "Select Channel/Slot" softkey.



The following parameters are available for the "Select Channel/Slot" tab:

Select Channel	<p>Selects a channel for the calculation of the result diagrams CDP PWR RELATIVE/ABSOLUTE, POWER VS SLOT, SYMBOL CONST and SYMBOL EVM.</p> <p>There are two ways of entering the channel numbers:</p> <ul style="list-style-type: none"> ◆ Entry of channel number and spreading factor, separated by a decimal point. If the channel number and the spreading factor are entered simultaneously, the entered channel is selected and marked in red if an active channel is involved. For the display, the channel number entered is converted on the basis of spreading factor 512. For unused channels, the code resulting from the conversion is marked. Example: Entry 5.128 Channel 5 is marked at spreading factor 128 (30 ksp) if the channel is active, otherwise code 20 at spreading factor 512. ◆ Entry of a channel number without a decimal point. In this case, FS-K72 interprets the entered code as based on spreading factor 512. If the code entered corresponds to a used channel, the entire associated channel is marked. If the code corresponds to an unused channel, only the code entered is marked. Example: Entry 20 Code 20 is marked at spreading factor 512 if there is no active channel on this code. If for instance channel 5 is active at spreading factor 128, the entire channel 5 is marked. If the entered code corresponds to an active channel, the entire associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked. If the code number is modified using the rotary knob, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel. The step width of the changed rotary knob position refers to a spreading factor of 512. <p>→ Remote: SENS:CDP:CODE 0 to 511</p>
Select Slot	<p>Selects the Slot for Evaluation. This affects the following result diagrams:</p> <ul style="list-style-type: none"> ◆ CODE DOMAIN POWER ◆ PEAK CODE DOMAIN ERROR ◆ RESULT SUMMARY ◆ COMPOSITE CONS, ◆ CODE DOMAIN ERROR POWER ◆ CHANNEL TABLE ◆ POWER VS SYMBOL ◆ SYMBOL CONST ◆ SYMBOL EVM

12.6.1.3 Measurement modes in Code Domain Analyzer

The display modes in this chapter are all based on the recording of the IQ-Data. With the same dataset of the recorded signal, we can calculate the following display modes. Therefore it is not necessary to restart the measurement for switching the display mode.

The following display modes and measurements specified by the 3GPP standard are available:

Code Domain Power
Code Domain Channel Table
Code Domain Result Summary
Trace Statistics
Composite EVM
Peak Code Domain Error
Power vs Slot
Composite Const
Code Domain Error
Power vs Symbol
Symbol Const
Symbol EVM
Symbol Magnitude Error
Symbol Phase Error
Freq Err vs Slot
Phase Discont

Code Domain Power

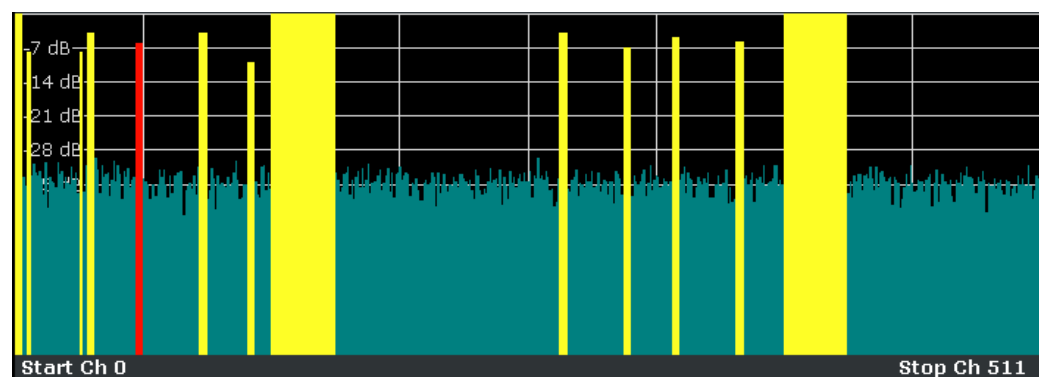


Figure 45: Code Domain Power Display for R&S FSV-K72

The "Code Domain Power" display mode shows the power of the different code channels in the the adjusted slot. Due to the circumstance that the power is regulated from slot to slot, the result power may differ between different slots. Detected channels are painted yellow. The channel which is adjusted via Select Channel is marked red. The codes where no channel could be detected are painted cyan.

If some of the DPCH-channels contain incorrect pilot symbols, these channels are marked with the color green, and a message "INCORRECT PILOT" is displayed in the status bar.

If HS-DPA/UPA is set "ON" in the "Channel Detection Settings" / "Common Settings" dialog box, channels without pilot symbols, e.g. channels of type HS-PDSCH, are recognized as active.

→ Remote: [CALC:FEED "XPOW:CDP"](#)

Code Domain Channel Table

The "Code Domain Channel Table" display mode selects the display of the channel assignment table. The channel assignment table can contain a maximum of 512 entries, corresponding to the 512 codes that can be assigned within the class of spreading factor 512.

The upper part of the table indicates the channels that have to be present in the signal to be analyzed:

CPICH:

The Common Pilot Channel is used to synchronize the signal in the case of CPICH synchronization. It is expected at code class 8 and code number 0.

PSCH:

The Primary Synchronization Channel is used to synchronize the signal in the case of SCH synchronization. It is a nonorthogonal channel. Only the power of this channel is determined.

SSCH:

The Secondary Synchronization Channel is a nonorthogonal channel. Only the power of this channel is determined.

PCCPCH:

The Primary Common Control Physical Channel is also used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1.

SCCPCH:

The Secondary Common Control Physical Channel is a QPSK-modulated channel without any pilot symbols. In the 3GPP test models, this channel can be found in code class 8 and code number 3. However, the code class and code number need not to be fixed and can vary. For this reason, the following rules are used to indicate the SCCPCH.

Only one QPSK-modulated channel without pilot symbols is detected and displayed as the SCCPCH. Any further QPSK-modulated channels without pilot symbols are not detected as active channels.

If the signal contains more than one channel without pilot symbols, the channel that is received in the highest code class and with the lowest code number is displayed as the SCCPCH. It is expected that only one channel of this type is included in the received signal. According to this assumption, this channel is probably the SCCPCH

If HS-DPA/UPA is set "ON" in the "Channel Detection Settings" / "Common Settings" dialog box, all QPSK-modulated channels without pilot symbols are detected. If one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. Any other QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN. All further QPSK-modulated channels without pilot symbols and a code class lower than 7 are marked with channel type HSPDSCH.

PICH:

The Paging Indication Channel is expected at code class 8 and code number 16. The lower part of the table indicates the data channels contained in the signal. A data channel is any channel that does not have a predefined channel number and symbol rate. There are different types of data channels, which can be indicated by the entry in the column "Chan Type":

DPCH:

The Dedicated Physical Channel is a data channel that contains pilot symbols. The displayed channel type is DPCH.

Chan Type:	DPCH	
Status:	inactive	channel is not active
	active	channel is active and all pilot symbols are correct
	pilotf	channel is active but it contains incorrect pilot symbols

HS-PDSCH

The High Speed Physical Downlink Shared Channel (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes lower than 7. The modulation type of these channels can be varied depending on the selected slot.

Chan Type:	HSPDSCH-QPSK_	QPSK-modulated slot of an HS PDSCH channel
	HSPDSCH-16QAM_	16QAM-modulated slot of an HS PDSCH channel
	HSPDSCH-NONE_	slot without power of an HS PDSCH channel
Status:	inactive	channel is not active
	active	channel is active

HS-SSCH

The High Speed Shared Control Channel (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7. The modulation type should always be QPSK. The channel does not contain any pilot symbols.

Chan Type:	CHAN_	QPSK-modulated channel without any pilot symbols
Status:	inactive	channel is not active
	active	channel is active

If HS-DPA/UPA is set "ON" in the "Channel Detection Settings" / "Common Settings" dialog box, the channels of HSDPA will be found among the data channels. If the type of a channel can be fully recognized, as for example with a DPCH (based on pilot sequences) or HS-PDSCH (based on modulation type), the type will be entered in the field TYPE. All other channels without pilot symbols are of type CHAN. The channels are in descending order according to symbol rates and, within a symbol rate, in ascending order according to the channel numbers. Therefore, the unassigned codes are always to be found at the end of the table.

If the modulation type for a channel can vary, the measured value of the modulation type will be appended to the type of the channel.

The following parameters of these channels are determined by the CDP measurement:

Type:

Type of channel (active channels only). If the modulation type of a channel can vary (HS-PDSCH, if HS-DPA/UPA is set "ON" in the "Channel Detection Settings" / "Common Settings" dialog box), the value of the modulation type measured by the firmware application will be appended to the channel type. Data channels that do not have a type that can be fully recognized are of type CHAN.

Symbol Rate:

Symbol rate at which the channel is transmitted
(7.5 ksp/s to 960 ksp/s).

Chan #:

Number of the channel spreading code (0 to [spreading factor-1]).

Status:

Status display. Unassigned codes are considered to be inactive.

TFCI:

Indication whether the data channel uses TFCI symbols.

PilotL:

Number of pilot bits of the channel.

Pwr Abs / Pwr Rel

Indication of the absolute and relative channel power (referenced to the CPICH or the total power of the signal).

T Offs:

Timing offset. Offset between the start of the first slot of the channel and the start of the analyzed 3GPP FDD frame.

A data channel is considered to be active if the required pilot symbols (see 3GPP specification, exception: PICH) are to be found at the end of each slot. In addition, the channel should have minimum power (see [Inactive Channel Threshold](#)).

In the R&S FSV-K72 the display configuration can be set to show quarter screens. In such a case the channel table is reduced to: Channel, Code SF, State and Power Abs

➔ Remote: [CALC<1..4>:FEED "XTIM:CDP:ERR:CTAB"](#)

Code Domain Result Summary

The display mode Result Summary displays a list of measurement results on the screen. There are three different tables which have to be implemented, depending if the corresponding window is a full screen, a split screen or a quarter screen window.

Split screen window

Two different results are displayed: global results and channel results.

Global Results:

Total Power:	Outputs the total signal power (average power of total evaluated 3GPP FDD frame).															
Chip Rate Error:	Outputs the chip rate error in ppm. As a result of a high chip rate error, symbol errors arise and the CDP measurement is possibly not synchronized to the 3GPP FDD signal. The result is valid even if synchronization of the analyzer and signal failed.															
IQ Offset:	DC offset of signal in %															
Composite EVM:	The composite EVM is the difference between the test signal and the ideal reference signal (see Composite EVM).															
CPICH Slot No:	Outputs the number of the CPICH slot at which the measurement is performed.															
No of Active Chan:	Indicates the number of active channels detected in the signal. Both the detected data channels and the control channels are considered active channels.															
Carrier Freq Error:	<p>Outputs the frequency error relative to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error. The specified value is averaged via one slot; the frequency offset of the slot selected under SELECT CPICH SLOT applies.</p> <p>The maximum frequency error that can be compensated is specified in the table below as a function of the sync mode. Transmitter and receiver should be synchronized as far as possible.</p> <table border="1"> <thead> <tr> <th>SYNC TYPE</th> <th>ANTENNA DIV</th> <th>Max. Freq. Offset</th> </tr> </thead> <tbody> <tr> <td>CPICH</td> <td>X</td> <td>5.0 kHz</td> </tr> <tr> <td>SCH</td> <td>OFF</td> <td>1.6 kHz</td> </tr> <tr> <td>SCH</td> <td>ANT 1</td> <td>330 Hz</td> </tr> <tr> <td>SCH</td> <td>ANT 2</td> <td>330 Hz</td> </tr> </tbody> </table>	SYNC TYPE	ANTENNA DIV	Max. Freq. Offset	CPICH	X	5.0 kHz	SCH	OFF	1.6 kHz	SCH	ANT 1	330 Hz	SCH	ANT 2	330 Hz
SYNC TYPE	ANTENNA DIV	Max. Freq. Offset														
CPICH	X	5.0 kHz														
SCH	OFF	1.6 kHz														
SCH	ANT 1	330 Hz														
SCH	ANT 2	330 Hz														
Trigger to Frame:	This result outputs the time difference between the beginning of the recorded signal section to the start of the analyzed 3GPP FDD frame. In the case of triggered data collection, this difference is identical with the time difference of frame trigger (+ trigger offset) – frame start. If synchronization of the analyzer and W-CDMA signal fails, the value of Trigger to Frame is not significant.															
IQ Imbalance:	I/Q imbalance of signals in %															

Pk CDE (30 ksps):	The Peak Code Domain Error measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see Peak Code Domain Error). The spreading factor onto which projection is made is shown beneath the measurement result.
CPICH Power	The power of the CPICH channel
Avg. RCDE (64 QAM)	Average RELATIVE CODE DOMAIN ERROR over all channels detected with 64 QAM in the selected frame.
RHO	Quality parameter rho for every slot.

Channel Results:

Symbol Rate:	Symbol rate at which the channel is transmitted.
Channel Code:	Number of the spreading code of the selected channel.
No of Pilot Bits:	Number of pilot bits of the selected channel.
Chan Power Rel:	Channel power, relative (referenced to CPICH or total signal power)
Chan Power Abs:	Channel power, absolute
Modulation Type:	Modulation type of an HSDPA channel. High speed physical data channels can be modulated with QPSK, 16 QAM or 64 QAM modulation.
Timing Offset:	Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD frame.
Channel Slot No:	The channel slot number is obtained by combining the value of the <i>selected CPICH</i> and the channel's timing offset.
Symbol EVM:	Peak or average of the results of the error vector magnitude measurement. The measurement provides information on the EVM of the channel (marked red) in the CDP diagram in the slot (marked red) of the power-versus slot diagram at the symbol level.
RCDE	RELATIVE CODE DOMAIN ERROR for the complete frame of the selected channel.

Full Screen window

The full screen display mode shows all the results like in the split screen window, but with a bigger font.

Quarter screen window

Only the most important results are displayed on the screen. For the detailed description of the displayed results see above.

Global Results:

Total Power
 Composite EVM
 No of Active Chan
 Carrier Freq Error
 Pk CDE (30 ksps)

Channel Results:

Chan Power Abs

Chan Power Rel

Timing Offset

Modulation Type

Symbol EVM (%rms)

Symbol EVM (%Peak)

→ Remote: [CALC<1..4>:FEED "XTIM:CDP:ERR:SUMM"](#)

Query of results:

→ Remote: [CALC2:MARK:FUNC:WCDP:BTS:RES?](#)**Trace Statistics (Avg, Min, Max) in Code Domain Analyzer Mode**

In order to evaluate the trace statistics, the R&S FSV-K72 has to work with predefined channel tables. Otherwise the channels could change from one sweep to the next.

The activated trace statistic affects all result diagrams in the code domain analyzer.

The following results are affected by the trace statistics. For the detailed description of the displayed results see [Code Domain Result Summary](#).

Global Results:

Total Power

Chip Rate Error

IQ Offset

Composite EVM

Carrier Frequency Error

Trigger To Frame

IQ Imbalance

Peak Code Domain Error

Channel Related Results:

Channel Power Abs

Channel Power Rel

Symbol Error Vector Magnitude (RMS and Peak)

Timing Offset

Composite EVM

The "Composite EVM" measurement displays the error between the entire measurement signal and the ideal reference signal in present. The error is averaged over all channels for different slots. A bar diagram with EVM values versus slots is used. The Composite EVM measurement covers the entire signal during the entire observation time.

→ Remote: [CALC<1..4>:FEED "XTIM:CDP:ERR:MACC"](#)

Peak Code Domain Error

With "Peak Code Domain Error" display mode for a given slot and for all codes the maximum of the code domain error values are determined. This display is a bar diagram over slots. The unit is dB. The Peak Code Domain Error measurement covers the entire signal and the entire observation time.

→ Remote: [CALC2:FEED "XTIM:CDP:ERR:PCD"](#)

Power vs Slot

The "Power vs Slot" display mode displays the average power of a given channel over all slots. The power is measured relative to the power of the pilot channel inside the slot. Therefore the unit is dB. For Antenna OFF or Antenna No 1 the PICH channel is used as reference. For Antenna No 2 the TDPICH channel is used. The channel width (width of the bars) depends on the IQ capture length. The bars have all the same width and use the complete range of the x axis.

→ Remote: [CALC2:FEED "XTIM:CDP:PVSL"](#)

Composite Const

The "Composite Const" measurement analyzes the entire signal given one single slot. For large numbers of channels to analyze the results will superimpose. In that case the benefit of this measurement is limited (senseless).

In Composite Const measurement the constellation points of the 1536 Chips will be displayed given the slot. These data will be determined inside the DSP even before the channel search. I.e. it is not possible to assign constellation points to channels. The constellation points are displayed normalized with respect to the total power.

→ Remote: [CALC2:FEED "XTIM:CDP:COMP:CONS"](#)

Code Domain Error

"Code Domain Error Power" is the difference in power between the measured and his ideal signal. The unit is dB. There are no other units for the y axis.

→ Remote: [CALC2:FEED "XTIM:CDP:ERR:PCD"](#)

Power vs Symbol

The "Power vs. Symbol" measurement shows the power over the symbol number for the selected channel and the selected slot. The power will not be averaged here. The trace is drawn using a histogram line algorithm, i.e. only vertical and horizontal lines, no diagonal, linear Interpolation (polygon interpolation). Surfaces are NOT filled. This measurement displays Power versus Symbol for one single channel and for one single slot.

→ Remote: [CALC2:FEED "XTIM:CDP:PVSY"](#)

Symbol Const

The "Symbol Const" measurement shows QPSK or BPSK modulated signals of the selected channel and the selected slot. QPSK constellation points are located on the diagonals (not x and y axis) of the constellation diagram. BPSK constellation points are always on the x axis. If possible the display should use more than just 1 pixel per value, as in the minimum case only 12 symbols are available. This would improve the visibility.

→ Remote: [CALC2:FEED "XTIM:CDP:SYMB:CONS"](#)

Symbol EVM

The "Symbol EVM" display mode shows the error between the measured signal and the ideal reference signal in percent for the selected channel and the selected slot. A trace over all symbols of a slot is drawn. The number of symbols is in the range from 12 (min) to 384 (max). It depends on the symbol rate of the channel.

→ Remote: [CALC2:FEED "XTIM:CDP:SYMB:EVM"](#)

Symbol Magnitude Error

The "Symbol Magnitude Error" is calculated analogous to symbol EVM. The result of calculation is one symbol magnitude error value for each symbol of the slot of a special channel. Positive values of symbol magnitude error indicate a symbol magnitude that is larger than the expected ideal value; negative symbol magnitude errors indicate a symbol magnitude that is less than the ideal one.

The symbol magnitude error is the difference of the magnitude of the received symbol and that of the reference symbol, related to the magnitude of the reference symbol.

→ Remote: [CALC2:FEED "XTIM:CDP:SYMB:EVM:MAGN"](#)

Symbol Phase Error

The "Symbol Phase Error" is calculated analogous to symbol EVM. The result of calculation is one symbol phase error value for each symbol of the slot of a special channel. Positive values of symbol phase error indicate a symbol phase that is larger than the expected ideal value; negative symbol phase errors indicate a symbol phase that is less than the ideal one.

→ Remote: [CALC2:FEED "XTIM:CDP:SYMB:EVM:PHAS"](#)

Freq Err vs Slot

To reduce the overall span of "Frequency Err vs Slot", for each value to be displayed the difference between the frequency error of the corresponding slot to the frequency error of the first (zero) slot is calculated. This will help to eliminate a static frequency offset of the whole signal to achieve a better display of a real time-dependent frequency curve.

→ Remote: [CALC2:FEED "XTIM:CDP:FVSL"](#)

Phase Discont

The "Phase Discontinuity" is calculated according to 3GPP specifications. The phase calculated for each slot is interpolated to both ends of the slot using the frequency shift of that slot. The difference between the phase interpolated for the beginning of one slot and the end of the preceding slot is displayed as the phase discontinuity of that slot.

→ Remote: [CALC2:FEED "XTIM:CDP:PSVSL"](#)

12.6.2 Output Power Measurements

The R&S Analyzer measures the unweighted RF signal power in a bandwidth of:

$$f_{BW} = 5 \text{ MHz} \geq (1 + \alpha) \cdot 3.84 \text{ MHz} \quad | \quad \alpha = 0.22$$

The power is measured in zero span mode (time domain) using a digital channel filter of 5 MHz in bandwidth. According to the 3GPP standard, the measurement bandwidth (5 MHz) is slightly larger than the minimum required bandwidth of 4.7 MHz. The bandwidth is displayed numerically below the screen.

→ Remote: [CONF:WCDP:MEAS POW](#)

12.6.3 Spectrum Emission Mask

The measurement Spectrum Emission Mask is the determination of the power of the 3GPP FDD signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.

This measurement is identical to the [Spectrum Emission Mask](#) of the Base System. By entering the measurement, the configuration to measure the 3GPP standard will be loaded.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

→ Remote: [CONF:WCDP:MEAS:ESP](#)

12.6.4 Adjacent Channel Power (ACP)

Selecting of Adjacent Channel Power (ACP) activates the adjacent channel power measurement in the default setting according to 3GPP specifications (adjacent channel leakage ratio). The R&S Analyzer measures the channel power and the relative power of the adjacent channels and of the alternate channels. The results are displayed below the screen.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

Pressing the Adjacent Channel Power softkey activates the analyzer mode with defined settings:

CHAN PWR / ACP	CP / ACP ON	
CP / ACP STANDARD	W-CDMA 3GPP FWD	
CP / ACP CONFIG	NO. OF ADJ CHAN	2

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

- Level parameters
- RBW, VBW
- Sweep time
- SPAN
- NO OF ADJ. CHANNELS
- FAST ACP MODUS

For further details about the ACP measurements refer to "[Measuring Channel Power and Adjacent Channel Power](#)" of the base unit.

→ Remote: [CONF:WCDP:MEAS ACLR](#)

Query of results:

→ Remote: [CALC:MARK:FUNC:POWER:RES? ACP](#)

12.6.5 Occupied Bandwidth

The Occupied Bandwidth softkey activates the measurement of the bandwidth that the signal occupies.

The occupied bandwidth is defined as the bandwidth in which – in default settings – 99% of the total signal power is to be found. The percentage of the signal power to be included in the bandwidth measurement can be changed.

The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen as OBW.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

Pressing the Occupied Bandwidth softkey activates the analyzer mode with defined settings:

OCCUPIED BANDWIDTH		
TRACE1	DETECTOR	SAMPLE

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

- Level parameters
- RBW, VBW
- Sweep time
- SPAN

For further details about the Occupied Bandwidth measurements refer to "[Measuring the occupied bandwidth](#)" of the base unit.

→ Remote: [CONF:WCDP:MEAS OBAN](#)

Query of results:

→ Remote: [CALC:MARK:FUNC:POW:RES? OBAN](#)

12.6.6 CCDF

The CCDF softkey starts a measurement of the distribution function of the signal amplitudes (complementary cumulative distribution function). The CCDF and the Crest factor are displayed. For the purposes of this measurement, a signal section of user-definable length is recorded continuously in the zero span, and the distribution of the signal amplitudes is evaluated.

The following user-specific settings are not modified on the first access following presetting:

- Reference Level, Reference Level Offset
- Center Frequency, Frequency Offset
- Input Attenuation, Mixer Level
- All trigger settings

Pressing the CCDF softkey activates the analyzer mode with defined settings:

CCDF		
TRACE1	DETECTOR	SAMPLE
BW	RES BW MANUAL	10 MHz
	VIDEO BW MANUAL	5 MHz

To restore adapted measurement parameters, the following level parameters are saved on exiting and are set again on re-entering this measurement:

- Level parameters
- RBW
- NO OF SAMPLES

For further details about the CCDF measurements refer to "[Measuring the APD and CCDF of white noise](#)" of the base unit.

→ Remote: [CONF:WCDP:MEAS CCDF](#)

or

→ Remote: [CALC:STAT:CCDF ON](#)

Query of results:

→ Remote: [CALC:MARK:X?](#)

→ Remote: [CALC:STAT:RES? MEAN | PEAK | CFAC | ALL](#)

12.6.7 Softkeys of the frequency menu – FREQ key

The FREQ key opens a submenu for changing the measurement frequency.

Center
Stepsize Manual
Frequency Offset

Center

The "Center" softkey opens an edit dialog box to change the value for the center frequency (CF).

→ Remote: [FREQ:CENT 100MHz](#)

Stepsize Manual

The "Stepsize Manual" softkey opens an edit dialog box to set the stepsize (increment / decrement value) for the center frequency.

→ Remote: [FREQ:CENT:STEP 120MHz](#)

Frequency Offset

The "Frequency Offset" softkey opens an edit dialog box to enter a frequency offset that shifts the displayed frequency range by the specified offset.

→ Remote: [FREQ:OFFS 10 MHz](#)

12.6.8 Softkeys of the amplitude menu – AMPT key

The AMPT key opens a submenu for level setting.

Ref Level	
Range>	Ref Value
	Y per Div
	Ref Value Position
Preamp On / Off	
RF Att Manual	
RF Att Auto	
EI Atten Auto On Off	
EI Att Manual On Off	
More	
RF-Level Offset	
Input AC DC	
Input 50 Ω / 75 Ω	

Ref Level

The "Ref Level" softkey opens an edit dialog box to enter the reference level.

→ Remote: [DISP:TRAC1:Y:RLEV -60dBm](#)

Range

The "range" softkey opens a submenu to define the amplitude range. The submenu contains the following commands:

Ref Value
Y per Div
Ref Value Position

Ref Value

The "Ref Value" softkey opens an edit dialog box to adjust the reference value.

→ Remote: [DISP:TRAC1:Y:SCAL:RVAL 0 DBM](#)

Y per Div

The "Y PER DIV" softkey opens an edit dialog box to change the range per division in the result diagram. The range is the length for one section of the y axis.

→ Remote: [DISP:WIND2:TRAC1:Y:SCAL:PDIV](#)

Ref Value Position

The "Ref Value Position" softkey opens an edit dialog box to adjust the position the reference value of the y-axis (0 – 100 %). 100% is at the top of the screen, 0% is at the bottom of the screen.

→ Remote: [DISP:WIND1:TRAC1:Y:SCAL:RPOS](#)

Preamp On / Off

The "Preamp On / Off" softkey switches the internal preamplifier on and off (only if RF Preamplifier (B22) is available).

→ Remote: [INP:GAIN:STAT ON](#)

RF Att Manual

The "RF Att Manual" softkey opens an edit dialog box to enter the attenuation value.

→ Remote: [INP:ATT 30 DB](#)

RF Att Auto

The "RF Att Auto" softkey activates the automatic attenuation mode.

→ Remote: [INP:ATT:AUTO ON](#)

EI Atten Auto On|Off

This softkey switches the electronic attenuator on and automatically sets its attenuation to 0 dB, or switches it off. The allowed setting range of the reference level ranges from the current reference level on switching on the electronic attenuator to over 25 dB. If a reference level is set outside the allowed 25 dB range, setting is performed by means of the mechanical attenuator. From this new reference level to over 25 dB the setting is again performed with the electronic attenuator.

→ Remote: [INP:EATT:AUTO OFF](#)

EI Att Manual On|Off

This softkey switches the electronic attenuator on and allows the attenuation of the electronic attenuator to be set. The attenuation can be varied in 5 dB steps from 0 to 30 dB. Other entries are rounded to the next lower integer value. If the defined reference level cannot be set for the given RF attenuation, the reference level is adjusted accordingly and the warning "Limit reached" is output.

**Note**

The 0 dB and 5 dB values can only be entered via the numeric keypad or via remote control command in order to protect the input mixer against overload.

→ Remote: [INP:EATT:AUTO OFF](#)

→ Remote: [INP:EATT 10 DB](#)

RF-Level Offset

The "Ref Level Offset" softkey opens an edit dialog box to set the value for the reference level offset, which is added to the measured level.

→ Remote: [DISP:WIND:TRAC:Y:RLEV:OFFS -10dB](#)

Input AC|DC

Toggles the RF input of the R&S FSV between AC and DC coupling.

→ Remote: [INP:COUP AC](#)

Input 50 Ω / 75 Ω

The "Input 50 Ω / 75 Ω" softkey selects the input impedance (50 or 75 ohm).

→ Remote: [INP:IMP 50OHM](#)

12.6.9 Softkeys of the sweep menu – SWEEP key

The menu of the SWEEP key contains options for switching between single measurement and continuous measurement and for controlling individual measurements.

Continuous Sweep
Single Sweep
Continue Single Sweep
Sweep Count

Continuous Sweep

The softkey "Continuous Sweep" selects the continuous sweep mode.

→ Remote: [INIT:CONT ON](#)

Single Sweep

The softkey "Single Sweep" selects the single sweep mode.

→ Remote: [INIT:CONT OFF](#)

Continue Single Sweep

The softkey "Continue Single Sweep" repeats the number of sweeps set by using the "Sweep Count" softkey, without deleting the trace of the last measurement.

→ Remote: [INIT:CONM](#)

Sweep Count

The softkey "Sweep Count" opens an edit dialog box to enter the number of sweep counts.

→ Remote: [SWE:COUN 64](#)

12.6.10 Softkeys of the trigger menu – TRIG key

The TRIG key opens the following submenu.

Trigger Source External / Free Run
Trigger Polarity Pos / Neg
Trigger Offset

Trigger Source External / Free Run

The "Trigger Source External / Free Run" softkey opens an edit dialog box to change the source of the trigger. For the R&S FSV-K72 the values "External" and "Free Run" are available.

→ Remote: [TRIG SOUR EXT | IMM](#)

Trigger Polarity Pos / Neg

The "Trigger Polarity Pos / Neg" softkey changes the polarity of the trigger between positive and negative.

→ Remote: [TRIG:SLOP POS | NEG](#)

Trigger Offset

The "Trigger Offset" softkey opens an edit dialog box to change the trigger offset. The trigger offset is the delay between the trigger event and the start of the sweep.

→ Remote: [TRIG:HOLD 10US](#)

12.6.11 Softkeys of the trace menu – TRACE key

The "TRACE" key is used to configure the data acquisition for measurement and the analysis of the measurement data. The trace menu of the R&S FSV-K72 is identical to the trace menu of the base unit but not all functions are available. The following softkeys of the trace menu of the R&S FSV-K72 are available:

Clear Write
Max Hold
Min Hold
Average
View

For a detailed description of the softkeys refer to the chapter "[Setting Traces - TRACE Key](#)" of the base unit.

12.6.12 Softkeys of the marker menu – MKR key

The MKR key opens a submenu for the marker settings.

Markers are not available for the following result diagram: Result Summary and Channel Table.

In all other result diagrams up to four markers can be activated, and they can be defined as a marker or delta marker by means of the "Marker Norm / Delta" softkey.

Marker 1 / 2 / 3 / 4
Marker Norm / Delta
Marker Zoom
All Marker Off

Marker 1 / 2 / 3 / 4

The "Marker 1 / 2 / 3 / 4" softkey selects the corresponding marker and activates it. "Marker 1" is always the normal marker. After "Marker 2 to 4" have been switched on, they are delta markers that are referenced to "Marker 1". These markers can be converted into markers with absolute value displays by means of the "Marker Norm / Delta" softkey. When "Marker 1" is the active marker, pressing the "Marker Norm / Delta" softkey switches on an additional delta marker. Pressing the "Marker 1" to "Marker 4" softkey switches the selected marker off.

- Remote: [CALC:MARK ON](#)
- Remote: [CALC:MARK:X <value>](#)
- Remote: [CALC:MARK:Y?](#)
- Remote: [CALC:DELT ON](#)
- Remote: [CALC:DELT:X <value>](#)
- Remote: [CALC:DELT:X REL?](#)
- Remote: [CALC:DELT:Y?](#)

Marker Norm / Delta

The "Marker Norm / Delta" softkey changes the active marker to a normal (norm) or delta marker (with respect to marker 1).

→ Remote: [CALC:DELT:MODE: ABS|REL](#)

Marker Zoom

The "Marker Zoom" softkey activates the zoom for the current active marker. With the zoom function, more details of the measurement signal can be seen. The softkey "Marker Zoom" can be selected only if at least one of the markers is activated.

If the zoom is active, this softkey deactivates the zoom.

→ Remote: [CALC:MARK:FUNC:ZOOM](#)

All Marker Off

The "All Markers Off" softkey switches all markers (reference and delta markers) off. It also switches off all functions and displays that are associated with the markers/delta markers.

→ Remote: [CALC:MARK:AOFF](#)

12.6.13 Softkeys of the marker to menu – MKR-> key

The MKR-> key opens a submenu for marker functions. The menu is not available for the all result displays.

Select 1 / 2 / 3 / 4 / d
Peak
Next Peak
Next Peak Mode <abs>
CPICH
PCCPCH
More
Select 1 / 2 / 3 / 4 / d
Min
Next Min
Next Min Mode <abs>
CPICH
PCCPCH

Select 1 / 2 / 3 / 4 / d

The "Select 1 / 2 / 3 / 4 / d" softkey selects the normal marker or the delta marker and activates the marker. "d" stands for delta marker 1.

→ Remote: [CALC:MARK1 ON](#)

→ Remote: [CALC:MARK1:X <value>](#)

→ Remote: [CALC:MARK1:Y?](#)

Peak

The "Peak" softkey sets the active marker/delta marker to the highest maximum of the trace.

- Remote: [CALC:MARK:MAX](#) , [CALC:MARK:MIN](#)
- Remote: [CALC:DELT:MAX](#) , [CALC:DELT:MIN](#)

Next Peak

The "Next Peak" softkey sets the active marker/delta marker to the next, previous or absolute maximum of the selected trace. See Softkey "Next Peak Mode < Abs >".

- Remote: [CALC:MARK:MAX:NEXT](#) , [CALC:MARK:MIN:NEXT](#)
- Remote: [CALC:DELT:MAX:NEXT](#) , [CALC:DELT:MIN:NEXT](#)

Next Peak Mode <abs>

The "Next Peak Mode < Abs >" softkey sets the mode for the softkey "Next Peak". If "<" is selected the softkey "Next Peak" sets the active marker to the previous maximum of the selected trace. If ">" is selected the softkey "Next Peak" sets the active marker to the next maximum of the selected trace. If "Abs" is selected the softkey "Next Peak" sets the active marker to the absolute maximum of the selected trace.

- Remote: [CALC:MARK:MAX:LEFT](#) , [CALC:MARK:MAX:RIGH](#)
- Remote: [CALC:DELT:MAX:LEFT](#) , [CALC:DELT:MAX:RIGH](#)
- Remote: [CALC:MARK:MIN:LEFT](#) , [CALC:MARK:MIN:RIGH](#)
- Remote: [CALC:DELT:MIN:LEFT](#) , [CALC:DELT:MIN:RIGH](#)

CPICH

The "CPICH" softkey sets the marker to the CPICH channel. The softkey is only available for R&S FSV-K72.

- Remote: [CALC:MARK:FUNC:CPIC](#)
- Remote: [CALC:MARK:Y?](#)

PCCPCH

The "PCCPCH" softkey sets the marker to the PCCPCH channel. The softkey is only available for R&S FSV-K72.

- Remote: [CALC:MARK:FUNC:PCCP](#)
- Remote: [CALC:MARK:Y?](#)

Min

The "Min" softkey sets the marker/delta marker to the minimum of the trace.

- Remote: [CALC:MARK:MIN](#)
- Remote: [CALC:DELT:MIN](#)

Next Min

The "Next Min" softkey sets the active marker/delta marker to the next, previous or absolute minimum of the selected trace (refer to softkey "Next Min Mode < Abs >").

- Remote: [CALC:MARK:MIN:NEXT](#)
- Remote: [CALC:DELT:MIN:NEXT](#)

Next Min Mode <abs>

The "Next Min Mode < Abs >" softkey sets the mode for the softkey "Next Min". If "<" is selected the softkey "Next Min" sets the active marker to the previous minimum of the selected trace. If ">" is selected the softkey "Next Min" sets the active marker to the next minimum of the selected trace. If "Abs" is selected the softkey "Next Peak" sets the active marker to the absolute minimum of the selected trace.

Next Peak:

- Remote: [CALC:MARK:MAX:LEFT](#) (>)
- Remote: [CALC:DELT:MAX:LEFT](#) (<)
- Remote: [CALC:MARK:MAX:RIGHT](#) (>)
- Remote: [CALC:DELT:MAX:RIGHT](#) (>)
- Remote: [CALC:MARK:MAX:NEXT](#) (abs)
- Remote: [CALC:DELT:MAX:NEXT](#) (abs)

Next Min:

- Remote: [CALC:MARK:MIN:LEFT](#) (>)
- Remote: [CALC:DELT:MIN:LEFT](#) (<)
- Remote: [CALC:MARK:MIN:RIGHT](#) (>)
- Remote: [CALC:DELT:MIN:RIGHT](#) (>)
- Remote: [CALC:MARK:MIN:NEXT](#) (abs)
- Remote: [CALC:DELT:MIN:NEXT](#) (abs)

12.6.14 Softkeys of the AUTOSSET menu – AUTOSSET key

The AUTOSSET key opens a menu to configure automatic settings.

Auto All	
Auto Level	
Auto Scrambling Code	
Settings >	
	Meas Time Manual
	Meas Time Auto

Auto All

Performs all automatic settings.

→ Remote: [ADJ:ALL](#)

Auto Level

Defines the optimal reference level for the current measurement automatically. The measurement time for automatic leveling can be defined using the "[Auto Scrambling Code](#)

[This softkey starts a calculation on the recorded signal with all scrambling codes. The scrambling code that leads to the highest signal power is chosen as the new scrambling code.](#)

→ Remote: [SENS:CDP:LCOD:SEAR?](#)

[Settings](#)" softkey.

→ Remote: [ADJ:LEV](#)

Auto Scrambling Code

This softkey starts a calculation on the recorded signal with all scrambling codes. The scrambling code that leads to the highest signal power is chosen as the new scrambling code.

→ Remote: [SENS:CDP:LCOD:SEAR?](#)

Settings

Opens a submenu to define settings for automatic leveling.

Possible settings are:

◆ [Meas Time Manual](#)

◆ [Meas Time Auto](#)

Meas Time Manual

Opens an edit dialog box to enter the duration of the level measurement in seconds. The level measurement is used to determine the optimal reference level automatically (see the "[Auto Level](#)" softkey). The default value is 100 ms.

→ Remote: [ADJ:CONF:LEV:DUR 5](#)

Meas Time Auto

The level measurement is used to determine the optimal reference level automatically (see the "[Auto Level](#)" softkey). This softkey resets the level measurement duration for automatic leveling to the default value of 100 ms.

12.6.15 Softkeys of the Span menu – SPAN key

The SPAN key is disabled for measurements in the CDA mode. For all other measurements (see root menu), the permissible span settings are described together with the measurement. The associated menu corresponds to that of the measurement in the base unit and is described in the manual for the base unit.

12.6.16 Softkeys of the bandwidth menu – BW key

The BW key is disabled for measurements in the CDA mode. For all other measurements (see root menu), the permissible span settings are described together with the measurement. The associated menu corresponds to that of the measurement in the base unit and is described in the manual for the base unit.

12.6.17 Softkeys of the marker function menu – MKR FUNC key

The MKR FUNC key is disabled for measurements in the CDA mode. For all other measurements (see root menu), the permissible span settings are described together with the measurement. The associated menu corresponds to that of the measurement in the base unit and is described in the manual for the base unit.

12.6.18 Softkeys of the save and recall menu – SAVE/RCL key

The functionality is the same as in the base system. For details refer to the base system.

12.6.19 Softkeys of the setup menu - SETUP key

The functionality is the same as in the base system. For details refer to the base system.

12.6.20 Softkeys of the print menu - PRINT key

The functionality is the same as in the base system. For details refer to the base system.

12.6.21 PRESET key

The functionality is the same as in the base system. For details refer to the base system.

12.6.22 HELP key

The functionality is the same as in the base system. For details refer to the base system.

12.7 Remote Control Commands

In this section all remote control commands for the base station test option R&S FSV-K72 are described in detail. For details on conventions used in this chapter refer to section "[Notation](#)".

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in "[Remote Control – Description of Analyzer Commands](#)" or section "[Remote Control - Description of Basic Settings Commands](#)".

12.7.1 CALCulate subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquisition, i.e. following the SENSE subsystem.

The following subsystems are included:

["CALCulate:FEED subsystem"](#) on page 822

["CALCulate:DELTamarker subsystem"](#) on page 824

["CALCulate:LIMit:ESPectrum subsystem"](#) on page 824

["CALCulate:MARKer subsystem"](#) on page 824

12.7.1.1 CALCulate:FEED subsystem

The CALCulate:FEED subsystem selects the result display for the different screens in the code domain analyzer. This corresponds to the result display selection in manual operation.

Commands of the CALCulate:FEED Subsystem

- [CALCulate<1..4>:FEED](#)

CALCulate<1..4>:FEED

This command selects the result display for the different screens.
The numeric suffixes <1..4> indicate the screen.

Parameter

'XPOW:CDP'	Result display of code domain power as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:ABSolute'	Result display of code domain power ratio as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:RATio'	Result display of code domain power ratio as bar graph [absolute scaling] (CALCulate<1>)
'XPOWer:CDEP'	Result display of code domain error power as bar graph
'XTIMe:CDPower:CHIP:EM' VM'	Result display error vector magnitude (EVM) versus
'XTIMe:CDPower:CHIP:MAGNitude' AGNitude'	Result display magnitude error versus chip
'XTIMe:CDPower:CHIP:PHASE' HASE'	Result display phase error versus chip
'XTIM:CDP:ERR:SUMM'	Result display in tabular form (CALCulate2)
'XTIM:CDP:ERR:CTABLE'	Result display of channel assignment table
'XTIM:CDP:ERR:PCDomain'	Result display of peak code domain error (CALCulate2)
'XTIM:CDP:MACCuracy'	Result display of composite EVM (error vector magnitude referenced to the overall signal) (CALCulate2)
'XTIM:CDP:PVSymbol'	Result display of power versus symbol (CALCulate2)
'XTIM:CDP:COMP:CONStellation'	Result display of composite constellation (CALCulate2)
'XTIM:CDP:FVSLot'	Result display of frequency versus slot (CALCulate2)
'XTIM:CDP:PVSLot'	Result display of power versus slot (CALCulate2)
'XTIM:CDP:PVSLot:ABSolute'	Result display of power versus slot [absolute scaling] (CALCulate2)
'XTIM:CDP:PVSLot:RATio'	Result display of power versus slot [absolute scaling] (CALCulate2)
'XTIM:CDP:BSTReam'	Result display of bit stream (CALCulate2)
'XTIM:CDP:SYMB:CONStellation'	Result display of symbol constellation (CALCulate2)
'XTIM:CDP:SYMB:EVM'	Result display of symbol error vector magnitude (CALCulate2)
'XTIMe:CDPower:SYMBol:EVM:PHASE'	Result display of the phase of EVM versus symbols (CALCulate2)
'XTIMe:CDPower:SYMBol:EVM:MAGNitude'	Result display of the magnitude of EVM versus symbols (CALCulate2)

'XPOW:CDP'	Result display of code domain power as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:ABSolute'	Result display of code domain power ratio as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:RATio'	Result display of code domain power ratio as bar graph

Example

```
CALC3:FEED 'ERR:SUMM'
```

Activates the result summary in screen C.

Characteristics

*RST value: XTIM:OFF

SCPI: device-specific

12.7.1.2 CALCulate:DELTa marker subsystem (R&S FSV-K72)

The CALCulate:DELTa marker subsystem controls the delta marker functions of the instrument.

For a detailed description of the commands of the [CALCulate:DELTa marker subsystem](#) refer to the description of the base unit.

12.7.1.3 CALCulate:LIMit:ESpectrum subsystem

The CALCulate:LIMit:ESpectrum subsystem defines limit checking for spectral measurements with options WCDMA 3G FDD BTS (option R&S FSV-K72).

For a detailed description of the commands of the [CALCulate:LIMit:ESpectrum subsystem](#) refer to the description of the base unit.

12.7.1.4 CALCulate:MARKer subsystem

The CALCulate:MARKer subsystem checks the marker functions of the instrument.

For a detailed description of the commands of the commands of the [CALCulate:MARKer:subsystem](#) refer to the description of the base unit.

12.7.1.5 CALCulate:MARKer:FUNCtion subsystem

The CALCulate:MARKer:FUNCtion subsystem checks the marker functions in the instrument.

For a detailed description of the commands of all other commands of the [CALCulate:MARKer:FUNCtion subsystem](#) refer to the description of the base unit.

Commands of the CALCulate:MARKer:FUNCtion Subsystem

- "[CALCulate<1..4>:MARKer<1...16>:FUNCtion:CPICH](#)"
- "[CALCulate<1..4>:MARKer<1...16>:FUNCtion:PCCPch](#)"
- "[CALCulate<1..4>:MARKer<1...16>:FUNCtion:WCDPower\[:BTS\]:RESult?](#)"

CALCulate<1..4>:MARKer<1...16>:FUNCtion:CPICH

This command sets the marker to channel 0.

This command is an event and, therefore, has neither an *RST value nor a query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with:

CALCulate<1>

for CDP absolute and relative

CALCulate<2>

for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

Example

```
CALC:MARK:FUNC:CPIC
```

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

CALCulate<1..4>:MARKer<1...16>:FUNCtion:PCCPch

This command sets the marker to channel 1.

This command is an event and, therefore, has neither an *RST value nor a query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with:

CALCulate<1>

for CDP absolute and relative

CALCulate<2>

for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

Example

CALC:MARK:FUNC:PCCP

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

CALCulate<1..4>:MARKer<1...16>:FUNCTION:WCDPower[:BTS]:RESult?

This command queries the measured and calculated results of the 3GPP FDD code domain power measurement.

Parameter

PTOTAL | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFFset | IQIMbalance | MTYPe | RHO

PTOTAL	total power	FERRor	frequency error in Hz
TFRame	trigger to frame	TOFFset	timing offset
MACCuracy	composite EVM	PCDerror	peak code domain error
EVMRms	error vector magnitude RMS	EVMPeak	error vector magnitude peak
CERRor	chip rate error	CSLot	channel slot number
SRATe	symbol rate	CHANnel	channel number
CDPabsolute	channel power absolute	CDPRelative	channel power relative
IQOFFset	I/Q offset	IQIMbalance	I/Q imbalance
MTYPe	modulation type	PSYMBOL	Number of pilot bits
RHO	rho value for every slot	ACHannels	Number of active channels

Example

CALC:MARK:FUNC:WCDP:RES? PTOT

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

12.7.2 CONFigure:WCDPower subsystem (3GPP FDD Base Station test, R&S FSV-K72)

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in CONFigure.

Commands of the CONFigure:WCDPower[:BTS]:MEASurement subsystem

- [CONFigure:WCDPower\[:BTS\]:MEASurement](#)
- [CONFigure:WCDPower\[:BTS\]:ASCale:STATe](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE\[:STATe\]](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:COMPare](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:NAME](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:SElect](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:DATA](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:COMMeNT](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:COpy](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:DELeTe](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:CATalog?](#)
- [CONFigure:WCDPower\[:BTS\]:CTABLE:TOFFset](#)
- [CONFigure:WCDPower\[:BTS\]:MCARier:STATe](#)

CONFigure:WCDPower[:BTS]:MEASurement

This command selects the 3GPP FDD base station tests.

Parameter

ACLR	Adjacent-channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
ESpectrum	Measurement of spectrum emission mask
WCDPower	Code domain power measurement. This selection has the same effect as command INSTRument:SElect
POWer	Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
OBANdwith	Measurement of occupied power bandwidth.
CCDF	Measurement of complementary cumulative distribution function.

Example

```
CONF:WCDP:MEAS POW
```

Characteristics

*RST value: POWer:OFF

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:ASCale:STATe

Is available if multi carrier is switched ON. The autoscaling function automatically changes the level settings if the center frequency is changed to another carrier.

Parameter

ON Changes the level settings, if the center frequency is changed to another carrier
OFF Does not change the level settings, if the center frequency is changed to another carrier

Example

```
CONF:WCDP:BTS:ASC:STAT ON
```

Characteristics

*RST value: ON
SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE[:STATe]

This command switches the channel table on or off. When switch-on takes place, the measured channel table is stored under the name RECENT and is switched on. After the RECENT channel table is switched on, another channel table can be selected with the command [CONF:WCDP:CTABLE:SElect](#).

Parameter

ON | OFF

Example

```
CONF:WCDP:CTAB ON
```

Characteristics

*RST value: OFF
SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:COMPare

This command switches between normal predefined mode and predefined channel table comparemode.

In the compare mode a predefined channel table model can be compared against the measurement in respect of power, pilot length and timing offset of the active channels.

Comparison is a sub mode from predefined channel table measurement. It only influences the measurement if the softkey CODE CHAN PREDEFINED is active. If the compare mode is selected the power values, pilot lengths and timing offsets are measured and are compared against the values from the predefined channel table. The softkey TIMING OFS PRED/MEAS becomes unavailable. These results are visualized in the corresponding columns of the measurement evaluation CHANNEL TABLE. The table can be switched on with the hotkey RESULT, NEXT and the softkey CHANNEL TABL. The columns are then titled PIL L, PWR and T OFS.

PIL L is the subtraction of PilotLengthMeasured – PilotLengthPredefined.

PWR is the subtraction of PowerRelMeasured – PowerRelPredefined.

The column POWER of the predefined channel table can be edited and via IEC/IEEE bus the value power of the definition of the channel table will be used to set the estimated power.

T OFS is the subtraction of TimingOffsetMeasured – TimingOffsetPredefined

For non active channels dashes are shown.

Parameter

ON | OFF

Example

```
CONF:WCDP:CTAB:COMP ON
```

Characteristics

*RST value: OFF

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:NAME

This command selects an existing channel table or creates the name of a new channel table.

Parameter

<file name>

Example

```
CONF:WCDP:CTAB:NAME 'NEW_TAB'
```

Characteristics

*RST value: RECENT

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:SElect

This command selects a predefined channel table file. Before using this command, the RECENT channel table must be switched on first with the command

```
CONF:WCDP:CTAB:STAT ON..
```

Parameter

<string>

Example

```
CONF:WCDP:CTAB1 ON  
CONF:WCDP:CTAB:SEL 'CTAB_1'
```

Characteristics

*RST value: RECENT

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:DATA

This command defines the values of the selected channel table.
Each line of the table consists of 8 values.

Parameter

Code Class	2 to 9
Code number	0 to 511
Use TFCI	0: not used, 1. used
Timing offset	0 to 38400, for code class 9, the step width is 512; otherwise, 256
Pilot length	code class 9: 4 code class 8: 2,4, 8 code class 7: 4, 8 code class 5/6: 8 code class 2/3/4: 16
Channel Type	0: DPCH Dedicated Physical Channel of a standard WCDMA Frame 1: PICH Paging Indication Channel 2: SCCPCH Secondary Common Control Physical Channel 3: HS_SCCH HSDPA: High Speed Shared Control Channel 4: HS_PDSCH HSDPA: High Speed Physical Downlink Shared Channel 5: CHAN any other QPSK modulated channel without pilot symbols 10: CPRSD Dedicated Physical Channel (DPCH) in compressed mode 11: CPR-TPC DPCH in compressed mode TPC symbols are sent in the first slot of the gap. 12: CPR-SF/2 DPCH in compressed mode using half spreading factor (SF/2). 13: CPR-SF/2-TPC DPCH in compressed mode using half spreading factor (SF/2).TPC symbols are sent in the first slot of the gap. 14: E-HICH: Enhanced HARQ Hybrid Acknowledgement Indicator Channel E-RGCH: Enhanced Relative Grant Channel 15 EAGCH E-AGCH: Enhanced Absolute Grant Channel 16 SCPICH Secondary Common Pilot Channel
Status	0: not active, 1: active
CDP relative	for setting commands any value, for query CDP relative value

Channels PICH, CPICH and PCCPCH may only be defined once. If channel CPICH or PCCPCH is missing in the command, it is automatically added at the end of the table.

Prior to this command, the name of the channel table has to be defined with the command `CONF:WCDP:CTAB:NAME`

Example

```
CONF:WCDP:CTAB:DATA
8,0,0,0,0,0,1,0.00,8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,1,0.00
```

Characteristics

*RST value: --
 SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:COMMeNT

This command defines a comment for the selected channel table:
 Prior to this command, the name of the channel table has to be defined with command [CONF:WCDP:CTAB:NAME](#) and the values of the table have to be defined with command [CONF:WCDP:CTAB:DATA](#).

Parameter

<string>

Example

```
CONF:WCDP:CTAB:COMM 'Comment for table 1'
```

Characteristics

*RST value: --
 SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:COpy

This command copies one channel table onto another one. The channel table to be copied is selected with command [CONF:WCDP:CTAB:NAME](#).
 The name of the channel table may contain a maximum of 8 characters. This command is an "event" which is why it is not assigned an *RST value and has no query.

Parameter

<file_name> ::= name of the new channel table

Example

```
CONF:WCDP:CTAB:COpy 'CTAB_2'
```

Characteristics

*RST value: --
 SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:DELeTe

This command deletes the selected channel table. The channel table to be deleted is selected with the command [CONF : WCDP : CTAB : NAME](#).

Example

```
CONF : WCDP : CTAB : DEL
```

Characteristics

*RST value: --

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:CATalog?

This command reads out the names of all channel tables stored on the hard disk. Syntax of output format: <Sum of file lengths of all subsequent files>,<free memory on hard disk>,<1st file name>,<1st file length>,<2nd file name>,<2nd file length>,<...>,<nth file name>,<nth file length>.

Example

```
CONF : WCDP : CTAB : CAT?
```

Characteristics

*RST value: --

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:CTABLE:TOFFset

This command specifies whether the timing offset and pilot length are measured or if the values are taken from the predefined table.

Parameter

PRED The timing offset and pilot length values from the predefined table are used.

MEAS The timing offset and the pilot length are measured by the application. The channel configuration is specified via the predefined channel table.

Example

```
CONF:WCDP:CTAB:TOFF MEAS
```

Characteristics

*RST value: --

SCPI: device specific

Mode

WCDMA

CONFigure:WCDPower[:BTS]:MCARier:STATe

If multi carrier is switched ON, the adjust reference level procedure ensures that the settings of RF attenuation and reference level are optimally adjusted for measuring a multi carrier signal.

Parameter

ON: Adjust reference level considering single carrier conditions

OFF: Adjust reference level considering single carrier conditions

Example

```
CONF:WCDP:BTS:MCAR:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device specific

Mode

WCDMA

12.7.3 DISPlay subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display.

For a detailed description of all other commands of the [DISPlay subsystem](#) refer to the description of the base unit.

Command of the DISPlay subsystem

- "[DISPlay\[:WINDow<1..4>\]:SIZE](#)"
- "[DISPlay\[:WINDow<1..4>\]:STATE](#)"
- "[DISPlay\[:WINDow<1..4>\]:TRACe:Y\[:SCALe\]:PDIVision](#)"
- "[DISPlay\[:WINDow<1..4>\]:TRACe:Y\[:SCALe\]:RPOSition](#)"

DISPlay[:WINDow<1..4>]:SIZE

This command switches the diagram to full screen size.

Parameter

LARGE: full screen size

SMALL: small screen size of the ACLR diagram

Example

```
DISP:WIND1:SIZE LARG
```

Characteristics

*RST value: SMALL

SCPI: device specific

Mode

WCDMA

DISPlay:WINDow<1..4>:STATe

Activates/deactivates a screen.

Parameter

ON | OFF

Example

```
DISP:WIND1:STAT ON
```

Characteristics

*RST value: OFF

SCPI: device specific

Mode

WCDMA

DISPlay[:WINDow<1..4>]:TRACe:Y[:SCALe]:PDIVision

This remote command determines the grid spacing on the Y axis for all diagrams, where possible.

Parameter

<numeric value>

Example

```
DISP<1..4>:TRAC1:Y:PDIV
```

Characteristics

*RST value: depends on the result display

SCPI: device specific

Mode

WCDMA

DISPlay[:WINDow<1..4>]:TRACe:Y[:SCALe]:RPOsition

This remote command allows entry of the position of the reference value on the Y axis (1 – 100%)

Parameter

<numeric value>

Example

```
DISP<1..4>:TRAC:Y:RPOS
```

Characteristics

*RST value: depends on the result display

SCPI: device specific

Mode

WCDMA

12.7.4 INITiate subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The INITiate subsystem is used to control the init-measurement function. For a detailed description of the commands of the [INITiate subsystem](#) refer to the description of the bsae unit.

12.7.5 INPut subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

For a detailed description of the commands of the [INPut subsystem](#) refer to the description of the bsae unit.

12.7.6 SENSE subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The SENSE subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSE subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword "SENSE" is optional for this reason, which means that it is not necessary to include the SENSE node in command sequences.

The commands of the following subsystem are described in detail in the corresponding section in the base unit.

- ["SENSE:AVERage subsystem"](#)
- ["SENSE:FREQuency subsystem"](#)
- ["SENSE:SWEep subsystem"](#)

The commands of the following subsystem are described below:

- ["SENSE:CDPower subsystem"](#)

12.7.6.1 SENSE:CDPower subsystem

This subsystem controls the parameters for the code domain mode. The numeric suffix in SENSE<1..4> is not significant in this subsystem.

Comands of the INPut subsystem

- ["\[SENSE<1..4>\]:CDPower:ANTenna"](#) on page 839
- ["\[SENSE<1..4>\]:CDPower:ASEquence"](#) on page 839
- ["\[SENSE<1..4>\]:CDPower:CPB"](#) on page 840
- ["\[SENSE<1..4>\]:CDPower:CODE"](#) on page 840
- ["\[SENSE<1..4>\]:CDPower:FRAME:LVALue"](#) on page 841
- ["\[SENSE<1..4>\]:CDPower:HSDPamode"](#) on page 841
- ["\[SENSE<1..4>\]:CDPower:ICTReshold"](#) on page 842
- ["\[SENSE<1..4>\]:CDPower:IQLength"](#) on page 842
- ["\[SENSE<1..4>\]:CDPower:LEVel:ADJust"](#) on page 843
- ["\[SENSE<1..4>\]:CDPower:LCODe:VALue\]"](#) on page 843
- ["\[SENSE<1..4>\]:CDPower:LCODe:DVALue"](#) on page 844
- ["\[SENSE<1..4>\]:CDPower:LCODe:SEARCh:\[IMMediate\]"](#) on page 844
- ["\[SENSE<1..4>\]:CDPower:LCODe:SEARCh:LIST?"](#) on page 845
- ["\[SENSE<1..4>\]:CDPower:NORMalize"](#) on page 845
- ["\[SENSE<1..4>\]:CDPower:PCONtrol"](#) on page 846
- ["\[SENSE<1..4>\]:CDPower:PDIF"](#) on page 846
- ["\[SENSE<1..4>\]:CDPower:PREFerence"](#) on page 847
- ["\[SENSE<1..4>\]:CDPower:QINVert"](#) on page 847

- "[\[SENSe<1..4>:ICDPower:RSUMmary](#)" on page 848
- "[\[SENSe<1..4>:ICDPower:SBANd](#)" on page 848
- "[\[SENSe<1..4>:ICDPower:SFACTOR](#)" on page 849
- "[\[SENSe<1..4>:ICDPower:SLOT](#)" on page 849
- "[\[SENSe<1..4>:ICDPower:STYPe](#)" on page 850

[SENSe<1..4>:ICDPower:ANTenna

This command activates or deactivates the antenna diversity mode and selects the antenna to be used.

Parameter

OFF | <numeric value>

Example

```
CDP:ANT 1
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:ICDPower:ASEquence

Automatically adjusts the amplitude settings to the signal

Example

```
SENS:CDP:ASEQ
```

Characteristics

*RST value: --

SCPI: device specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:CPB

This command selects the constellation parameter B. According to 3GPP specification the mapping of 16QAM symbols to an assigned bit pattern depends on the constellation parameter B.

Parameter

<numeric value>

Example

```
SENS:CDP:ANT 1
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:CODE

This command sets the code number. The code number refers to code class 9 (spreading factor 512).

Parameter

<numeric value>

Example

```
SENS:CDP:CODE 30
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:FRAMe[:LVALue]

Parameter

<numeric value> [0 ... CAPTURE_LENGTH - 1]

Example

```
SENS:CDP:FRAM 1
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:HSDPamode

This command selects if the HS-DPCCH channel is searched or not.

ON: The high speed channels can be detected. A detection of the modulation type (QPSK /16QAM) is done instead of a detection of pilot symbols.

OFF: The high speed channel can not be detected. A detection of pilot symbols is done instead a detection of the modulation type (QPSK /16QAM)

Parameter

ON | OFF

Example

```
SENS:CDP:HSDP OFF
```

Characteristics

*RST value: ON

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:ICTReshold

This command sets the threshold value from which a channel is treated as active. The level entered refers to the total signal power.

Parameter

<numeric value>

Example

```
SENS:CDP:ICTR -100
```

Characteristics

*RST value: -60 dB

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:IQLength

This command specifies the number of frames that are captured by one sweep.

Parameter

<numeric value>

Example

```
SENS:CDP:IQLength 3
```

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:LEVel:ADJust

This command adjusts the reference level to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the R&S FSL or limiting the dynamic range by an S/N ratio that is too small.

The numeric suffixes <1..4> are irrelevant for this command.

This command is an event and therefore has no *RST value and no query..

Example

```
SENS : CDP : LEV : ADJ
```

Adjusts the reference level to the measured channel power.

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:LCODe[:VALue]

This command defines the scrambling code in hexadecimal format.

Parameter

<hex>

Example

```
SENS : CDP : LCOD : #H2
```

Defines the scrambling code in hexadecimal format.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:LCODe:DVALue

This command defines the scrambling code in decimal format.

Parameter

<numeric value>

Example

```
SENS:CDP:LCOD:DVAL 3
```

Defines the scrambling code in decimal format.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:LCODe:SEARch:[IMMediate]

This command searches automatically the scrambling code that leads to the highest signal power and stores it as new scrambling code for further measurements

Example

```
SENS:CDP:LCOD:SEAR
```

Defines the scrambling code in decimal format.

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:LCODE:SEARch:LIST?

This command returns a comma separated result table of the automatic search sequence containing the highest power values calculated and the corresponding scrambling codes.

The numeric suffixes <1..4> are irrelevant for this command.

This command is only a query and therefore has no *RST value.

Example

```
SENS:CDP:LCOD:SEAR:LIST?
```

Defines the scrambling code in decimal format.

Characteristics

*RST value: --

SCPI: device-specific

Return value:

16,0x10,-18.04,32,0x20,-22.87,48,0x30,-27.62,64,0x40,-29.46

code (dec)	code(hex)	CPICH power (dBm)
16,	0x10,	-18.04
32,	0x20,	-22.87
48,	0x30,	-27.62
64,	0x40,	-29.46

Mode

WCDMA

[SENSe<1..4>:]CDPower:NORMalize

This command switches elimination of I/Q offset on or off.

Parameter:

ON | OFF

Example

```
SENS:CDP:NORM ON
```

Activates the elimination of the I/Q offset.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:PCONtrol

This command determines the power control measurement position. The slot power can be averaged from the beginning of the slot to the end of the slot (parameter SLOt) or from the beginning of the pilot symbols of the previous slot to the beginning of the pilot symbols of the actual slot. (parameter PILot). Furthermore, an enhanced channel search is used to consider the properties of compressed mode channels.

Parameter:

SLOt | PILot

Example

```
SENS:CDP:PCON SLOt
```

Switch to power averaging from slot start to the end of the slot An enhanced channel search to consider the properties of compressed mode channels is used.

```
SENS:CDP:PCON PIL
```

Switch to power averaging from the pilot symbols of the previous slot number to the start of the pilots of the displayed slot number

The channel search does only consider standard channels.

Characteristics

*RST value: PILot

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:PDIFf

This command activates or deactivates the slot power difference calculation of the POWER VERSUS SLOt display. The slot power difference between the actual and the previous slot is displayed, if the power versus slot display is enabled
ON: The slot power difference to the previous slot is displayed (POWER VS SLOt display).

OFF: The slot power of each slot is displayed (POWER VS SLOt display).

Parameter:

ON | OFF

Example

```
SENS:CDP:PDIF ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:PREFERENCE

This command switches between the use of total power or CPICH power as the reference for the relative CDP measurement values.

Parameter:

TOTAL | CPICH

Example

```
SENS:CDP:REF CPICH
```

Characteristics

*RST value: TOTAL

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:QINVERT

This command inverts the Q component of the signal.

Parameter:

ON | OFF

Example

```
SENS:CDP:QINV ON
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:RSUMmary

This command sets the view of the Code Domain Result Summary. In NORMal view some of the most important results are shown in the table on the R&S FSV display. In EXTended view all available results are shown in the table on the R&S FSV display.

Parameter:

NORMal | EXTended

Example

```
SENS:CDP:RSUM EXT
```

Characteristics

*RST value: NORM

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:SBANd

This command is for interchanging the left and the right sidebands

Parameter:

NORMal | INVers

Example

```
SENS:CDP:SBAN INV
```

Characteristics

*RST value: NORM

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:SFACTOR

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR

Parameter:

4 | 8 | 16 | 32 | 64 | 128 | 256 | 512

Example

```
SENS:CDP:SFACTOR 16
```

Characteristics

*RST value: 512

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:SLOT

This command sets the slot number of the common pilot channels (CPICH).

Parameter:

<numeric value>

Example

```
SENS:CDP:SLOT 3
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:STYPe

This command selects the type of synchronization. If CPICH is selected, the synchronization is carried out to CPICH. For this type of synchronization, the CPICH must be present in the transmit signal. If SCHannel is selected, the synchronization is carried out without CPICH. This type of synchronization is required for test model 4 without CPICH.

Parameter:

CPICH | SCHannel

Example

```
SENS:CDP:STYP SCH
```

Characteristics

*RST value: CPICH

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:UCPich:CODE

This command sets the code number of the user defined CPICH used for signal analysis.

Parameter:

0 to 255

Example

```
SENS:CDP:UCP:CODE 10
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:UCPich:PATtern

This command defines which pattern for the user defined CPICH is used for signal analysis. OFF leads to a pattern selection according to the antenna selection, 1 leads to the fixed usage of "Pattern 1" and 2 leads to the fixed usage of "Pattern 2" according to standard.

Parameter:

OFF | 1 | 2

Example

SENS:CDP:UCP:PATT 1

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

[SENSe<1..4>:]CDPower:UCPich[:STATe]

This command defines if the user defined CPICH settings are valid and shall be used for signal analysis.

Parameter:

ON | OFF

Example

SENS:CDP:UCP ON

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

12.7.7 STATus:QUEStionable subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The STATus subsystem contains the commands for the status reporting system (for details refer to chapter 5 "Remote Control - Basics", section "Status Reporting System") of the base unit. *RST does not influence the status registers.

The STATus:QUEStionable subsystem contains information about the observance of limits during adjacent power measurements, the reference and local oscillator, the observance of limit lines and limit margins and possible overloads of the unit.

The available remote commands are described in detail in chapter

[STATus:QUEStionable subsystem](#) in the base unit.

12.7.8 STATus:QUEStionable:SYNC subsystem (3GPP FDD Base Station test, R&S FSV-K72)

This register contains information on the error situation in the code domain power analysis of the R&S FSV-K72 option. It can be queried with the following commands:

Commands of the STATus:QUEStionable:SYNC Subsystem

- ["STATus:QUEStionable:SYNC:CONDition?"](#)
- ["STATus:QUEStionable:SYNC\[:EVENT\]?"](#)

STATus:QUEStionable:SYNC:CONDition?

This command reads the information on the error situation in the code domain power analysis of the R&S FS-K72 option.

Example

```
STAT:QUES:SYNC:COND?
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

Return value

see table below

STATus:QUEStionable:SYNC[:EVENT]?

This command reads the information on the error situation in the code domain power analysis of the R&S FS-K72 option. The value can only be read once.

Example

```
STAT:QUES:SYNC[:EVENT]?
```

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WCDMA

Return value

see table below

Bit No.	Definition
0	Not used in R&S FSV-K72.
1	R&S FSV-K72 Frame Sync failed This bit is set when synchronization is not possible within the application. Possible reasons: Incorrectly set frequency Incorrectly set level Incorrectly set scrambling code Incorrectly set values for Q-INVERT or SIDE BAND INVERT Invalid signal at input
2 to 4	Not used in the R&S FSV-K72 application.
5	R&S FSV-K72 Incorrect Pilot Symbol This bit is set when one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard. Possible reasons: Incorrectly sent pilot symbols in the received frame. Low signal to noise ratio (SNR) of the WCDMA signal. One or more code channels has a significantly lower power level compared to the total power. The incorrect pilots are detected in these channels because of low channel SNR. One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display).
6 to 14	Not used in the R&S FSV-K72 application.
15	This bit is always 0.

12.7.9 TRACe subsystem (3GPP FDD Base Station test, R&S FSV-K72)

The TRACe subsystem controls access to the instruments internal trace memory.

The following subsystem is included:

[TRACe:IQ Subsystem](#) on page "860"

Commands of the TRACe Subsystem

- ["TRACe<1..4>\[:DATA\]"](#)

TRACe<1..4>[:DATA]

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument. TRACE1, TRACE2, CTABLE, PWCDp, CWCDp, TPVSlot or ABITstream can be queried depending on the display mode.

Parameter:

ATRACE2 | FINAL1 | TRACE1 | TRACE2 | ABITstream | PWCDp | CWCDp | CTABLE | TPVSlot | LIST

ATRACE2	<p>returns a list of slot number / absolute frequency error vs slot for all slots. In contrast to the scope presentation and the TRACE2 parameter return value, absolute values are returned.</p> <p>Output: List of slot number and absolute frequency error values of all slots</p> <p>Format: SlotNumber 0, FreqError 0,, SlotNumber 14, FreqError 14</p> <p>Unit: [Hz]</p> <p>Quantity: 15</p>
FINAL1	<p>returns the peak list. For each peak the following entries are given:</p> <p><freq1>, <level1>, <delta level 1>, <freq2>, <level2>, <delta level 2>, ... <freq n>, <level n>, <delta level n></p>
TRACE1 2	<p>returns the trace data. Depending on the display, the trace data format varies</p>
PWCDp	<p>can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length is transmitted in addition to the values as transmitted for trace 1. The pilot length is specified in symbols.</p> <p>Six values are transmitted for each channel:</p> <p>< class>,<channel number>,<absolute level>,<relative level>,<timing offset> or <I/Q-mapping>, <pilot length>,...</p>
CTABLE	<p>can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length and the channel state (active, inactive) are transmitted in addition to the values transmitted for trace 1. The pilot length is specified in symbols.</p> <p>Seven values are transmitted for each channel:</p> <p>< class>,<channel number>,<absolute level>,<relative level>,<timing offset>,<pilot length>, <active inactive>...</p>
CWCDp	<p>can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length, channel state, channel type, modulation type and a reserved value are transmitted in addition to the values transmitted for trace 1. For each channel 10 values are transmitted. The range of channel types 13.</p> <p><code class>,<channel number>,<absolute level>,<relative level>, <timing offset>, <pilot length>, <active flag>, <channel type>, <modulation type>, <reserved>...</p> <p>The channels are output in ascending order sorted by code number, i.e. in the</p>

same sequence they are displayed on screen.

No.	Parameter	Range	Unit	Explanation
1)	<code class>	{2 ... 9}	[1]	Code class of the channel.
2)	<channel number>	{0 ... 511}	[1]	Code number of the channel.
3)	<absolute level>	{-∞ ... ∞}	[dBm]	Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.)
1	< relative level >	{-∞ ... ∞}	[dB]	Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.)
5)	<timing offset>	{0 ... 38400}	[chips]	Timing offset of the code channel to the frame start. The value is measured in chips. The step width is 256 chips in the case of code class 2 to 8, and 512 chips in the case of code class 9.
6)	<pilot length>	{0,2,4,8,16}	[symbols]	Pilot length of the code channel. According to the 3GPP standard, the pilot length range depends on the code class.
7)	<active flag>	{0,1}	[1]	Flag to indicate whether a channel is active 0 - channel not active 1 - channel active
8)	<channel type>	{0 ... 13}	[1]	Channel type indication

0 - DPCH	D edicated P hysical C hannel of a standard frame
1 - PICH	P aging I ndication C hannel
2 - CPICH	C ommon P ilot C hannel
3 - PSCH	P rietary S ynchronization C hannel
4 - SSCH	S econdary S ynchronization C hannel
5 - PCCPCH	P rietary C ommon C ontrol P hysical C hannel
6 - SCCPCH	S econdary C ommon C ontrol P hysical C hannel
7 - HS_SCCH	HSDPA: H igh S peed S hared C ontrol C hannel
8 - HS_PDSCH	HSDPA: H igh S peed P hysical D ownlink S hared C hannel

9 - CHAN	Channel without any pilot symbols (QPSK modulated)
10 - CPRSD	Dedicated Physical Channel in compressed mode
11 - CPR-TPC	Dedicated Physical Channel in compressed mode TPC symbols are sent in the first slot of the gap.
12 - CPR-SF/2	Dedicated Physical Channel in compressed mode using half spreading factor (SF/2).
13 - CPR-SF/2-TPC	Dedicated Physical Channel in compressed mode using half spreading factor (SF/2). TPC symbols are sent in the first slot of the gap.
14 - EHICH-ERGCH	HSUPA: Enhanced HARQ Hybrid A cknowledgement I ndicator C hannel HSUPA: E nhanced R elative G rant C hannel
15 - EAGCH	E-AGCH : Enhanced A bsolute G rant C hannel
16 - SCPICH	S econdary C ommon P ilot C hannel

No.	Parameter	Range	Unit	Explanation
9)	<modulation type>	{2,4,15}	[1]	Modulation type of the code channel at the selected channel slot. (The channel slot can be marked by adjusting SELECT CPICH slot.)
		2 - QPSK		Modulation type QPSK.
		4 - 16QAM		Modulation type 16QAM.
		15 - NONE		There is no power in the selected channel slot [slot is switched OFF]. (According to 3GPP, the power of an HSDPA channel can be switched every 2 ms, i.e. 3 slots.)
10)	<reserved>	{0}	[1]	Reserved for future functionality.

ABITstream	<p>can be set only if CALC2:FEED "XTIM:CDP:BSTream" is selected (in the lower bitstream window). This command returns the bit streams of all 15 slots one after the other. The output format may be REAL, UINT or ASCII. The number of bits of a 16QAM-modulated channel is twice that of a QPSK-modulated channel, the number of bits of a 64QAM-modulated channel is three times that of a QPSK-modulated channel.</p> <p>The output format is equal to that of the ":TRAC1:DATA? TRAC2" command in case of an activated bitstream display. The only difference is the number of symbols which are evaluated. The ABITSTREAM command evaluates all symbols of one frame. One value is transferred per bit (range 0,1,). Each symbol contains of two (QPSK) or four (16QAM) consecutive bits. The number of symbols is not constant and may vary depending on the selected channel and its symbol modulation type. The bit stream may contain invalid (symbols without power).</p> <p>If HS-DPA/UPA (Channel Detection Settings – Common Settings) is set OFF the</p>
------------	--

values and number of the bits are as follows:	
Unit	[]
Range	{0, 1, 6, 9}
Bits per slot	$N_{\text{BitPerSymb}} = 2$
number of symbols	$N_{\text{Symb}} = 150 \cdot 2^{(\beta\text{-Code Class})}$
Number of bits	$N_{\text{Bit}} = N_{\text{Symb}} \cdot N_{\text{BitPerSymb}}$
Format	Bit ₀₀ , Bit ₀₁ , Bit ₁₀ , Bit ₁₁ , Bit ₂₀ , Bit ₂₁ , ..., Bit _{N_{Symb} 0} , Bit _{N_{Symb} 1}
Explanation	0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)
If HS-DPA/UPA (Channel Detection Settings – Common Settings) is set ON the values and number of the bits are as follows:	
Unit	[]
Range	{0, 1, 6, 7, 8, 9}
Bits per slot	$N_{\text{BitPerSymb}} = \{2, 4, 6\}$
Max. bits per symbol	$N_{\text{BitPerSymb MAX}} = \text{MAX} \{N_{\text{BitPerSymb}}(\text{slot})\}_{\text{slot}=1}^{15}$
Symbols per slot	$N_{\text{Symb_Slot}} = 10 \cdot 2^{(\beta\text{-Code Class})}$
Symbols per frame	$N_{\text{Symb_Frame}} = 15 \cdot N_{\text{Symb_Slot}} = 150 \cdot 2^{(\beta\text{-Code Class})}$
Number of bits	$N_{\text{Bit}} = N_{\text{Symb_Frame}} \cdot N_{\text{BitPerSymb MAX}}$
Format (16QAM)	Bit ₀₀ , Bit ₀₁ , Bit ₀₂ , Bit ₀₃ , Bit ₁₀ , Bit ₁₁ , Bit ₁₂ , Bit ₁₃ , ..., Bit _{N_{Symb_Frame} 0} , Bit _{N_{Symb_Frame} 1} , Bit _{N_{Symb_Frame} 2} , Bit _{N_{Symb_Frame} 3}
Format (64QAM)	Bit ₀₀ , Bit ₀₁ , Bit ₀₂ , Bit ₀₃ , Bit ₀₄ , Bit ₀₅ , Bit ₁₀ , Bit ₁₁ , Bit ₁₂ , Bit ₁₃ , Bit ₁₄ , Bit ₁₅ , ..., Bit _{N_{Symb_Frame} 0} , Bit _{N_{Symb_Frame} 1} , Bit _{N_{Symb_Frame} 2} , Bit _{N_{Symb_Frame} 3} , Bit _{N_{Symb_Frame} 4} , Bit _{N_{Symb_Frame} 5}
Explanation	0 - Low state of a transmitted bit 1 - High state of a transmitted bit 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) 7 - Bit of a switched-off symbol of an HS-PDSCH channel 8 - Fill value for unused bits of a lower order modulation symbol in a frame containing higher order modulation. 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)

The values 7 and 8 are only used in case of a varying modulation type of an HS-PDSCH channel. In this case the number of bits per symbol ($N_{\text{BitPerSymb}}$) varies too. However, the length of the transmitted bit vector (N_{Bit}) depends only of the maximum number of bits per symbol in that frame. That means, if the modulation type changes throughout the frame this will not influence the number of biots being transmitted.
Example 1:

Some slots of the frame are 64QAM modulated, other are 16QAM and QPSK modulated and some are switched OFF (NONE). If one or more slots of the frame are 64QAM modulated, six bits per symbol are transmitted and if the highest modulation order is 16QAM, four bits per symbol are transmitted. In any slot of the frame with lower order modulation, the first two or four of the four or six bits are marked by the number 8 and the last bits represent the transmitted Remote Control Commands symbol. If no power is transmitted in a slot, four or six entries per symbol of value 7 are transmitted.

Example 2:

Some slots of the frame are QPSK modulated and some are switched OFF. If one or more slots of the frame are QPSK modulated and no slot is 16QAM modulated, 2 bits per symbol are transmitted. If no power is transmitted in a slot, 2 entries per symbol of value 7 are transmitted.

Third case:

Some slots of a DPCH are suppressed because of compressed mode transmission. The bits of the suppressed slots are marked by the digit '6'. In this case always 2 bits per symbol are transmitted.

TPVSlot	can be set if POWER VS SLOT is selected. Sixteen (16) pairs of slots (slot number of CPICH) and level values (for 16 slots) are always transferred. The query is possible no matter which evaluation is selected in the code domain analyzer. <slot number>, <level value in dBm>, <slot number>, <level value in dBm>,
LIST	This command reads the peak list of the spectrum emission mask measurement list evaluation (refer to CALC:PEAK:AUTO ON OFF). An array of values is returned for each range of the limit line. The arrays for each limit line range are following sequentially. <value array of range 1>, <value array of range 2>,, <value array of range n> The array of each range contains the following value list: <No>, <Start>, <Stop>, <Rbw>, <Freq>, <Levelabs>, <Levelrel>, <Delta>, <Limitcheck>, <unused1>, <unused2> where: No [] : number of the limit line range Start [Hz] : start frequency of the limit line range Stop [Hz] : stop frequency of the limit line range Rbw [Hz] : resolution band width of the limit line range Freq [Hz] : frequency of the power peak with in the range Levelabs [dBm] : absolute power of the peak with in the range Levelrel [dB] : relative power of the peak with in the range related to channel power. Delta [dB] : power difference to margin power Limitcheck [0 1] : decision whether the power is below [0] or above [1] the limit line Unused1 [] : reserved (0.0) Unused2 [] : reserved (0.0)

Example

```
"INST WCDP "  
start K72  
"CALC:FEED `XTIM:CDP:FVSL` "  
select FREQUENCY ERROR VS SLOT display  
"INIT:CONT OFF"  
select single sweep mode  
"INIT"  
performs a single sweep  
"TRACe:DATA? ATRACE2"  
reads the trace data of FREQUENCY 'ERROR VS SLOT display  
":TRAC1:DATA? FINAL1"
```

Query of results

Result: <freq> [Hz] frequency of the peak <level> [dBm] absolute level of the peak <delta level> [dB] distance to the limit line

" :TRAC TRACE1 , +A\$ "

'A\$: data list in current format

" :TRAC? TRACE1 "

Characteristics

*RST value: --

SCPI: device-specific

Mode

WCDMA

12.7.10 TRACe:IQ Subsystem

For a detailed description of the [TRACe:IQ Subsystem](#) refer to the description of the base unit.

12.7.11 TRIGger Subsystem

For a detailed description of the [TRIGger Subsystem](#) refer to the description of the base unit.

12.8 Error Messages

Error messages are entered in the error/event queue of the status reporting system in the remote control mode and can be queried with the command `SYSTEM:ERROR?`.

A short explanation of the device-specific error messages for R&S FSV-K72 is given below.

Status bar message	Description
Sync not found	This message is displayed if synchronization is not possible. Possible causes are that frequency, level, scrambling code, Invert Q values are set incorrectly, or the input signal is invalid.
Sync OK	This message is displayed if synchronization is possible.
Incorrect pilot symbols	This message is displayed if one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard. Possible causes are: <ul style="list-style-type: none"> ◆ Incorrectly sent pilot symbols in the received frame. ◆ Low signal to noise ratio (SNR) of the WCDMA signal. ◆ One or more code channels have a significantly lower power level compared to the total power. The incorrect pilots are detected in these channels because of low channel SNR. ◆ One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display

12.9 Glossary

CPICH	<p>Common pilot channel (spreading code number 0 at spreading factor 128).</p> <p>The channel constantly contains the symbol (1,1) throughout the total length of the 3GPP FDD frame. For the measurements, the CPICH (Primary CPICH) is used for synchronization. For this reason, the CPICH must be contained in the signal to be measured.</p>
Composite EVM	<p>In accordance with the 3GPP specifications, the squared error between the real and imaginary components of the test signal and an ideal reference signal is determined (EVM referenced to the total signal) in a composite EVM measurement.</p>
DPCH	<p>Dedicated physical channel, data channel. The data channels, which can be sent at different transmission rates, are automatically recognized during the measurement.</p>
Inactive channel threshold	<p>Minimum power that a single channel must have as compared to the total signal in order to be recognized as an active channel.</p>
PCCPCH	<p>Primary common control physical channel (spreading code number 1 at spreading factor 128).</p> <p>The channel is used for synchronizing the measurements. For this reason, it must be contained in the signal to be measured.</p>
Peak code domain error	<p>In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement.</p>
PICH	<p>Paging indication channel.</p> <p>This special channel is defined in the test models to 3GPP for measurements on base station signals. Since it does not contain any pilot symbols, it cannot automatically be recognized during measurement. Therefore, this channel must be deactivated for CDP measurements.</p>

SCH	<p>Synchronization channel, divided into P-SCH (primary synchronization channel) and S-SCH (secondary synchronization channel).</p> <p>The two channels are required for synchronizing the measurement. Therefore, they must always be contained in the signal to be measured.</p>
Timing offset	<p>Offset between the start of the first slot of a channel and the start of the analyzed 3GPP FDD frame (in multiples of 256 chips).</p>

13 Firmware Option WLAN TX Measurements R&S FSV-K91

13.1 Overview of Firmware Option R&S FSV-K91

This manual contains all information about the operation of an R&S FSV equipped with Application Firmware R&S FSV-K91. It covers operation via menus and the remote control commands for analog demodulation measurements.

This manual consists of the data sheet and 4 chapters:

Data sheet	Lists the guaranteed specifications and the firmware characteristics.
Chapter 1.1	Gives a brief overview over the document structure.
Chapter 1.2	Describes the measurement setup for WLAN TX measurements.
Chapter 1.3	Describes the overall instrument functions and provides further information
Chapter 1.4	Shows all softkeys available in the analog demodulation menu. This chapter also presents the remote control commands associated with each softkey function.
Chapter 1.5	Describes all remote control commands defined for the power meter measurement.

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware R&S FSV-K91. For all other descriptions, please refer to the R&S FSV Analyzer operating manual.

13.2 WLAN TX Measurements (Option R&S FSV-K91)

The R&S FSV-K91 application extends the functionality of the R&S FSV spectrum analyzer to enable wireless LAN TX measurements in accordance with IEEE standards 802.11 a b, g, j.

13.2.1 Basic measurement examples

This section provides step-by-step instruction for working through an ordinary measurement. The following steps are described:

1. [Setting up the measurement](#)
2. [Performing the main measurement](#)

In this example, a DUT using IEEE 802.11a is to be used. The DUT is connected to the R&S FSPB using the RF input of the R&S FSPB. The DUT generates a signal modulated using 16QAM.

13.2.1.1 Setting up the measurement

1. Activate the "WLAN" mode (for details refer to chapter "Instrument Functions", section "[Measurement Mode Selection - MODE Key](#)").
2. Press the "FREQ" key once to select and open the "General Settings" dialog box and to activate the frequency input field.

Demod Settings	
Burst To Analyze	
Signal Field Content	<input checked="" type="checkbox"/>
Burst Type	Direct Link Burst
Auto Demodulation	<input checked="" type="checkbox"/>
Analyze PSDU Mod	54 Mbps 64 QAM
Equal Burst Length	<input type="checkbox"/>
Min Data Symbols	1
Max Data Symbols	1366
Channel Estimation	Payload
Tracking	
Phase	<input checked="" type="checkbox"/>
Timing	<input type="checkbox"/>
Level	<input type="checkbox"/>

3. Activate "Auto Demodulation" (to use the content of the signal inherent field) to detect the modulation type automatically.

13.2.1.2 Performing the main measurement

- ◆ Select single sweep measurements by pressing the "RUN SINGLE" hardkey.
- ◆ Select continuous measurements by pressing the "RUN CONT" hardkey. During the measurement, the status message "Running" is displayed. Leveling is done automatically. Measurement results are updated once the measurement has completed. The results are displayed in graphical form. The display can be toggled to a tabular list of measurement points by pressing the "Display" softkey (in the WLAN menu or trace menu).

13.2.2 Signal Processing of the IEEE 802.11a application

13.2.2.1 Abbreviations

$a_{l,k}$	symbol at symbol l of subcarrier k
EVM_k	error vector magnitude of subcarrier k
EVM	error vector magnitude of current packet
g	signal gain
Δf	frequency deviation between TX and RX
l	symbol index $l = [1, \text{nof_Symbols}]$
nof_symbols	number of symbols of payload
H_k	channel transfer function of subcarrier k
k	channel index $k = [-31, 32]$
K_{mod}	modulation-dependent normalization factor
ξ	relative clock error of reference oscillator
$r_{l,k}$	subcarrier k of symbol l

This description gives a rough view of the IEEE 802.11a application signal processing. Details are disregarded in order to get a concept overview.

A diagram of the interesting blocks is shown in Figure 46. First the RF signal is down converted to the IF frequency $f_{IF} = 96$ MHz. The resulting IF signal $r_{IF}(t)$ is shown on the left-hand side of the figure. After bandpass filtering, the signal is sampled by an Analog to Digital Converter (ADC) at a sampling rate of $f_{s1} = 128$ MHz. This digital sequence is resampled. Thus the sampling rate of the down sampled sequence $r(i)$ is the Nyquist rate of $f_{s3} = 20$ MHz. Up to this point the digital part is implemented in an ASIC.

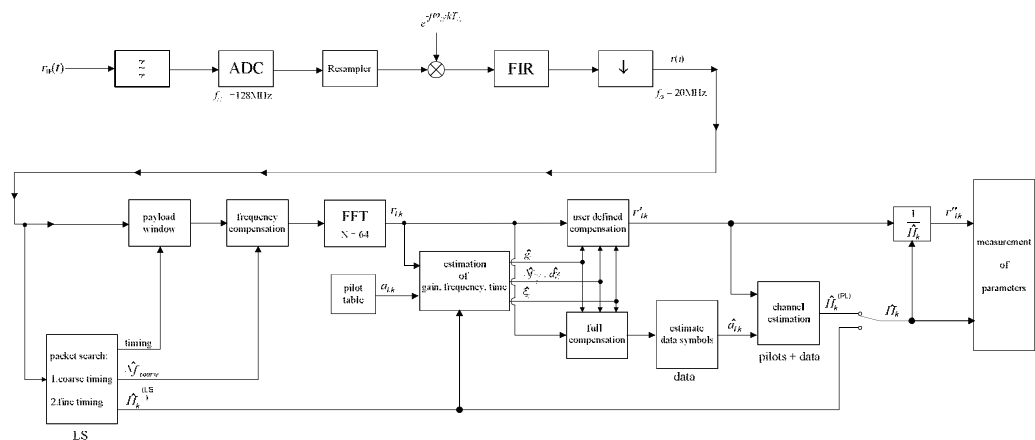


Figure 46: Signal processing of the IEEE 802.11a application

In the lower part of the figure the subsequent digital signal processing is shown. In the first block the packet search is performed. This block detects the Long Symbol (LS) and recovers the timing. The coarse timing is detected first. This search is implemented in the time domain. The algorithm is based on cyclic repetition within the LS after $N = 64$ samples. Numerous treatises exist on this subject, e.g. [1] to [3]. Furthermore a coarse estimate $\Delta\hat{f}_{coarse}$ ¹ of the Rx-Tx frequency offset Δf is derived from the metric in [6]. This can easily be understood because the phase of $r(i) \cdot r^*(i + N)$ is determined by the frequency offset. As the frequency deviation Δf can exceed half a bin (distance between neighbor sub-carriers) the preceding Short Symbol (SS) is also analyzed in order to detect the ambiguity.

After the coarse timing calculation the time estimate is improved by the fine timing calculation. This is achieved by first estimating the coarse frequency response $\hat{H}_k^{(LS)}$, with $k = [-26, 26]$ denoting the channel index of the occupied sub-carriers. First the FFT of the LS is calculated. After the FFT calculation the known symbol information of the LS sub-carriers is removed by dividing by the symbols. The result is a coarse estimate \hat{H}_k of the channel transfer function. In the next step the complex channel impulse response is computed by an IFFT. Next the energy of the windowed impulse response (the window size is equal to the guard period) is calculated for every trial time. Afterwards the trial time of the maximum energy is detected. This trial time is used to adjust the timing. Now the position of the LS is known and the starting point of the useful part of the first payload symbol can be derived. In the next block this calculated time instant is used to position the payload window. Only the payload part is windowed. This is sufficient because the payload is the only subject of the subsequent measurements.

In the next block the windowed sequence is compensated by the coarse frequency estimate $\Delta\hat{f}_{coarse}$. This is necessary because otherwise inter channel interference (ICI) would occur in the frequency domain.

The transition to the frequency domain is achieved by an FFT of length 64. The FFT is performed symbol-wise for every of the *nof_symbols* symbols of the payload. The calculated FFTs are described by $r_{l,k}$ with

- the symbol index $l = [1, \text{nof_symbols}]$ and
- the channel index $k = [-31, 32]$.

In case of an additive white Gaussian noise (AWGN) channel the FFT is described by [4], [5]

$$r_{l,k} = K_{\text{mod}} \times a_{l,k} \times g_l \times H_k \times e^{j(\text{phase}_l^{(\text{common})} + \text{phase}_{l,k}^{(\text{timing})})} + n_{l,k} \quad (10)$$

with

- the modulation-dependant normalization factor K_{mod} ,
- the symbol $a_{l,k}$ of sub-carrier k at symbol l ,
- the gain g_l at the symbol l in relation to the reference gain $g = 1$ at the long symbol (LS),
- the channel frequency response H_k at the long symbol (LS),

¹ The hat generally describes an estimate. Example: \hat{x} is the estimate of x .

- the common phase drift $phase_l^{(common)}$ of all sub-carriers at symbol l (see below),
- the phase $phase_{l,k}^{(timing)}$ of sub-carrier k at symbol l caused by the timing drift (see below),
- the independent Gaussian distributed noise samples $n_{l,k}$.

The common phase drift in equation (10) is given by

$$phase_l^{(common)} = 2\pi \times N_s / N \times \Delta f_{rest} T \times l + d\gamma_l \quad (11)$$

with

- $N_s = 80$ being the number of Nyquist samples of the symbol period,
- $N = 64$ being the number of Nyquist samples $N = 64$ of the useful part of the symbol,
- Δf_{rest} being the (not yet compensated) frequency deviation,
- $d\gamma_l$ being the phase jitter at the symbol l .

In general, the coarse frequency estimate $\hat{\Delta f}_{coarse}$ (see figure 1) is not error-free. Therefore the remaining frequency error Δf_{rest} represents the not yet compensated frequency deviation in $r_{l,k}$. Consequently the overall frequency deviation of the device under test (DUT) is calculated by $\Delta f = \hat{\Delta f}_{coarse} + \Delta f_{rest}$. Remark: The only motivation for dividing the common phase drift in equation (11) into two parts is to be able to calculate the overall frequency deviation of the DUT.

The reason for the phase jitter $d\gamma_l$ in equation (11) may be different. The nonlinear part of the phase jitter may be caused by the phase noise of the DUT oscillator. Another reason for nonlinear phase jitter may be the increase of the DUT amplifier temperature at the beginning of the burst. Please note that besides the nonlinear part the phase jitter $d\gamma_l$ also contains a constant part. This constant part is caused by the not yet compensated frequency deviation Δf_{rest} . To understand this, please keep in mind that the measurement of the phase starts at the first symbol $l = 1$ of the payload. In contrast the channel frequency response H_k in equation (10) represents the channel at the long symbol of the preamble. Consequently the not yet compensated frequency deviation Δf_{rest} produces a phase drift between the long symbol and the first symbol of the payload. Therefore this phase drift appears as a constant value ("DC value") in $d\gamma_l$.

Referring to the IEEE 802.11a measurement standard *Chapter 17.3.9.7 "Transmit modulation accuracy test"* [6], the common phase drift $phase_l^{(common)}$ must be estimated and compensated from the pilots. Therefore this "symbol wise phase tracking" (Tracking Phase) is activated as the default setting of the R&S FSV-K91.

Furthermore the timing drift in equation (10) is given by

$$phase_{l,k}^{(timing)} = 2\pi \times N_s / N \times \xi \times k \times l \quad (12)$$

with ξ being the relative clock deviation of the reference oscillator. Normally a symbol-wise timing jitter is negligible and thus not modeled in equation (12). There may be situations where the timing drift has to be taken into account. This is illustrated by an example: In accordance to [6] the allowed clock deviation of the DUT is up to $\xi_{\max} = 20$ ppm. Furthermore a long packet with $\text{nof_symbols} = 400$ symbols is assumed. From equations (10) and (12), it results that the phase drift of the highest sub-carrier $k = 26$ in the last symbol $l = \text{nof_symbols}$ is 93 degrees. Even in the noise-free case, this would lead to symbol errors. The example shows that it is actually necessary to estimate and compensate the clock deviation, which is accomplished in the next block. Referring to the IEEE 802.11a measurement standard [6], the timing drift $\text{phase}_{l,k}^{(\text{timing})}$ is not part of the requirements. Therefore the "time tracking" (Tracking Time) is not activated as the default setting of the R&S FSV-K91.

The time tracking option should rather be seen as a powerful analyzing option. In addition the tracking of the gain g_l in equation (10) is supported for each symbol in relation to the reference gain $g = 1$ at the time instant of the long symbol (LS). At this time the coarse channel transfer function $\hat{H}_k^{(LS)}$ is calculated. This makes sense since the sequence $r'_{l,k}$ is compensated by the coarse channel transfer function $\hat{H}_k^{(LS)}$ before estimating the symbols. Consequently a potential change of the gain at the symbol l (caused, for example, by the increase of the DUT amplifier temperature) may lead to symbol errors especially for a large symbol alphabet M of the MQAM transmission. In this case the estimation and the subsequent compensation of the gain are useful.

Referring to the IEEE 802.11a measurement standard [6], the compensation of the gain g_l is not part of the requirements. Therefore the "gain tracking" (Tracking Gain) is not activated as the default setting of the R&S FSV-K91.

How can the parameters above be calculated? In this application the optimum maximum likelihood algorithm is used. In the first estimation step the symbol-independent parameters Δf_{rest} and ξ are estimated. The symbol dependent parameters can be neglected in this step i.e. the parameters are set to $g_l = 1$ and $d\gamma_l = 0$. Referring to equation (10) the log likelihood function²

$$L_1(\tilde{\Delta f}_{\text{rest}}, \tilde{\xi}) = \sum_{l=1}^{\text{nof_symbols}} \sum_{k=-21,-7,7,21} \left| r_{l,k} - a_{l,k} \times \hat{H}_k^{(LS)} \times e^{j(\tilde{\text{phase}}_l^{(\text{common})} + \tilde{\text{phase}}_l^{(\text{timing})})} \right|^2 \quad (13)$$

with

$$\tilde{\text{phase}}_l^{(\text{common})} = 2\pi \times N_s / N \times \tilde{\Delta f}_{\text{rest}} T \times l$$

$$\tilde{\text{phase}}_l^{(\text{timing})} = 2\pi \times N_s / N \times \tilde{\xi} \times k \times l$$

must be calculated as a function of the trial parameters $\tilde{\Delta f}_{\text{rest}}$ and $\tilde{\xi}$. The trial parameters leading to the minimum of the log likelihood function are used as estimates $\hat{\Delta f}_{\text{rest}}$ and $\hat{\xi}$. In equation (13) the known pilot symbols $a_{l,k}$ are read from a table. In the second step for every symbol l the log likelihood function

² The tilde generally describes an estimate. Example: \tilde{x} is the trial parameter of x .

$$L_2(\tilde{g}_l, d\tilde{\gamma}_l) = \sum_{k=-21,-7,7,21} \left| r_{l,k} - a_{l,k} \times \tilde{g}_l \times \hat{H}_k^{(LS)} \times e^{j(\tilde{p}hase_l^{(common)} + \tilde{p}hase_{l,k}^{(i\ min\ g)})} \right|^2$$

with

$$\tilde{p}hase_l^{(common)} = 2\pi \times N_s / N \times \Delta f_{rest} T \times l + d\tilde{\gamma}_l$$

$$\tilde{p}hase_l^{(i\ min\ g)} = 2\pi \times N_s / N \times \tilde{\xi} \times k \times l$$

is calculated as a function of the trial parameters \tilde{g}_l and $d\tilde{\gamma}_l$. Finally, the trial parameters leading to the minimum of the log likelihood function are used as estimates \hat{g}_l and $d\hat{\gamma}_l$.

This robust algorithm works well even at low signal to noise ratios with the Cramer Rao Bound being reached.

After estimation of the parameters, the sequence $r_{l,k}$ is compensated in the compensation blocks.

In the upper analyzing branch the compensation is user-defined i.e. the user determines which of the parameters are compensated. This is useful in order to extract the influence of these parameters. The resulting output sequence is described by $r'_{l,k}$.

In the lower compensation branch the full compensation is always performed. This separate compensation is necessary in order to avoid symbol errors. After the full compensation the secure estimation of the data symbols $\hat{a}_{l,k}$ is performed. From equation (10) it is clear that first the channel transfer function H_k must be removed.

This is achieved by dividing the known coarse channel estimate $\hat{H}_k^{(LS)}$ calculated from the LS. Usually an error free estimation of the data symbols can be assumed.

In the next block a better channel estimate $\hat{H}_k^{(PL)}$ of the data and pilot sub-carriers is calculated by using all *nof_symbols* symbols of the payload (PL). This can be accomplished at this point because the phase is compensated and the data symbols are known. The long observation interval of *nof_symbols* symbols (compared to the short interval of 2 symbols for the estimation of $\hat{H}_k^{(LS)}$) leads to a nearly error-free channel estimate.

In the following equalizer block $r'_{l,k}$ is compensated by the channel estimate. The resulting channel-compensated sequence is described by $r''_{l,k}$. The user may either choose the coarse channel estimate $\hat{H}_k^{(LS)}$ (from the long symbol) or the nearly error-free channel estimate $\hat{H}_k^{(PL)}$ (from the payload) for equalization. In case of using the improved estimate $\hat{H}_k^{(PL)}$ a 2 dB reduction of the subsequent EVM measurement can be expected.

According to the IEEE 802.11a measurement standard [6], the coarse channel estimation $\hat{H}_k^{(LS)}$ (from the long symbol) has to be used for equalization. Therefore the default setting of the R&S FSV-K91 is equalization from the coarse channel estimate derived from the long symbol.

In the last block the measurement variables are calculated. The most important variable is the error vector magnitude

$$EVM_k = \sqrt{\frac{1}{nof_symbols} \sum_{l=1}^{nof_symbols} \left| r''_{l,k} - K_{mod} \times a_{l,k} \right|^2} \quad (14)$$

of the sub-carrier k of the current packet. Furthermore the packet error vector magnitude

$$EVM = \sqrt{\frac{1}{52} \sum_{k=-26(k \neq 0)}^{26} EVM_k^2} \quad (15)$$

is derived by averaging the squared EVM_k versus k . Finally the average error vector magnitude

$$\overline{EVM} = \sqrt{\frac{1}{nof_packets} \sum_{counter=1}^{nof_packets} EVM^2(counter)} \quad (16)$$

is calculated by averaging the packet EVM of all $nof_packets$ detected packets. This parameter is equivalent to the so-called "RMS average of all errors $Error_{RMS}$ " of the IEEE 802.11a measurement commandment (see [6], Chapter 17.3.9.7).

13.2.2.2 Literature

[1]	Speth, Classen, Meyr: "Frame synchronization of OFDM systems in frequency selective fading channels", VTC '97, pp. 1807-1811
[2]	Schmidl, Cox: "Robust Frequency and Timing Synchronization of OFDM", IEEE Trans. on Comm., Dec. 1997, pp. 1613-621
[3]	Minn, Zeng, Bhargava: "On Timing Offset Estimation for OFDM", IEEE Communication Letters, July 2000, pp. 242-244
[4]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM - Part I", IEEE Trans. On Comm. VOL. 47, NO 11, Nov. 1999
[5]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM - Part II", IEEE Trans. On Comm. VOL. 49, NO 4, April. 2001
[6]	IEEE 802.11a, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

13.2.3 Signal Processing of the IEEE 802.11b application

13.2.3.1 Abbreviations

ε	timing offset
Δf	frequency offset
$\Delta \phi$	phase offset
$ARG\{\dots\}$	calculation of the angle of a complex value
EVM	error vector magnitude
\hat{g}_I	estimate of the gain factor in the I-branch
\hat{g}_Q	estimate of the gain factor in the Q-branch
$\Delta \hat{g}_Q$	accurate estimate of the crosstalk factor of the Q-branch in the I-branch
$\hat{h}_s(v)$	estimated baseband filter of the transmitter

$\hat{h}_r(v)$	estimated baseband filter of the receiver
$\hat{\delta}_I$	estimate of the IQ-offset in the I-branch
$\hat{\delta}_Q$	estimate of the IQ-offset in the I-branch
$r(v)$	measurement signal
$\hat{s}(v)$	estimate of the reference signal
$\hat{s}_n(v)$	estimate of the power normalized and undisturbed reference signal
REAL{...}	calculation of the real part of a complex value
IMAG{...}	calculation of the imaginary part of a complex value

This description gives a rough overview of the signal processing concept of the IEEE 802.11b application.

A block diagram of the measurement application is shown in Figure 47. The baseband signal of an IEEE 802.11b wireless LAN system transmitter is sampled with a sampling rate of 44 MHz.

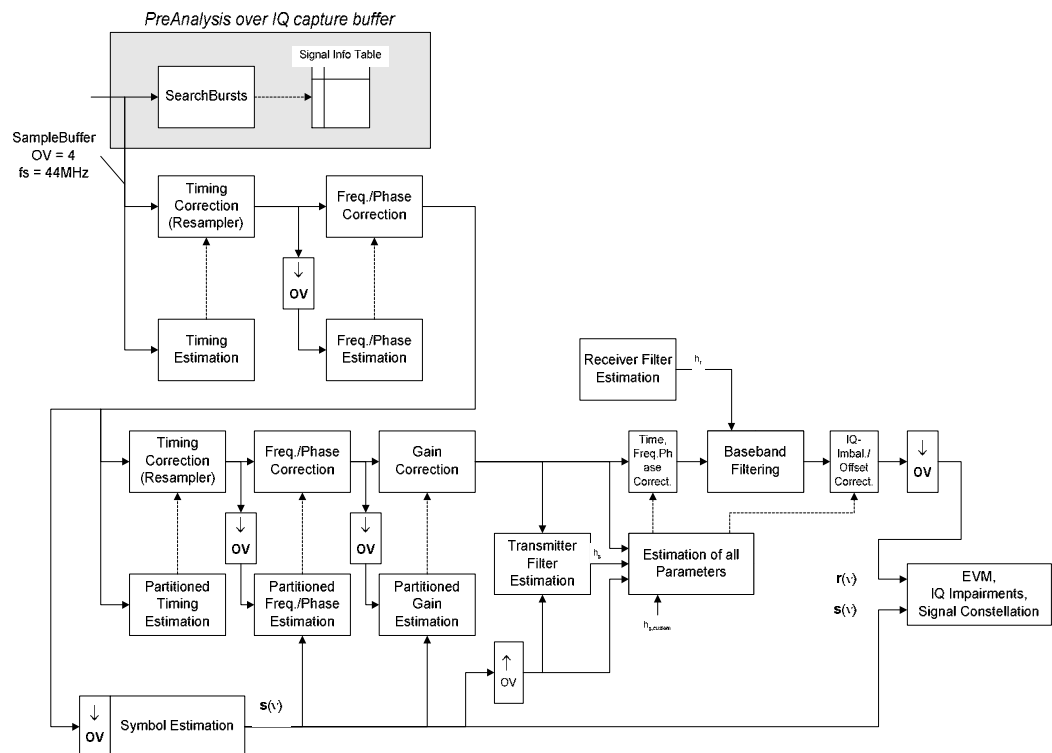


Figure 47: Signal processing of the IEEE 802.11b application

The first task of the measurement application is to detect the position of the bursts within the measurement signal $r_1(v)$. The detection algorithm is able to find the positions of the beginning of short and long bursts and can distinguish between them. The algorithm also detects the initial state of the scrambler. This is required if IEEE 802.11 signals should be analyzed, because this standard does not specify the initial state of the scrambler.

With the knowledge of the start position of the burst, the header of the burst can be demodulated. The bits transmitted in the header provide information about the length of the burst and the modulation type used in the PSDU.

After the start position and the burst length is fully known, better estimates of timing offset, timing drift, frequency offset and phase offset can be calculated using the entire data of the burst.

At this point of the signal processing a demodulation can be performed without decision error. After demodulation the normalized and undisturbed reference signal $s(v)$ is available.

If the frequency offset is not constant and varies with time, the frequency- and phase offset in several partitions of the burst must be estimated and corrected. Additionally, timing offset, timing drift and gain factor can be estimated and corrected in several partitions of the burst. These corrections can be separately switched off in the demodulation settings menu.

Knowing the normalized power and undisturbed reference signal, the transmitter baseband filter is estimated by minimizing the cost function

$$L_1 = \sum_{v=0}^{N-1} \left| r(v) \times e^{-j2\pi\Delta\tilde{f}v} \times e^{-j\Delta\tilde{\phi}} - \sum_{i=-L}^{+L} \tilde{h}_s(i) \times \hat{s}_n(v-i) - \tilde{o}_I - j\tilde{o}_Q \right|^2 \quad (17)$$

of a maximum-likelihood-based estimator, where $r(v)$ is the over sampled measurement signal, $\hat{s}_n(v)$ the over sampled power normalized and undisturbed reference signal, N the observation length, L the filter length, $\Delta\tilde{f}$, $\Delta\tilde{\phi}$, \tilde{o}_I , \tilde{o}_Q and $\tilde{h}_s(v)$ the variation parameters of the frequency-, the phase, the IQ-offset and the coefficients of the transmitter filter. The frequency-, the phase- and the IQ-offset are estimated jointly with the coefficients of the transmitter filter to increase the estimation quality.

Once the transmitter filter is known, all other unknown signal parameters are estimated with a maximum-likelihood-based estimation, which minimizes the cost function

$$L_2 = \sum_{v=0}^{N-1} \left| r(v - \tilde{\varepsilon}) \times e^{-j2\pi\tilde{f}v} \times e^{-j\Delta\tilde{\phi}} - \tilde{g}_I \times s_I(v) - j\tilde{g}_Q \times s_Q(v) + \Delta\tilde{g}_Q \times s_Q(v) - \tilde{o}_I - j\tilde{o}_Q \right|^2 \quad (18)$$

where \tilde{g}_I resp. \tilde{g}_Q are the variation parameters of the gain used in the I- resp. the Q-branch, $\Delta\tilde{g}_Q$ is the crosstalk factor of the Q-branch into the I-branch and $s_I(v)$ resp. $s_Q(v)$ are the filtered reference signal of the I- resp. the Q-branch. The unknown signal parameters are estimated in a joint estimation process to increase the accuracy of the estimates.

The accurate estimates of the frequency offset, the IQ-imbalance, the quadrature-mismatch and the normalized IQ-offset are displayed by the measurement software.

The IQ-imbalance

$$IQ - Imbalance = \left| \frac{\tilde{g}_Q + \Delta\tilde{g}_Q}{\tilde{g}_I} \right| \quad (19)$$

is the quotient of the estimates of the gain factor of the Q-branch, the crosstalk factor and the gain factor of the I-branch, the quadrature-mismatch

$$Quadrature - Mismatch = ARG\{\tilde{g}_Q + j \times \Delta\tilde{g}_Q\} \quad (20)$$

is a measure for the crosstalk of the Q-branch into the I-branch. The normalized IQ-offset

$$\text{IQ-Offset} = \frac{\sqrt{\hat{\delta}_I^2 + \hat{\delta}_Q^2}}{\sqrt{\frac{1}{2} \cdot [\hat{g}_I^2 + \hat{g}_Q^2]}} \quad (21)$$

is defined as the magnitude of the IQ-offset normalized by the magnitude of the reference signal.

At this point of the signal processing all unknown signal parameters such as timing-, frequency-, phase-, IQ-offset and IQ-imbalance have been evaluated and the measurement signal can be corrected accordingly.

Using the corrected measurement signal $r(v)$ and the estimated reference signal $\hat{s}(v)$ the modulation quality parameters can be calculated. The mean error vector magnitude (EVM)

$$\text{EVM} = \frac{\sqrt{\sum_{v=0}^{N-1} |r(v) - \hat{s}(v)|^2}}{\sqrt{\sum_{v=0}^{N-1} |\hat{s}(v)|^2}} \quad (22)$$

is the quotient of the root-mean-square values of the error signal power and the reference signal power, whereas the instant error vector magnitude

$$\text{EVM}(v) = \frac{|r(v) - \hat{s}(v)|}{\sqrt{\sum_{v=0}^{N-1} |\hat{s}(v)|^2}} \quad (23)$$

is the momentary error signal magnitude normalized by the root mean square value of the reference signal power.

In [2] a different algorithm is proposed to calculate the error vector magnitude. In a first step the IQ-offset in the I-branch

$$\hat{\delta}_I = \frac{1}{N} \sum_{v=0}^{N-1} \text{REAL}\{r(v)\} \quad (24)$$

and the IQ-offset of the Q-branch

$$\hat{\delta}_Q = \frac{1}{N} \sum_{v=0}^{N-1} \text{IMAG}\{r(v)\} \quad (25)$$

are estimated separately, where $r(v)$ is the measurement signal which has been corrected with the estimates of the timing-, frequency- and phase offset, but not with the estimates of the IQ-imbalance and IQ-offset. With these values the IQ-imbalance of the I-branch

$$\hat{g}_I = \frac{1}{N} \sum_{v=0}^{N-1} |\text{REAL}\{r(v) - \hat{\delta}_I\}| \quad (26)$$

and the IQ-imbalance of the Q-branch

$$\hat{g}_Q = \frac{1}{N} \sum_{v=0}^{N-1} \left| \text{IMAG}\{r(v) - \hat{o}_Q\} \right| \quad (27)$$

are estimated in a non-linear estimation in a second step. Finally, the mean error vector magnitude

$$V_{\text{err}(v)} = \frac{\sqrt{\frac{1}{2} \sum_{v=0}^{N-1} \left[\left| \text{REAL}\{r(v) - \hat{o}_I\} - \hat{g}_I \right|^2 + \frac{1}{2} \sum_{v=0}^{N-1} \left[\left| \text{IMAG}\{r(v) - \hat{o}_Q\} - \hat{g}_Q \right|^2 \right]}}{\sqrt{\frac{1}{2} \cdot \left[\hat{g}_I^2 + \hat{g}_Q^2 \right]^2}} \quad (28)$$

can be calculated with a non data aided calculation. The instant error vector magnitude

$$V_{\text{err}(v)} = \frac{\sqrt{\frac{1}{2} \left[\left| \text{REAL}\{r(v) - \hat{o}_I\} - \hat{g}_I \right|^2 + \frac{1}{2} \left[\left| \text{IMAG}\{r(v) - \hat{o}_Q\} - \hat{g}_Q \right|^2 \right]}}{\sqrt{\frac{1}{2} \cdot \left[\hat{g}_I^2 + \hat{g}_Q^2 \right]^2}} \quad (29)$$

is the error signal magnitude normalized by the root mean square value of the estimate of the measurement signal power. The advantage of this method is that no estimate of the reference signal is needed, but the IQ-offset and IQ-imbalance values are not estimated in a joint estimation procedure. Therefore, each estimation parameter is disturbing the estimation of the other parameter and the accuracy of the estimates is lower than the accuracy of the estimations achieved by equation (17). If the EVM value is dominated by Gaussian noise this method yields similar results as equation (18).

13.2.3.2 Literature

- [1] Institute of Electrical and Electronic Engineers, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, IEEE Std 802.11-1999, Institute of Electrical and Electronic Engineers, Inc., 1999.
- [2] Institute of Electrical and Electronic Engineers, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Higher-Speed Physical Layer Extensions in the 2.4 GHz Band, IEEE Std 802.11b-1999, Institute of Electrical and Electronic Engineers, Inc., 1999.

13.2.4 802.11b RF carrier suppression

13.2.4.1 Definition

The RF carrier suppression, measured at the channel center frequency, shall be at least 15 dB below the peak SIN(x)/x power spectrum. The RF carrier suppression shall be measured while transmitting a repetitive 01 data sequence with the scrambler disabled using DQPSK modulation. A 100 kHz resolution bandwidth shall be used to perform this measurement.

13.2.4.2 Comparison to IQ offset measurement in R&S FSV-K91 list mode

The IQ offset measurement in R&S FSV-K91 returns the actual carrier feed through normalized to the mean power at the symbol timings. This measurement doesn't need a special test signal and is independent of the transmit filter shape.

The RF carrier suppression measured according to the standard is inversely proportional to the IQ offset measured in R&S FSV-K91 list mode. The difference (in dB) between the two values depends on the transmit filter shape and should be determined with one reference measurement.

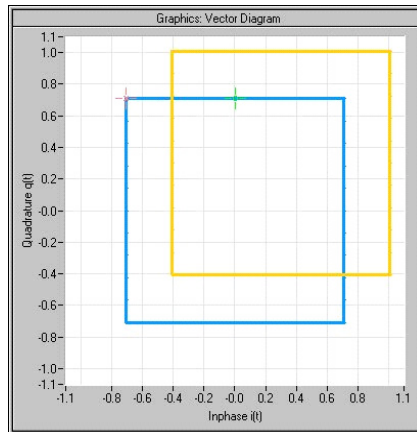
The following table lists exemplary the difference for three transmit filter shapes (± 0.5 dB):

Transmit filter	- IQ-Offset [dB] – RF-Carrier-Suppression [dB]
rectangular	11 dB
Root raised cosine, $\alpha = 0.3$	10 dB
Gaussian, $\alpha = 0.3$	9 dB

13.2.5 IQ Impairments

13.2.5.1 IQ Offset

An IQ-Offset indicates a carrier offset with fixed amplitude. This results in a constant shift of the IQ axes. The offset is normalized by the mean symbol power and displayed in dB.

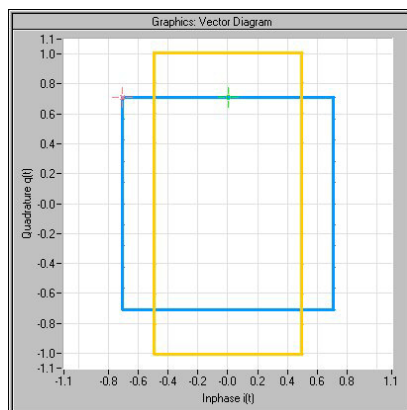


13.2.5.2 Gain Imbalance

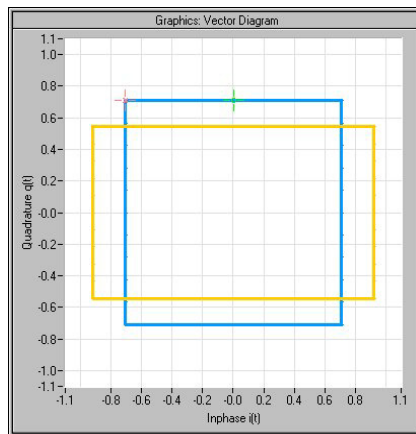
An ideal I/Q modulator amplifies the I and Q signal path by exactly the same degree. The imbalance corresponds to the difference in amplification of the I and Q channel and therefore to the difference in amplitude of the signal components. In the vector diagram, the length of the I vector changes relative to the length of the Q vector. The entry is displayed in dB and %, where 1 dB offset is roughly 12 % according to the following:

$$\text{Imbalance [dB]} = 20 \log (| \text{Gain}_Q | / | \text{Gain}_I |)$$

Positive values mean that the Q vector is amplified more than the I vector by the corresponding percentage:



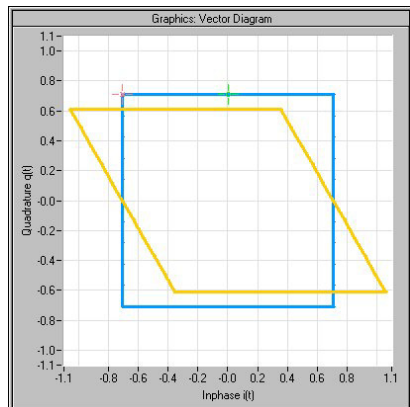
Negative values mean that the I vector is amplified more than the Q vector by the corresponding percentage:



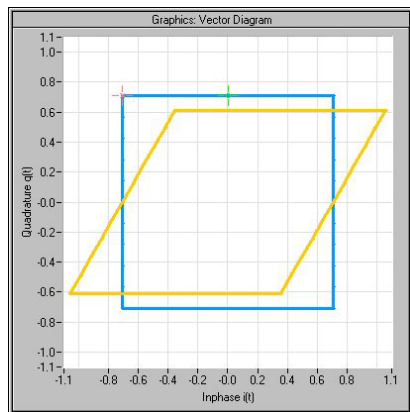
13.2.5.3 Quadrature Error

An ideal I/Q modulator sets the phase angle to exactly 90 degrees. With a quadrature error, the phase angle between the I and Q vector deviates from the ideal 90 degrees, the amplitudes of both components are of the same size. In the vector diagram, the quadrature error causes the coordinate system to shift.

A positive quadrature error means a phase angle greater than 90 degrees:



A negative quadrature error means a phase angle less than 90 degrees:



13.3 Instrument Functions WLAN TX Measurements (Option R&S FSV-K91)

The WLAN TX Measurements option extends the functionality of the R&S FSV spectrum analyzer to enable Wireless LAN TX measurements according to the standards specified for the device:

- ◆ Modulation formats:
 - IEEE 802.11a, j & g (OFDM)
 - BPSK
 - QPSK
 - 16QAM
 - 64QAM
- ◆ IEEE 802.11b & g (single carrier mode)
 - DBPSK
 - DQPSK
 - CCK (5.5 & 11 Mbps)
 - PBCC (5.5, 11 & 22 Mbps)
- ◆ Modulation measurements:
 - Constellation diagram
 - Constellation diagram per OFDM carrier
 - I/Q offset and I/Q imbalance
 - Carrier and symbol frequency errors
 - Modulation error (EVM) per OFDM carrier or symbol
 - Amplitude response and group-delay distortion (spectral flatness)
- ◆ Amplitude statistics (CCDF) and crest factor
- ◆ Transmit spectrum mask
- ◆ FFT, also over a selected part of the signal, e.g. preamble
- ◆ Payload bit information
- ◆ Capture time selectable (dependent on selected standard), multiple sweeps possible for large number of bursts

- ◆ Freq/Phase Err vs. Preamble

To open the WLAN menu

- ◆ If the "WLAN" mode is not the active measurement mode, press the "MODE" key and activate the "WLAN" option.
- ◆ If the "WLAN" mode is already active, use the "WLAN" tab to display the WLAN measurement windows..

To exit the "WLAN" measurement mode, select another option.

13.3.1 Menu and softkey description

- ◆ "[Softkeys of the WLAN TX menu \(Option |variable=K91\)](#)" on page 888
- ◆ "[Softkeys of the sweep menu – SWEEP key \(Option |variable=K91\)](#)" on page 915
- ◆ "[Softkeys of the marker menu - MKR key \(Option |variable=K91\)](#)" on page 916
- ◆ "[Softkeys of the marker to menu – MKR-> key \(Option |variable=K91\)](#)" on page 917
- ◆ "[Softkeys of the lines menu – LIN key \(Option |variable=K91\)](#)" on page 918
- ◆ "[Softkeys of the trace menu – TRAC key \(Option |variable=K91\)](#)" on page 918

The file, setup, and print menus are provided as described for the base unit. For details refer to the corresponding menu descriptions. The span and bandwidth menus are not available in the "WLAN" mode.

The "FREQ", "AMPT", and "TRIG" keys open the "General Settings" or the "Demod Settings" dialog box. For details refer to the [Settings General/Demod](#) softkey description (WLAN menu).

To display help to a softkey, press the "HELP" key and then the softkey for which you want to display help. To close the help window, press the "ESC" key. For further information refer to section "How to use the Help System".

13.3.2 Further information

- ◆ "[Measurement and result displays](#)" on page 883
- ◆ "[Result summary list](#)" on page 884
- ◆ "[Result display graph](#)" on page 885
- ◆ "[Measurement settings](#)" on page 883
- ◆ "[Result summary list](#)" on page 884
- ◆ "[Result display graph](#)" on page 885
- ◆ "[Rise / fall time measurement](#)" on page 887
- ◆ "[Title bar information](#)" on page 887
- ◆ "[Status bar information](#)" on page 887

13.3.2.1 Measurement and result displays

The WLAN option provides two main measurement types:

IQ measurements (based on captured IQ data):

- ◆ Power vs Time (see [PVT](#) softkey)
- ◆ EVM vs Symbol, EVM vs Carrier (see [EVM vs Symbol/Carrier](#) softkey)
- ◆ Phase vs Preamble, Frequency vs Preamble (see [Error Frequency/Phase](#) softkey)
- ◆ Spectrum Flatness (see [Spectrum Flatness](#) softkey)
- ◆ Spectrum FFT (see [Spectrum FFT](#) softkey)
- ◆ Constellation vs Symbol, Constellation vs Carrier (see [Constell vs Symbol/Carrier](#) softkey)
- ◆ Conditional Cumulative Distribution Function (see [CCDF](#) softkey)
- ◆ Bit Stream (see [Bitstream](#) softkey)
- ◆ Signal Field (see [Signal Field](#) softkey)

Frequency sweep measurements:

- ◆ Spectrum mask (see [Spectrum Mask](#) or [Spectrum IEEE/ETSI](#) softkeys)
- ◆ Spectrum ACP/ACPR (see [Spectrum ACPR](#) or [ACP Rel/Abs](#) softkey)

The measurement result display is divided into two panes:

- ◆ "[Measurement settings](#)" on page 883
- ◆ Result displays

The results can be displayed in form of a list or a graph (see also [Display List/Graph](#) softkey).

- ◆ "[Result summary list](#)" on page 884
- ◆ "[Result display graph](#)" on page 885

13.3.2.2 Measurement settings

The overall measurement settings used to obtain the current measurement results are displayed below the title bar (see Figure 48). The following settings are listed:

Setting	Description	Restrictions
Frequency	The frequency of the measured input signal.	
Burst Type	The type of burst being analyzed.	IEEE 802.11a, g (OFDM), j and Turbo Mode only
Preamble Type	The type of preamble of analyzed bursts.	IEEE 802.11b & g (Single Carrier) only
Signal Level	The expected mean signal level for the input signal.	IEEE 802.11a, g (OFDM), j and Turbo Mode only
Ref Level	The reference level used for the input signal.	IEEE 802.11b, g (Single Carrier) only
Modulation	Shows the active setting selected in the "Demod Settings" dialog box: "Demodulator" or "PSDU Modulation to Analyze".	
External Att	The attenuation (positive values) or gain (negative	

Instrument Functions WLAN TX Measurements (Option R&S FSV-K91)

Setting	Description	Restrictions
	values) applied to the signal externally (i.e. before the RF or IQ connector of the spectrum analyzer), e.g.: External Att = 10 dB means that before the RF connector of the R&S FSPB a 10 dB attenuator is used External Att = -20 dB means that before the RF connector of the R&S FSPB a amplifier with 20 dB gain is used	
Data Symbols	Shows the minimum and maximum number of data symbols that a burst may have if it is to be considered in results analysis.	IEEE 802.11a, g (OFDM), j and Turbo Mode only
PSDU Data Length	Shows the minimum and maximum number of data bytes that a burst may have if it is to be considered in results analysis.	IEEE 802.11b, g (Single Carrier) only

Spectrum Analyzer		WLAN x	
R&S FSV-K91 Wireless LAN		IEEE 802.11a	
Frequency:	2.4 GHz	Sig. Lvl Setting:	-21.5 dBm
Burst Type:	Direct Link Burst	External Att:	0 dB
		Modulation:	54 Mbps 64 QAM
		Data Symbols:	1/1 366

Spectrum Analyzer		WLAN x	
R&S FSV-K91 Wireless LAN		IEEE 802.11b	
Frequency:	2.4 GHz	Ref Level:	-17.2 dBm
Preamble Type:	Long PLCP	External Att:	0 dB
		Modulation:	11 Mbps CCK
		PSDU Len:	1/4096 Bytes

Figure 48 Measurement settings (example)

13.3.2.3 Result summary list

The result summary list shows the overall measurement results and provides limit checking for result values in accordance with the selected standard. Result values which are within the limit as specified by the standard are displayed in green. Result values which are outside of the limits specified by the standard are displayed in red with a '*' to the left. Results which have no limits specified by the standard are displayed in white. Limit values are displayed in white (not bold) and can be modified, if focused, via the keypad. To reset the limit values to the values specified in the standard, use the lines menu ("LINES" key).

The results displayed in this list are for the entire measurement. If a specific number of bursts have been requested which requires more than one sweep, the result summary list is updated at the end of each sweep. The number of bursts measured and the number of bursts requested are displayed to show the progress through the measurement. The Min / Mean / Max columns show the minimum, mean or maximum values of the burst results.



Figure 49 Result summary list (example)

13.3.2.4 Result display graph

Additionally to the selected graphical result display, the Magnitude Capture Buffer display is provided for all IQ measurements. The different result displays are described with the corresponding softkey.

The Magnitude Capture Buffer display shows the complete range of captured data for the last sweep. All analyzed bursts are identified with a green bar at the bottom of the Magnitude Capture Buffer display. If, in the "Demod Settings" dialog box, the "Signal Field Content" option is activated only bursts that match the required criteria are marked with a green bar.

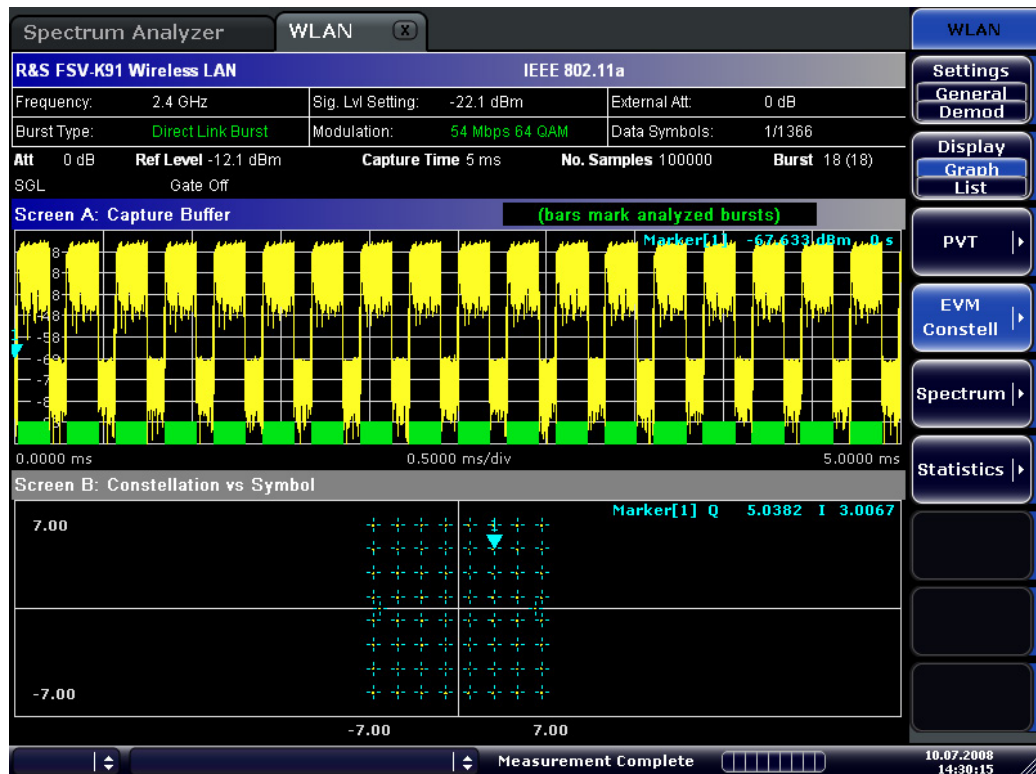


Figure 50 Magnitude capture buffer results (example)

- ◆ IQ measurements

All IQ measurements process the same signal data and as such all IQ measurement results are available after a single IQ measurement execution. IQ measurements can be run in split screen mode (allowing both the Magnitude Capture Buffer display and the selected IQ measurement results to be displayed simultaneously) or in full screen mode (with either the Magnitude Capture Buffer display or the selected IQ measurement results displayed).

- ◆ frequency sweep measurements

The frequency sweep measurements use different signal data to IQ measurements and as such it is not possible to run an IQ measurement and then view the results in the frequency sweep measurements and vice-versa. Also because each of the frequency sweep measurements uses different settings to obtain signal data it is not possible to run a frequency sweep measurement and view the results of another frequency sweep measurement.

All frequency sweep measurements are run in full screen mode.

13.3.2.5 Rise / fall time measurement

The rise/fall time is calculated according to the following algorithm:

- ◆ Apply a moving average filter over the burst power (adjustable average length)
- ◆ If "Ref Pow Max" is set: Search maximum power P_{max} over the whole burst. Set $P_{ref}=P_{max}$
- ◆ If "Ref Pow Mean" is set: Calculate mean power P_{mean} of the whole burst. Set $P_{ref}=P_{mean}$
- ◆ Rise time
 - Search the first crossing of $0.5 \times P_{ref}$ from the left.
 - Search backwards for the 10% crossing $0.1 \times P_{ref}$ and note t_{10} .
 - Search forward for the 90% crossing $0.9 \times P_{ref}$ and note t_{90} .
 - Return $T_{rise}=t_{90}-t_{10}$.
- ◆ Fall time
 - Search the first crossing of $0.5 \times P_{ref}$ from the right.
 - Search forwards for the 10% crossing $0.1 \times P_{ref}$ and note t_{10} .
 - Search backwards for the 90% crossing $0.9 \times P_{ref}$ and note t_{90} .
 - Return $T_{fall}=t_{10}-t_{90}$.

Since the single carrier modes of 802.11b, g use linear modulation formats like BPSK or QPSK, the transmit signal power varies between symbol sampling times. These power variations are determined by the transmit filter, which is not defined in the standard. The R&S FSV-K91 allows fine tuning of the PVT measurements on signals with high crest factors by an adjustable moving average filter and two different reference power settings.

The reference power equals the 100% setting for the rise / fall time calculation. Either the maximum burst power or the mean burst power can be chosen as reference power. Using the mean burst power, rarely power peaks within the burst does not influence the rise / fall time measurement.

The moving average filter smoothes the power trace and thus eliminates the modulation. While a long average length leads to more stable measurement results, it naturally increases the rise / fall times compared to no averaging.

13.3.2.6 Title bar information

The title bar displays the following information:

- ◆ wireless LAN standard applicable to the current measurement

13.3.2.7 Status bar information

- ◆ The status bar displays the same information as the base device (see the "R&S FSV Quick Start Guide").

13.4 WLAN TX measurements (Option R&S FSV-K91)

13.4.1 Softkeys of the WLAN TX menu (Option R&S FSV-K91)

The following table shows all softkeys available in the WLAN menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Command
Settings General/Demod	
Display List/Graph	
PVT >	Settings General/Demod
	Display List/Graph
	Full Burst
	Rising & Falling
	Ramp Up/Down/Up & Down
	Ref Pow Max/Mean
	Average Length
	More >
	Gating Settings On/Off
	Import
	Export
	R&S Support
EVM Constell >	Settings General/Demod
	Display List/Graph
	EVM vs Symbol/Carrier
	Error Frequency/Phase
	Constell vs Symbol/Carrier
	Carrier Selection
	More >
	Gating Settings On/Off
	Import
	Export
	Y-Axis/Div
	R&S Support
Spectrum >	Settings General/Demod
	Display List/Graph
	Spectrum Flatness
	Spectrum Mask / Spectrum IEEE/ETSI
	Spectrum FFT
	Spectrum ACPR / Spectrum ACP / ACP Rel/Abs
	More >
	Gating Settings On/Off
	SEM Settings
	Import
	Export

Menu / Command	Command
	R&S Support
Statistics >	Settings General/Demod
	Display List/Graph
	CCDF
	Bitstream
	Signal Field / PLCP Header
	More >
	same contents as PVT side menu

Settings General/Demod

Opens the "General Settings" or the "Demod Settings" dialog box. Screenshots of the dialog boxes are provided in chapter "[Basic measurement examples](#)".

Alternatively, the "General Settings" dialog box is opened as follows:

- ◆ "FREQ" key, with focus on the "Frequency" field
- ◆ "AMPT" key, with focus on the "Signal Level" ("RF") field
- ◆ "TRIG" key, with focus on the "Trigger Mode" field

In the "General Settings" dialog box, all settings related to the overall measurement can be modified. The right pane with the advanced settings is only displayed if the "Advanced Settings" option is activated. The "General Settings" dialog box contains the following elements:

Signal Characteristics	Standard
	Frequency
	Channel No
Level Settings	Signal Level
	Auto Lvl
	Ext Att
Data Capture Settings	Capture Time
	Burst Count
	Analyze Bursts
	Sweep Count
Trigger Settings	Trigger Mode
	Trigger Offset
	Power Level
	Auto Lvl
IQ Settings	Swap IQ
Advanced Settings	Auto Level Time
	Ref Level
	Attenuation
	Sample Rate

In the "Demod Settings" dialog box, the settings associated with the signal modulation can be modified. The settings under "Burst to Analyze" specify the characteristics of the bursts to be considered in the measurement results. Only the bursts which meet the criteria specified in this group will be included in measurement analysis if the "Use Header Content" option is activated. The tracking settings allow various errors in measurement results to be compensated for.

The "Demod Settings" dialog box contains the following elements. If an element is only available for certain standards, the corresponding standards are listed.

Burst to Analyze	Signal Field Content
	Use Header Content
	Burst Type
	PPDU Frame Format
	Preamble Type
	Auto Demodulation
	Analyze PSDU Mod
	Demodulator
	Equal Burst Length
	Data Symbols
	Min Data Symbols
	Max Data Symbols
	Channel Estimation
	Payload Length
	Min Payload Length
	Max Payload Length
Tracking	Phase
	Timing
	Level
Filters	Transmit Filter
	Receive Filter

Standard (General Settings dialog box)

Displays a list of all installed standards to select the wireless LAN standard. This is necessary to ensure that the measurements are performed according to the specified standard with the correct limit values and limit lines.

→ Remote: [CONF:STAN 0](#)

Frequency (General Settings dialog box)

Specifies the center frequency of the signal to be measured. If the frequency is modified, the "Channel No" field is updated accordingly.

→ Remote: [FREQ:CENT 100MHz](#)

Channel No (General Settings dialog box)

Specifies the channel to be measured. If the "Channel No" field is modified, the frequency is updated accordingly.

→ Remote: [CONF:CHAN 9](#)

Signal Level (General Settings dialog box)

Specifies the expected mean level of the RF input signal. If an automatic level detection measurement has been executed the signal level (RF) is updated. For all standards other than IEEE 802.11b & g (Single Carrier), the reference level is set 10 dB higher than the signal level (RF) because of the expected crest factor of the signal. For standards IEEE 802.11b & g (Single Carrier), the reference level is set to the signal level (RF).

→ Remote: [CONF:POW:EXP:RF 9](#)

Auto Lvl (General Settings dialog box)

Activates or deactivates the automatic setting of the reference level for measurements.

On The reference level is measured automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times.

Off The reference level is defined manually in the [Signal Level](#) field.

→ Remote: [CONF:POW:AUTO 1](#)

→ Remote: [CONF:POW:AUTO:SWE:TIME 200MS](#)

Ext Att (General Settings dialog box)

Specifies the external attenuation or gain applied to the RF signal. A positive value indicates attenuation, a negative value indicates gain. All displayed power level values are shifted by this value.

→ Remote: [INP:ATT 30dB](#)

Capture Time (General Settings dialog box)

Specifies the time (and therefore the amount of data) to be captured in a single measurement sweep.

→ Remote: [SWE:TIME 10ms](#)

Burst Count (General Settings dialog box)

Activates or deactivates a specified number of bursts for capture and analysis.

On The data analysis is performed over a number of consecutive sweeps until the required number of bursts has been captured and analyzed.

Off The data analysis is performed on a single measurement sweep.

→ Remote: [BURS:COUN:STAT ON](#)

Analyze Bursts (General Settings dialog box)

Specifies the number of bursts to be measured, if the "Burst Count" option is activated.

→ Remote: [BURS:COUN 16](#)

Sweep Count (General Settings dialog box)

Specifies the number of sweeps to be performed for Spectrum ACP/ACPR and Spectrum Mask measurements.

→ Remote: [SWEep:COUNT 64](#)

Trigger Mode (General Settings dialog box)

Sets the source of the trigger for the measurement sweep.

"Free Run" The measurement sweep starts immediately.

"External" Triggering via a TTL signal at the input connector EXT TRIGGER/GATE IN on the rear panel.

"Power" The measurement sweep starts when the signal power meets or exceeds the specified power trigger level. This trigger mode is not available for Spectrum Mask measurements in ETSI standard. If it is set and then the Spectrum Mask measurement in ETSI standard is selected, it automatically changes to "Free Run".

→ Remote: [TRIG:MODE IMM](#)

Trigger Offset (General Settings dialog box)

Specifies the time offset between the trigger signal and the start of the sweep. A negative value indicates a pre-trigger. This field is not available in the "Free Run" trigger mode.

→ Remote: [TRIG:HOLD 500us](#)

Power Level (General Settings dialog box)

Specifies the trigger level if the "Power" trigger mode is set.

→ Remote: [TRIG:LEV:POW 10 DBM](#)

Auto Lvl (General Settings dialog box)

Activates or deactivates the automatic measurement of the power trigger level.

On The power trigger level is measured automatically at the start of each measurement sweep. This ensures that the power trigger level is always set at the optimal level for obtaining accurate results but will result in a slightly increased measurement times.

Off The power trigger level is defined manually in the [Power Level](#) field.

→ Remote: [TRIG:LEV:POW:AUTO ON](#)

Swap IQ (General Settings dialog box)

Activates or deactivates the inverted I/Q modulation.

On I and Q signals are interchanged.

Off Normal I/Q modulation.

→ Remote: [SWAP ON](#)

Auto Level Time (General Settings dialog box)

Specifies the sweep time used for the automatic level measurements.

→ Remote: [CONF:POW:AUTO:SWE:TIME 200MS](#)

Ref Level (General Settings dialog box)

Specifies the reference level to use for measurements. If the reference level is modified, the signal level is updated accordingly (depending on the currently selected standard and measurement type). This field is only editable if the "Auto Lvl" is deactivated.

→ Remote: [DISP:TRAC:Y:RLEV?](#)

Attenuation (General Settings dialog box)

Specifies the settings for the attenuator. This field is only editable if the "Auto Lvl" option is deactivated. If the "Auto Lvl" option is activated, the RF attenuator setting is coupled to the reference level setting.

→ Remote: [INP:ATT 30dB](#)

Sample Rate (General Settings dialog box)

Specifies the sample rate used for IQ measurements.

→ Remote: [TRACE:IQ:SRAT 20000](#)

Signal Field Content (Demod Settings dialog box, IEEE 802.11a, g (OFDM), j)

Activates or deactivates the decoding of the captured burst data.

On Only the bursts are included in the results analysis whose modulation format specified in the signal symbol field matches the modulation format specified in the [Analyze PSDU Mod](#) field.

Off The data is demodulated according to the modulation scheme specified in the [Demodulator](#) field. If any of the analyzed data has a modulation different to that specified the results will be of limited use.

→ Remote: [DEM:FORM:SIGS ON](#)

Use Header Content (Demod Settings dialog box, IEEE 802.11b, g - Single Carrier)

Activates or deactivates the PLCP header field decoding of the captured burst data.

On Only the bursts are included in the results analysis whose modulation format specified in the signal symbol field matches the modulation format specified in the [Analyze PSDU Mod](#) field.

Off The data is demodulated according to the modulation scheme specified in the [Demodulator](#) field. If any of the analyzed data has a modulation different to that specified the results will be of limited use.

→ Remote: [DEM:FORM:AUT ON](#)

Burst Type (Demod Settings dialog box, IEEE 802.11a, g (OFDM, Single Carrier), j)

Specifies the type of burst to be included in measurement analysis. Only one burst type can be selected for the measurement results. The following burst types are supported:

"Direct Link Burst"	IEEE 802.11a, j
"OFDM"	IEEE 802.11g
"Long DSSS"- "OFDM"	IEEE 802.11g
"Short DSSS"- "OFDM"	IEEE 802.11g
"Long PLCP"	IEEE 802.11g
"Short PLCP"	IEEE 802.11g

→ Remote: [DEM:FORM:BAN:BTYPe 'DIRECT'](#)

Preamble Type (Demod Settings dialog box, IEEE 802.11b)

Specifies the type of burst which should be included in measurement analysis. The following burst types are supported: Short PLCP, Long PLCP.

→ Remote: [DEM:FORM:BAN:BTYPe 'SHORT'](#)

PPDU Frame Format (Demod Settings dialog box, IEEE 802.11b)

Specifies the type of PHY Protocol Data Unit (PPDU) which should be included in measurement analysis. The following PPDU formats are supported:

- ◆ Mixed 20MHz
- ◆ Green Field 20MHz
- ◆ Mixed 40MHz
- ◆ Green Field 40MHz

→ Remote: [DEM:FORM:BAN:BTYP 'MM20'](#)

Auto Demodulation (Demod Settings dialog box)

Activates or deactivates the automatic detection of the modulation. If activated, the modulation applied to the input data is determined from the modulation type of the first complete burst within the captured data. This option automatically activates the "Signal Field Content" option.

→ Remote: [DEM:FORM:AUT ON](#)

Analyze PSDU Mod (Demod Settings dialog box)

Specifies the modulation of the bursts to be analyzed. Only bursts using the selected modulation are considered in measurement analysis. This option is only available if the "Signal Field Content" or the "Use Header Content" option is activated.

→ Remote: [DEM:FORM:AUT ON](#)

Demodulator (Demod Settings dialog box)

Specifies the modulation to be applied to the measured data. If the captured data uses a different modulation scheme than specified by this field the results will be of limited use. This field is only available if the "Signal Field Content" or the "Use Header Content" option is deactivated.

→ Remote: [DEM:FORM:BAN 'QAM16'](#)

Equal Burst Length (Demod Settings dialog box)

Activates or deactivates the burst selection for measurement analysis according to the range or specific number of data symbols/bytes.

Standard	State	Description
IEEE 802.11a, j	On	Only bursts with exactly the number of symbols specified in the Data Symbols field are considered for measurement analysis.
	Off	Only bursts within the range of data symbols specified by the Min Data Symbols and Max Data Symbols fields are considered for measurement analysis.
IEEE 802.11b, g (Single Carrier)	On	Only bursts with exactly the number of data bytes or duration specified in the Payload Length field are considered for measurement analysis.
	Off	Only bursts within the range of data bytes or duration specified by the Min Payload Length and Max Payload Length fields are considered for measurement analysis.
IEEE 802.11g (OFDM)	On	Only bursts with exactly the number of data symbols or duration specified in the Payload Length field are considered for measurement analysis.
	Off	Only bursts within the range of data symbols or duration specified by the Min Payload Length and Max Payload Length fields are considered for measurement analysis.

→ Remote: [DEM:FORM:BAN:SYMB:EQU ON](#)

→ Remote: [DEM:FORM:BAN:DBYTES:EQU ON](#)

→ Remote: [DEM:BAN:DUR:EQU ON \(PVT\)](#)

Data Symbols (Demod Settings dialog box, IEEE 802.11a, j)

Specifies the number of data symbols of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is activated.

→ Remote: [DEM:FORM:BAN:SYMB:MIN 16](#)

Min Data Symbols (Demod Settings dialog box, IEEE 802.11a, j)

Specifies the minimum number of data symbols of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is deactivated.

→ Remote: [DEM:FORM:BAN:SYMB:MIN 16](#)

Max Data Symbols (Demod Settings dialog box, IEEE 802.11a, j)

Specifies the maximum number of data symbols of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is deactivated.

→ Remote: [DEM:FORM:BAN:SYMB:MAX 1300](#)

Channel Estimation (Demod Settings dialog box, IEEE 802.11a, g (OFDM), j)

Specifies how accurately the EVM results are calculated.

"Preamble" The channel estimation is performed in the preamble as required in the standard.

"Payload" The channel estimation is performed in the payload.

→ Remote: [DEM:CEST ON](#)

Payload Length (Demod Settings dialog box, IEEE 802.11b, g)

Specifies the number of symbols, bytes or duration of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is activated.

→ Remote: [DEM:FORM:BAN:DBYTeS:MIN 16](#)

→ Remote: [DEM:BAN:DUR:MIN 45](#)

Min Payload Length (Demod Settings dialog box, IEEE 802.11b, g)

Specifies the minimum number of symbols, bytes or duration of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is deactivated.

→ Remote: [DEM:FORM:BAN:DBYTeS:MIN 16](#)

→ Remote: [DEM:BAN:DUR:MIN 45](#)

Max Payload Length (Demod Settings dialog box, IEEE 802.11b, g)

Specifies the maximum number of symbols, bytes or duration of a burst to be considered in measurement analysis. This field is only available if the "Equal Burst Length" option is deactivated.

→ Remote: [DEM:FORM:BAN:DBYTeS:MAX 1300](#)

→ Remote: [DEM:BAN:DUR:MAX 1300](#)

Phase (Demod Settings dialog box)

Activates or deactivates the compensation for phase error. If activated, the measurement results are compensated for phase error on a per-symbol basis.

→ Remote: [TRAC:PHAS 1](#)

Timing (Demod Settings dialog box)

Activates or deactivates the compensation for timing error. If activated, the measurement results are compensated for timing error on a per-symbol basis.

→ Remote: [TRAC:TIME ON](#)

Level (Demod Settings dialog box)

Activates or deactivates the compensation for level error. If activated, the measurement results are compensated for level error on a per-symbol basis.

→ Remote: [TRAC:LEV ON](#)

Transmit Filter (Demod Settings dialog box)

Specifies the transmit filter to be used

The settings provided by default are:

- ◆ Auto – Specifies the default filter
- ◆ DefRecieve – default receive filter
- ◆ DefTransimt - default transmit filter

See also Chapter "[Signal Processing of the IEEE 802.11b application](#)"

Receive Filter (Demod Settings dialog box)

Specifies the receive filter to be used

The settings provided by default are:

- ◆ Auto – Specifies the default filter
- ◆ DefRecieve – default receive filter
- ◆ DefTransimt - default transmit filter

See also Chapter "[Signal Processing of the IEEE 802.11b application](#)"

Display List/Graph

Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

→ Remote: [DISP:WIND1:TABL ON](#)

For result queries see "[FETCh Subsystem \(WLAN, |variable=K91\)](#)"

PVT

Opens the PVT submenu to select the Power vs Time measurement results.

The PVT result displays show the minimum, average and maximum levels measured over the full range of the measured input data, or over complete bursts displayed within the gating lines if gating is switched on. The results are displayed as a single burst. Using screen B in full screen provides additional power information during this measurement.

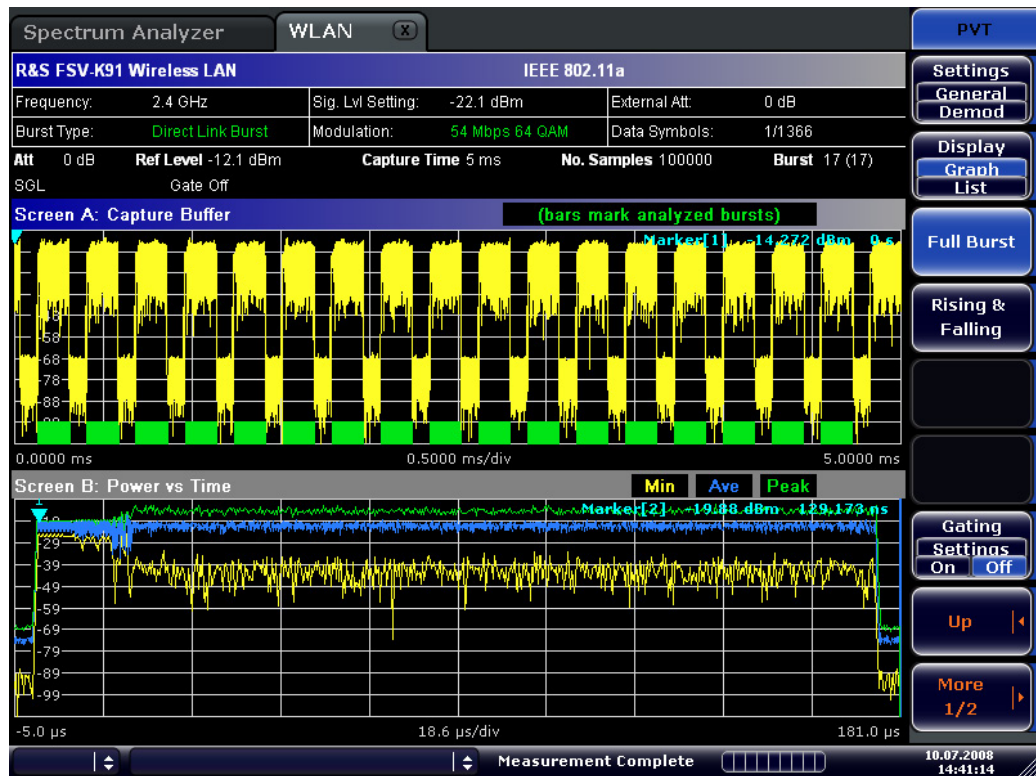
For IEEE 802.11b and g (single carrier), the PVT results are displayed as percentage values of the reference power. The reference can be set to either the max or mean power of the burst. For both rising and falling edges two time lines are displayed, which mark the points 10% and 90% of the reference power. The time between these two points is compared against the limits specified for the rising and falling edges.

For further details see also "[Rise / fall time measurement](#)" on page 887

→ Remote: [CONF:BURS:PVT](#)

Full Burst (IEEE 802.11a, g, j - OFDM)

Displays the PVT results in a single graph with all burst data being displayed.

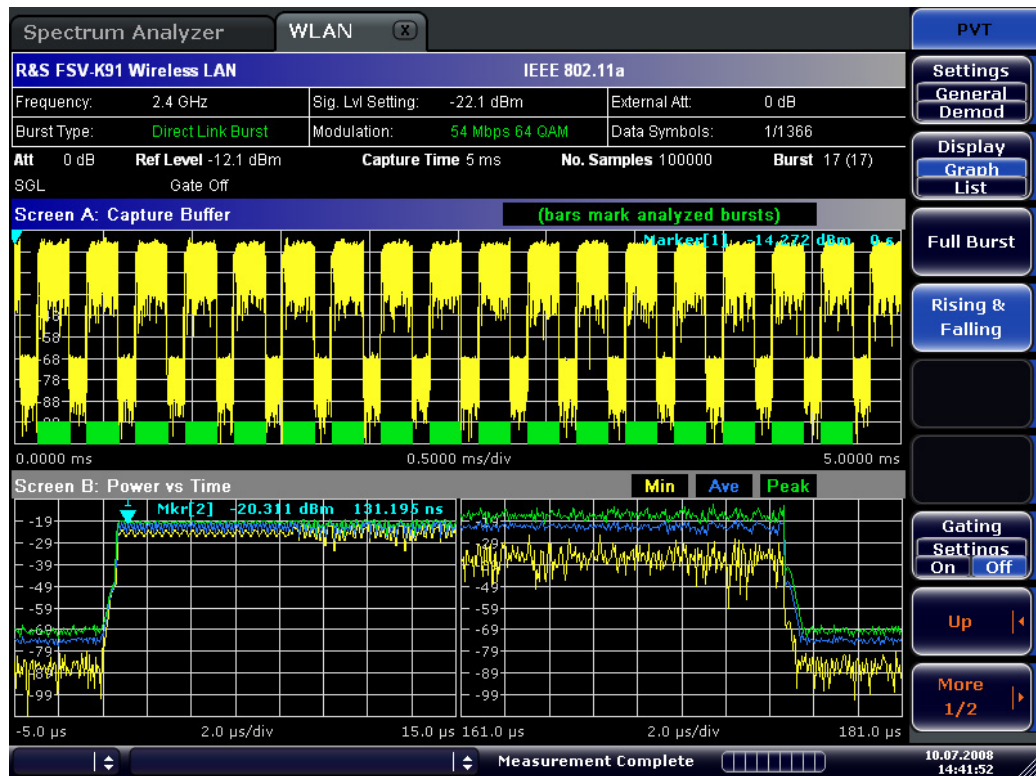


For further details refer to the [PVT](#) softkey.

→ Remote: [CONF:BURS:PVT:SEL_FULL](#)

Rising & Falling (IEEE 802.11a, g, j - OFDM)

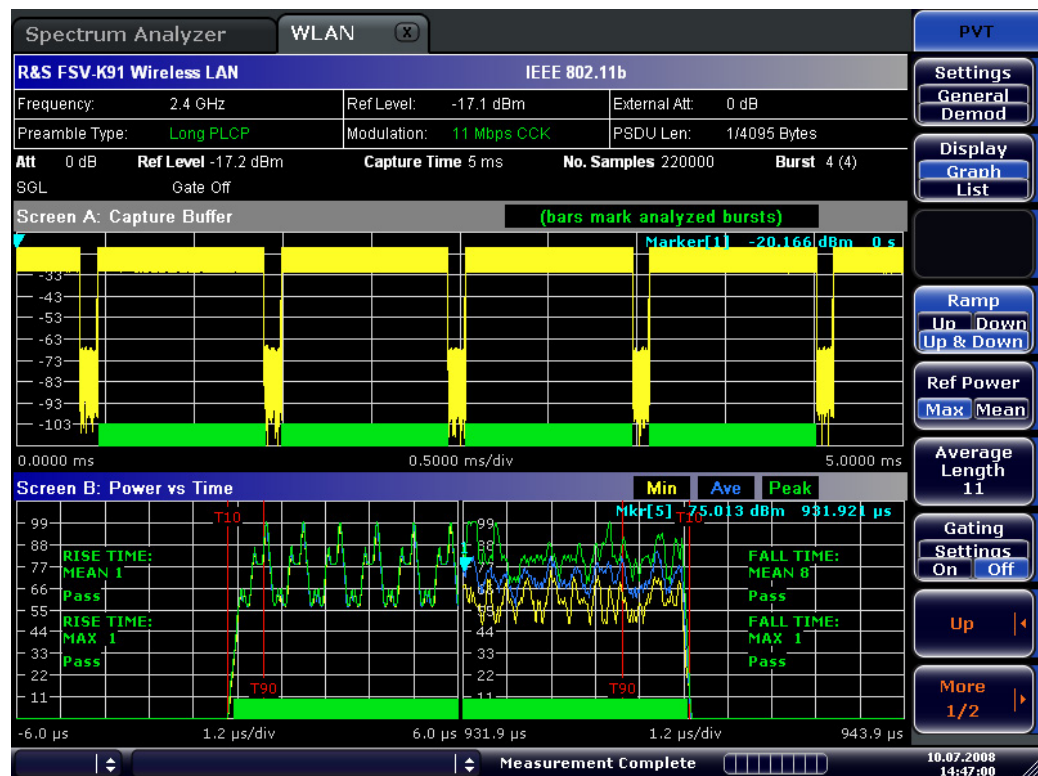
Displays the PVT results in two separate graphs, the left hand side showing the rising edge and the right hand side showing the falling edge.



Ramp Up/Down/Up & Down (IEEE 802.11b, g - Single Carrier)

Sets the display of the rising/falling edge graph:

- "Up" Displays the rising edge graph.
- "Down" Displays the falling edge graph.
- "Up" & "Down" Displays the rising and falling edge graph.



For further details refer to the [PVT](#) softkey.

→ Remote: [CONF:BURS:PVT:SEL_RISE](#)

Ref Pow Max/Mean (IEEE 802.11b, g - Single Carrier)

Sets the reference for the rise and fall time calculation to the maximum or mean burst power.

For further details refer to the [PVT](#) softkey.

→ Remote: [CONF:BURS:PVT:RPOW_MEAN](#)

Average Length (IEEE 802.11b, g - Single Carrier)

Opens an edit dialog box to enter the number of samples in order to adjust the length of the smoothing filter.

For further details refer to the [PVT](#) softkey.

→ Remote: [CONF:BURS:PVT:AVER_31](#)

Gating Settings On/Off

Activates or deactivates gating, or opens the "Gate Settings" dialog box to specify range of captured data used in results calculation.

On Uses only the specified range of captured data in results calculation. In the Magnitude Capture Buffer trace, two vertical lines mark the specified range.

Off Uses all the captured data in results calculation.

In the "Gate Settings" dialog box, the following parameters are set:

"Delay" Start point of captured data to be used in results calculation, i.e. the

	delay from the start of the captured data in time or samples. If the delay is specified in time, the number of samples is updated accordingly, and vice versa.
"Length"	Amount of captured data to be used in results calculation. If the length is specified in time, the number of samples is updated accordingly, and vice versa.
"Link Gate and Mark"	If activated, the position of the marker and the gate lines are linked. The marker is positioned half way between gate start and end. The marker position alters when the gate is modified, and the gate lines move with the marker when the marker position is altered.

The gate settings are defined for following measurements: PVT, Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR.

If a frequency sweep measurement is active (Spectrum Mask and Spectrum ACP) the result display is switched to the Magnitude Capture Buffer display in order to allow the gate to be set the correct part of the sweep.

- Remote: [SWE:EGAT ON](#)
- Remote: [SWE:EGAT:HOLD 125us](#), [SWE:EGAT:HOLD:SAMP 2500](#) (Delay)
- Remote: [SWE:EGAT:LENG 20ms](#), [SWE:EGAT:LENG:SAMP 200000](#) (Length)
- Remote: [SWE:EGAT:LINK ON](#) (Link Gate and Mark)

SEM Settings

The SEM SETTINGS softkey brings up the SEM Settings view.

SEM according to

“SEM according to” specifies how the Spectrum Emission Mask settings and limits are applied. This parameter provides the following settings:

- ◆ ETSI – Settings and limits are as specified in the standard
- ◆ IEEE – Settings and limits are as specified in the standard
- ◆ User – Settings and limits are configured via an XML file

File Name

When “User” settings are specified, “File Name” shows the name of the loaded XML file. Clicking the arrow switches to the File Manager to locate an XML file, and automatically selects “SEM according to: User”.

When using “ETSI” or “IEEE” standards, “File Name” reflects the name of the built-in configuration.

SEM Configuration

The “SEM Configuration” table shows the settings and limits applied over specified frequency ranges around the TX channel. The settings displayed are dependent on the selected Link Direction and Power Class

- Remote: `SENS:POW:SEM USER | IEEE | ETSI`
- Remote: `SENS:POW:SEM:CLAS`

Import

Opens the "Choose the file to import" dialog box.

Select the IQ data file you want to import and press "ENTER". The extension of data files is *.iqw.

→ Remote: [MMEB:LOAD:IQ:STAT](#)

Export

Opens the "Choose the file to export" dialog box.

Enter the path and the name of the IQ data file you want to export and press "ENTER".

The extension of data files is *.iqw. If the file cannot be created or there is no valid IQ data to export an error message is displayed.

→ Remote: [MMEB:STOR:IQ:STAT](#)

R&S Support

Creates files that help identifying the current problem. They are stored under C:\R_S\Instr\user\Support. If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

Y-Axis/Div

Opens a dialog box to modify the y-axis settings:

"Auto Scaling" If activated, the scaling of the y-axis is calculated automatically.

"Per Division"

Specifies the scaling to be used if "Auto Scaling" is deactivated.

"Unit"

Specifies the y-axis unit. With the unit is dB, "Auto Scaling" is always activated.

→ Remote: [DISP:WIND2:TRAC:Y:SCAL:AUTO ON](#)

→ Remote: [DISP:WIND2:TRAC:Y:SCAL:DPIV 2](#)

EVM Constell

Opens a submenu to select the error vector magnitude (EVM) or the constellation result displays.

EVM vs Symbol/Carrier

Selects the EVM vs Symbol or EVM vs Carrier result displays.

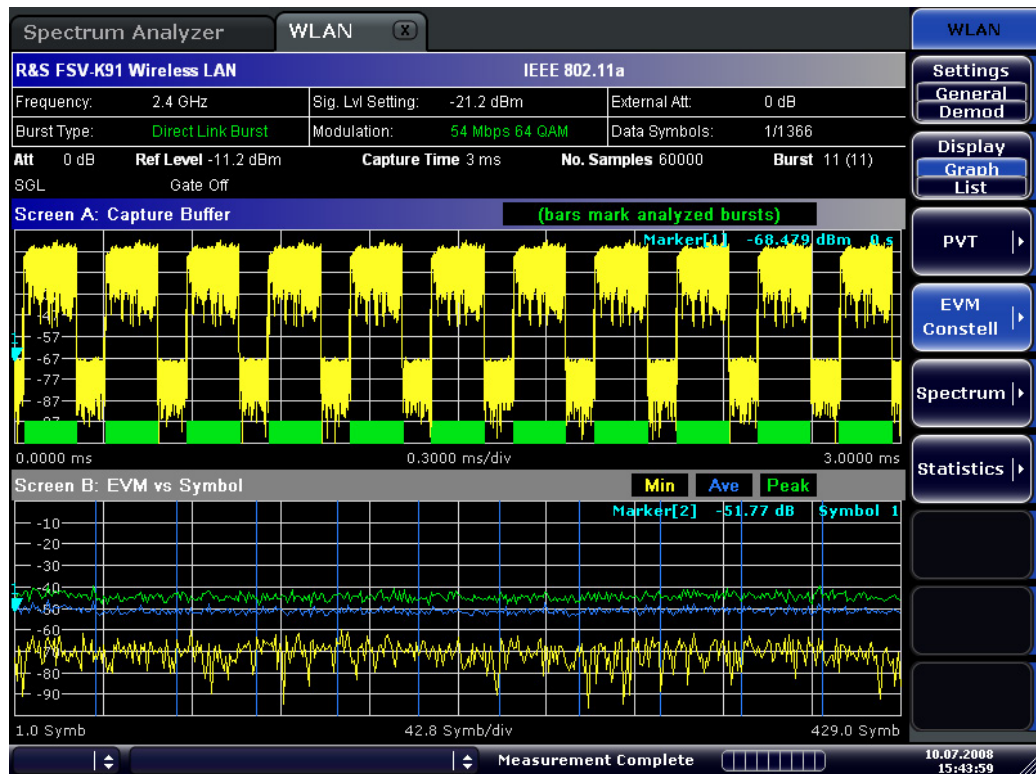
◆ EVM vs Symbol

This result display shows the EVM measured over the full range of the measured input data. The results are displayed on a per-symbol basis, with blue vertical lines marking the boundaries of each burst. Note that burst boundary lines are only displayed if the number of analyzed bursts is less than 250.

For IEEE 802.11a, j, g (OFDM) the minimum, average, and maximum traces are displayed.

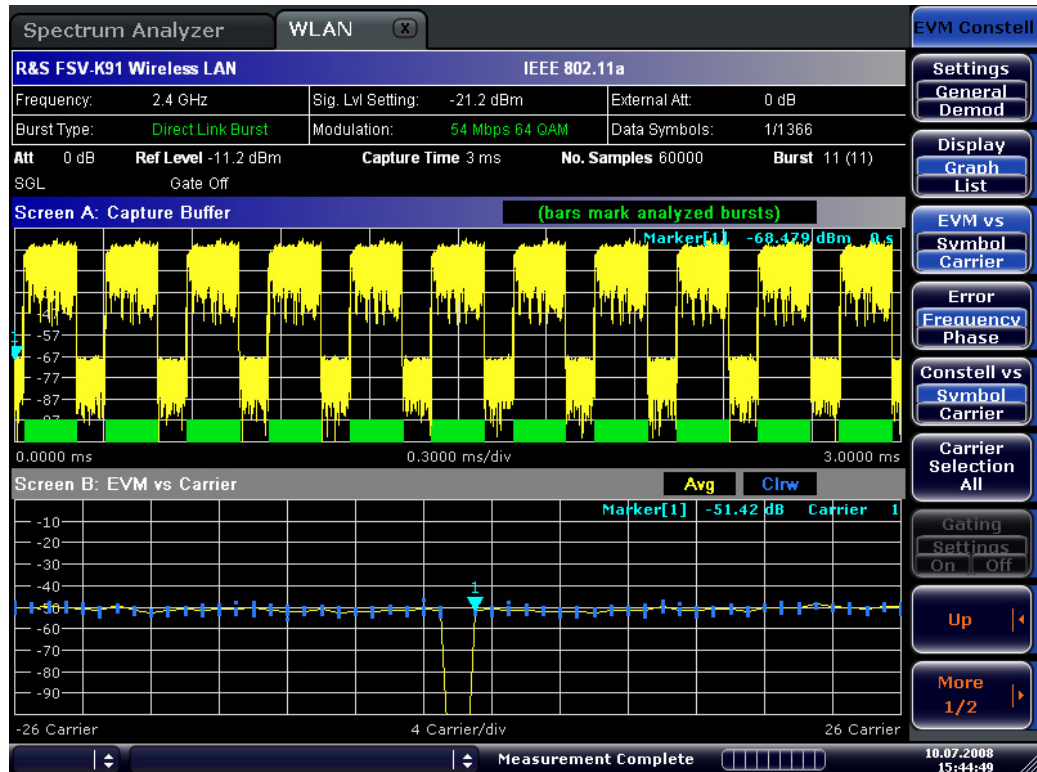
WLAN TX measurements (Option R&S FSV-K91)

For IEEE 802.11b, g (Single Carrier) two EVM traces are displayed. The trace labeled with VEC ERR IEEE shows the error vector magnitude as defined in the IEEE 802.11b, g standards. For the trace labeled with EVM a commonly used EVM definition is applied, which is the square root of the momentary error power normalized by the averaged reference power.



◆ EVM vs Carrier (IEEE 802.11a, g, j - OFDM)

This result display shows all EVM values recorded on a per-carrier basis over the full set of measured data. An average trace is also displayed.



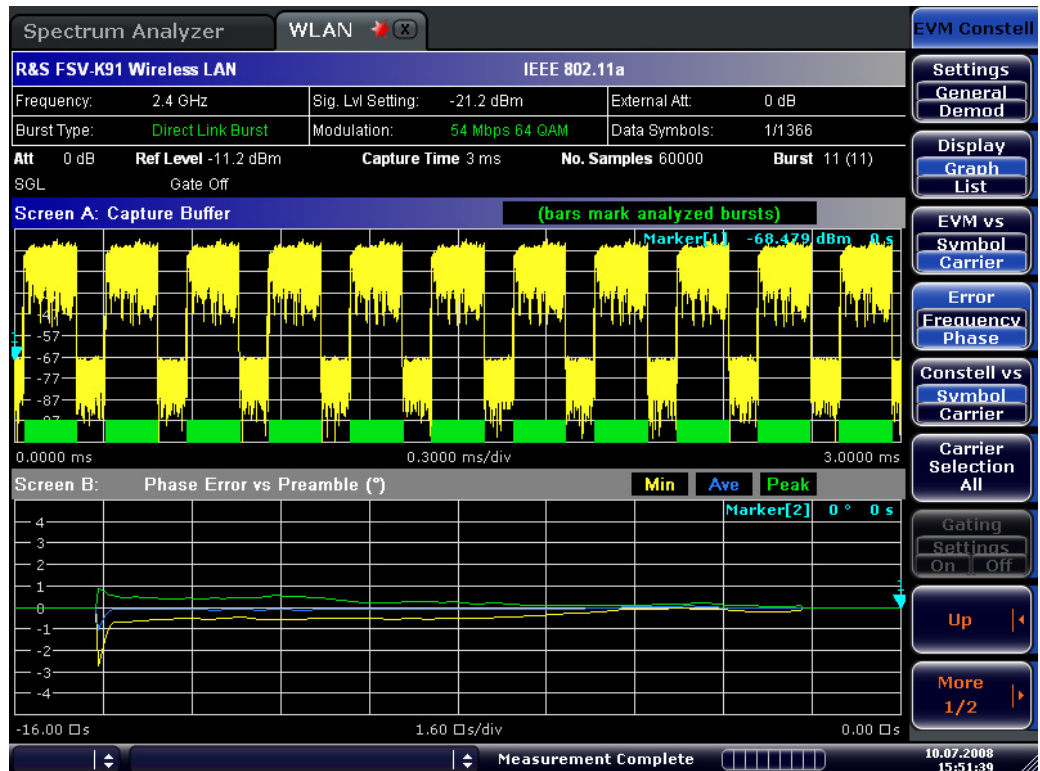
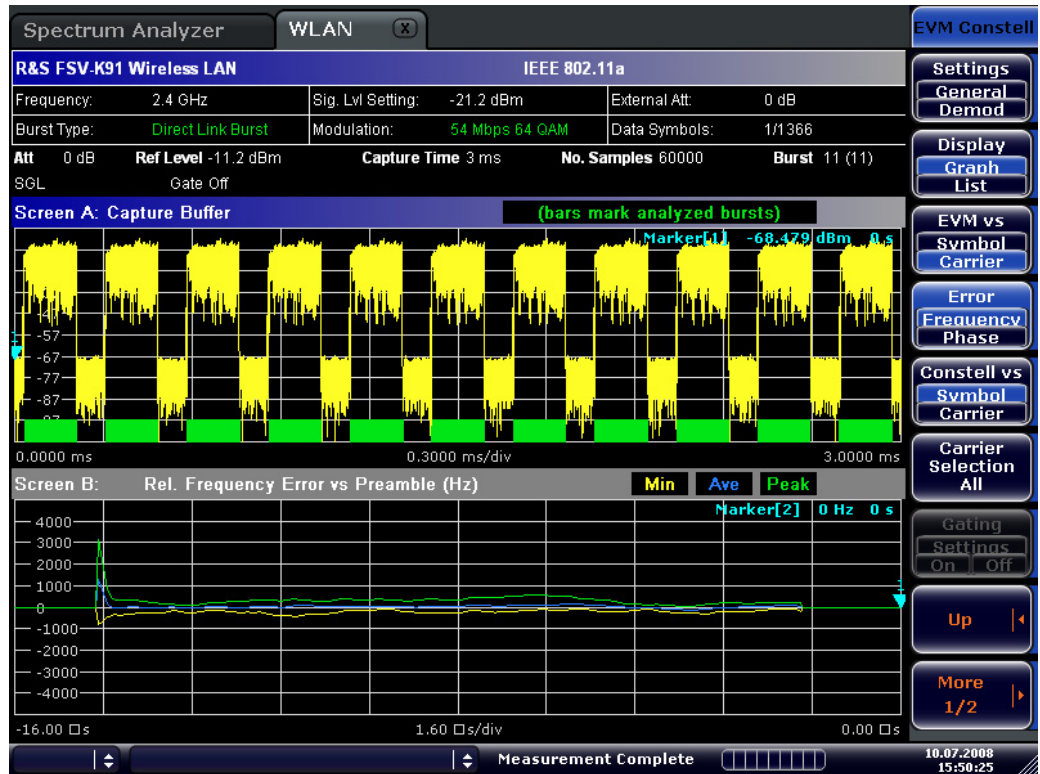
- Remote: [CONF:BURS:EVM:ESYM](#) (EVM vs Symbol)
- Remote: [CONF:BURS:EVM:ECAR](#) (EVM vs Carrier)

Error Frequency/Phase

Selects the Rel. Frequency Error vs Preamble or the Phase Error vs Preamble result displays.

These result displays show the error values recorded over the preamble part of the burst. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.

WLAN TX measurements (Option R&S FSV-K91)



- Remote: [CONF:BURS:PRE](#)
- Remote: [CONF:BURS:PRE:SEL_FREQ](#) (Frequency Error vs Preamble)
- Remote: [CONF:BURS:PRE:SEL_PHAS](#) (Phase Error vs Preamble)

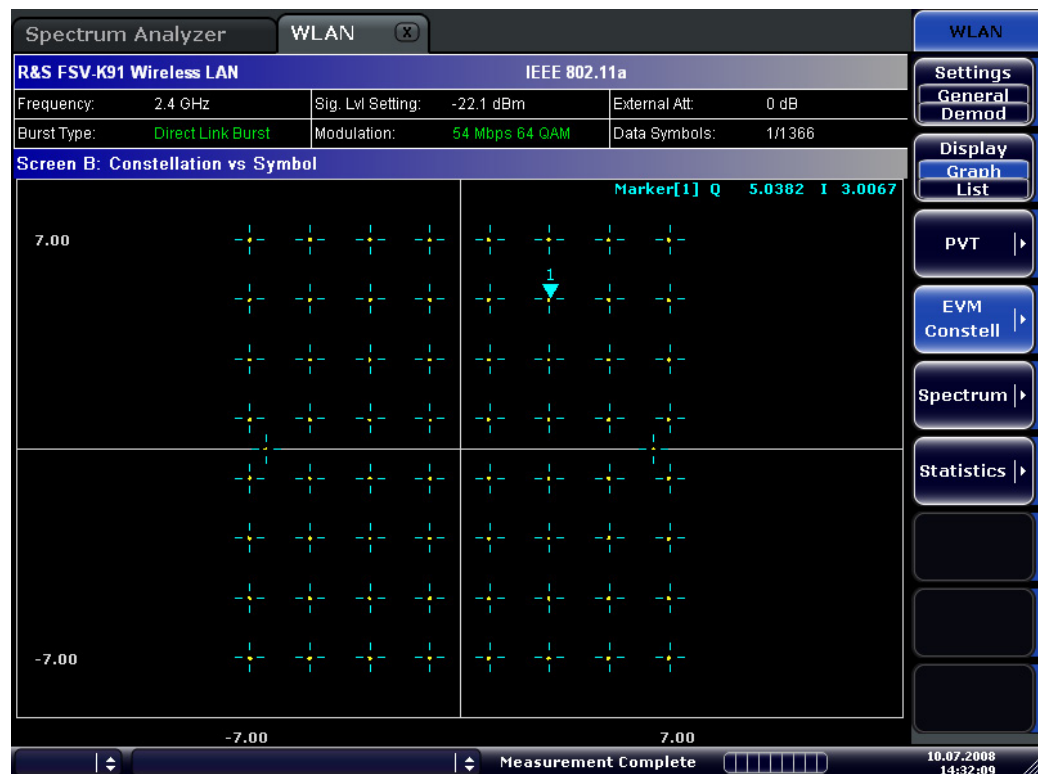
Constell vs Symbol/Carrier

Selects the Constellation vs Symbol or the Constellation vs Carrier result displays.

- ◆ Constellation vs Symbol (all standards)

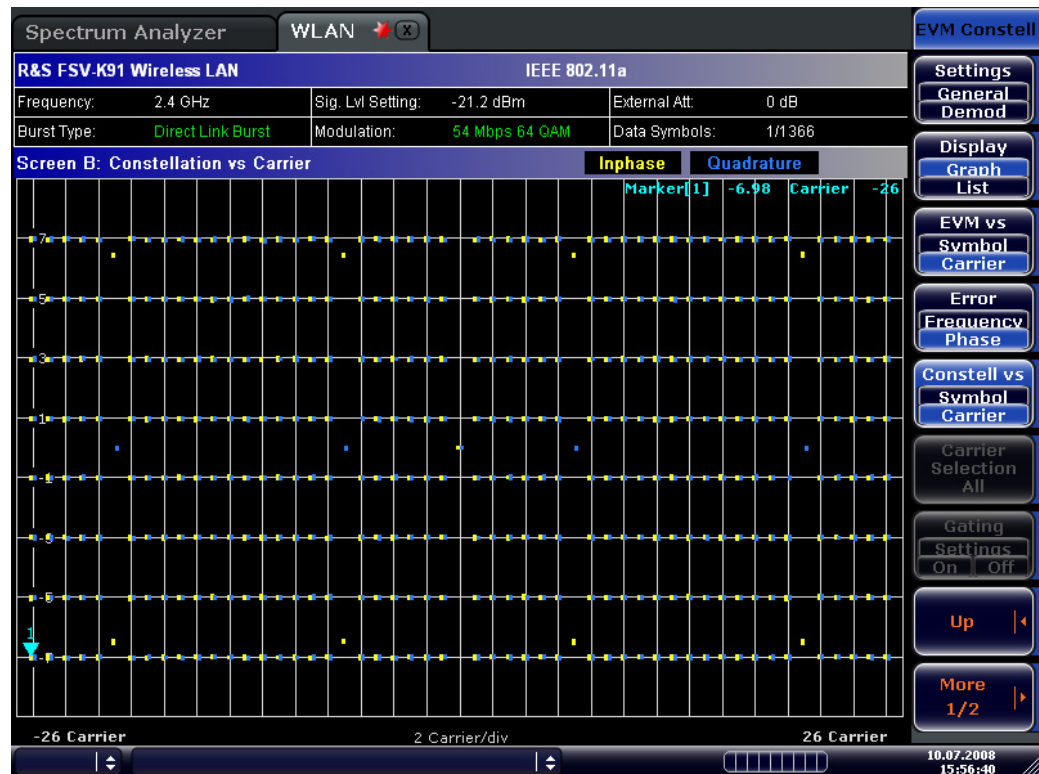
This result display shows the in-phase and quadrature phase results over the full range of the measured input data. The ideal points for the selected modulations scheme are displayed for reference purposes.

The amount of data displayed in the Constellation result display can be reduced by selecting the carrier or carriers for which data is to be displayed ([Carrier Selection](#) softkey).



- ◆ Constellation vs Carrier (IEEE 802.11a, g, j - OFDM)

This result display shows the in-phase and quadrature phase results over the full range of the measured input data plotted on a per-carrier basis. The magnitude of the in-phase and quadrature part is shown on the y-axis, both are displayed as separate traces (I-> trace 1, Q-> trace 2).



→ Remote: [CONF:BURS:CONS:CSYM](#) (Constellation vs Symbol)

→ Remote: [CONF:BURS:CONS:CCAR](#) (Constellation vs Carrier)

Carrier Selection (IEEE 802.11a, g, j - OFDM)

Opens a dialog box to select the carrier for data display. Either a specific carrier number, pilots only or all carriers can be selected.

→ Remote: [CONF:BURS:CONS:CARR:SEL -26](#)

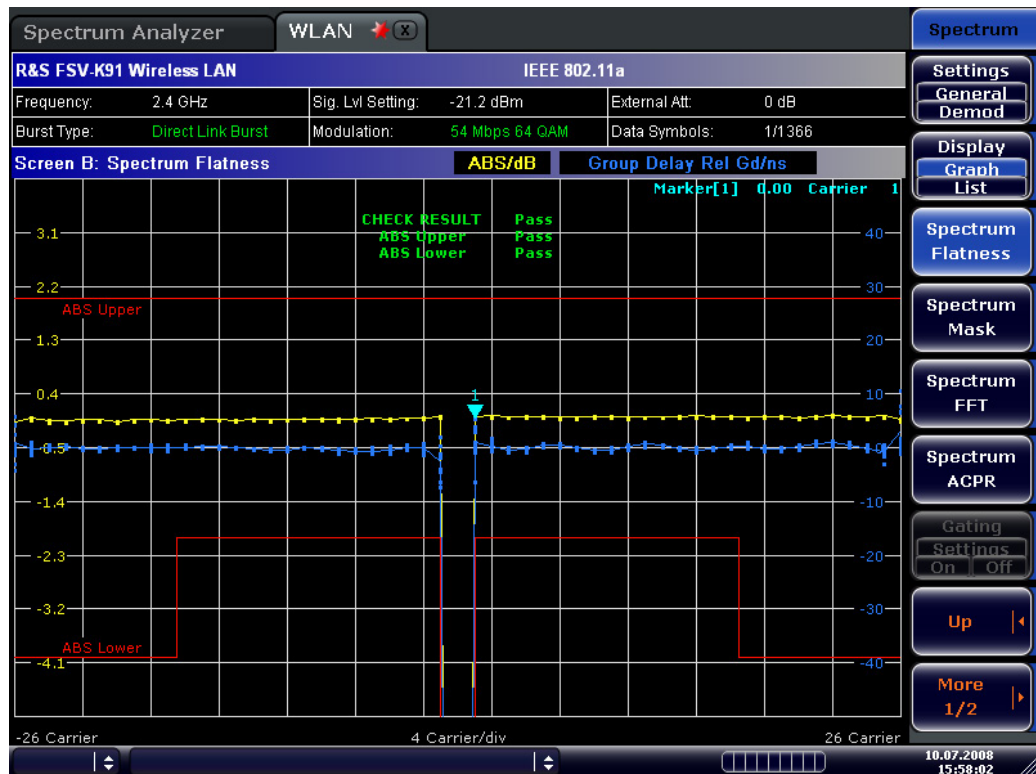
Spectrum

Opens a submenu for frequency measurements.

Spectrum Flatness (IEEE 802.11a, g, j - OFDM)

Sets the Spectrum Flatness result display.

This result display shows the spectrum flatness and group delay values recorded on a per-carrier basis over the full set of measured data. An average trace is also displayed for each of the result types. An upper and lower limit line representing the limits specified for the selected standard are displayed and an overall pass/fail status is displayed for the obtained (average) results against these limit lines.



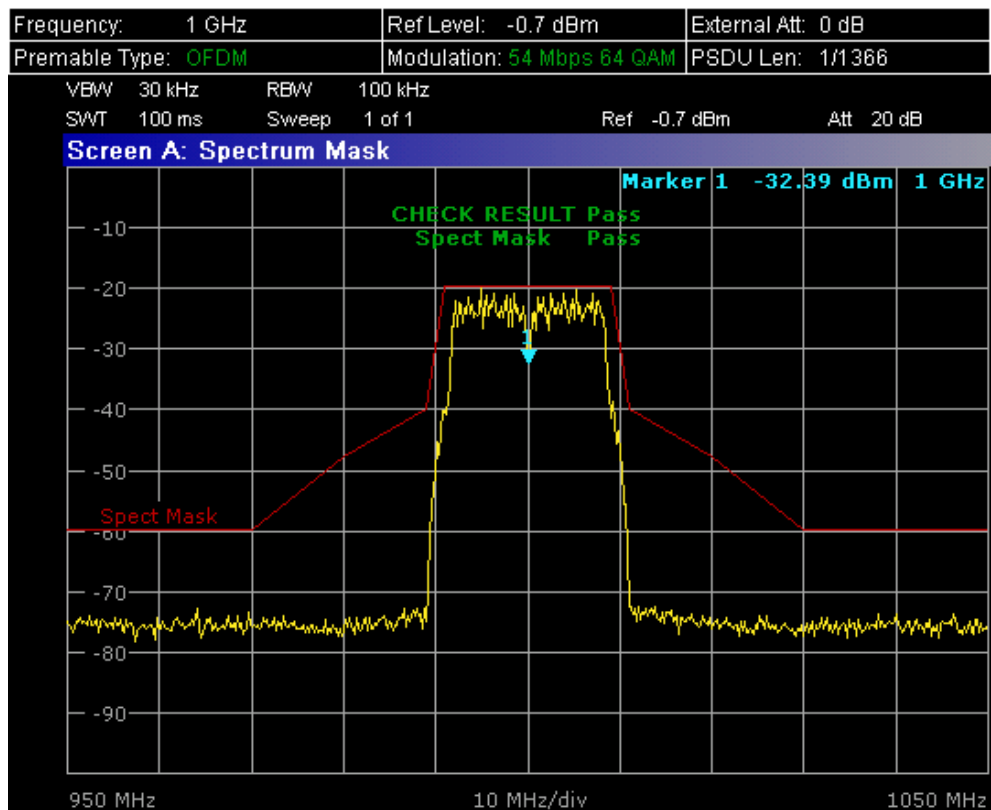
Spectrum Mask (IEEE 802.11b, g - Single Carrier),

Spectrum IEEE/ETSI (IEEE 802.11a, g, j - OFDM)

Sets the Spectrum Mask result display.

This result display shows power against frequency. The span of the results is 100 MHz for IEEE and 500 MHz for ETSI around the specified measurement frequency. A limit line representing the spectrum mask specified for the selected standard is displayed and an overall pass/fail status is displayed for the obtained results against this limit line.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed.



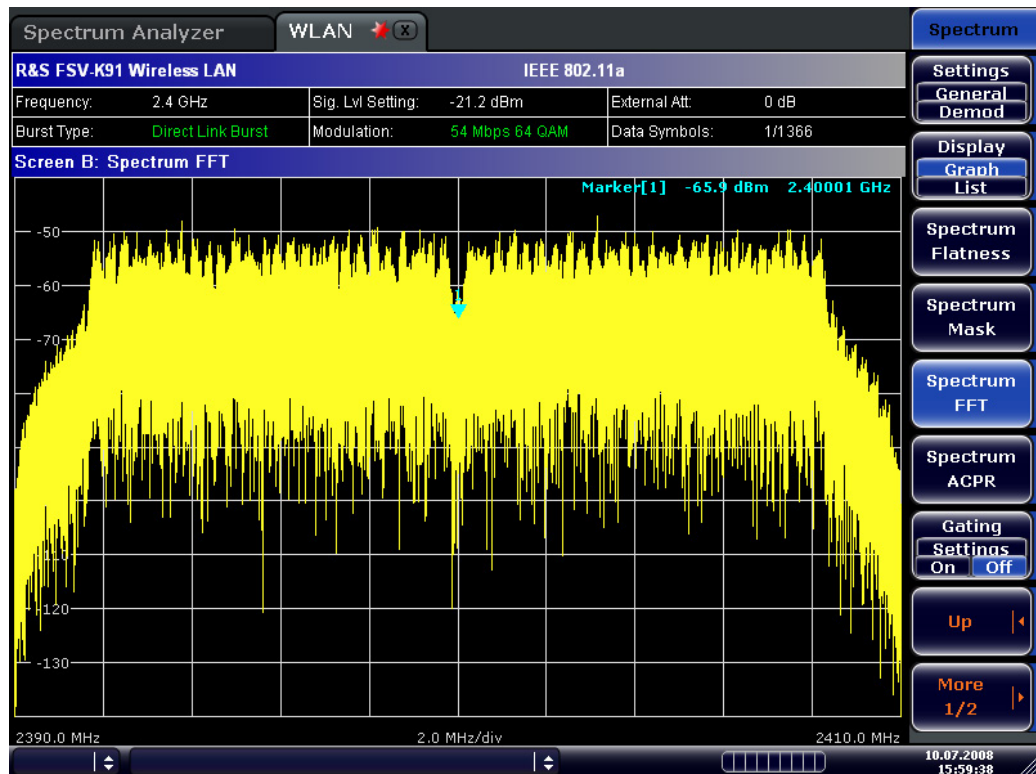
→ Remote: [CONF:BURS:SPEC:MASK](#)

→ Remote: [CONF:BURS:SPEC:MASK:SEL_ETSI](#)

Spectrum FFT

Sets the Spectrum FFT result display.

This result display shows the Power vs Frequency results obtained from a FFT performed over the range of data in the Magnitude Capture Buffer which lies within the gate lines.



→ Remote: [CONF:BURS:SPEC:FFT](#)

Spectrum ACPR (IEEE 802.11a, g, OFDM Turbo Mode)

Spectrum ACP (IEEE 802.11b)

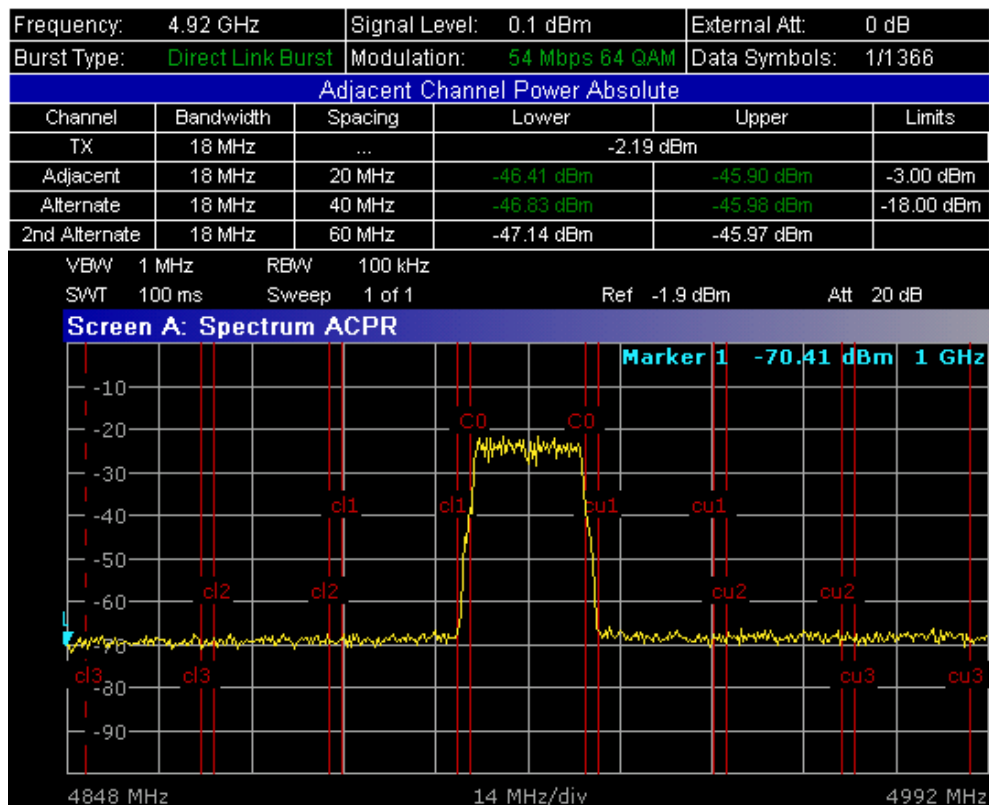
ACP Rel/Abs (IEEE 802.11j)

Sets the ACP (Adjacent Channel Power) result display.

This result display is similar to the Spectrum Mask measurement, and provides information about leakage into adjacent channels. The results show the absolute or relative power measured in the three nearest channels either side of the measured channel. This measurement is the same as the adjacent channel power measurement provided by the spectrum analyzer.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed.

WLAN TX measurements (Option R&S FSV-K91)



- Remote: [CONF:BURS:SPEC:ACPR](#)
- Remote: [CALC:MARK:FUNC:POW:RES?](#) (result query)
- Remote: [CALC:MARK:FUNC:POW:RES:MAXH?](#) (result query)

Statistics

Opens a submenu to display statistics measurement results.

CCDF

Sets the CCDF result display.

This result display shows the probability of an amplitude within the gating lines exceeding the mean power measured between the gating lines. The x-axis displays power relative to the measured mean power.

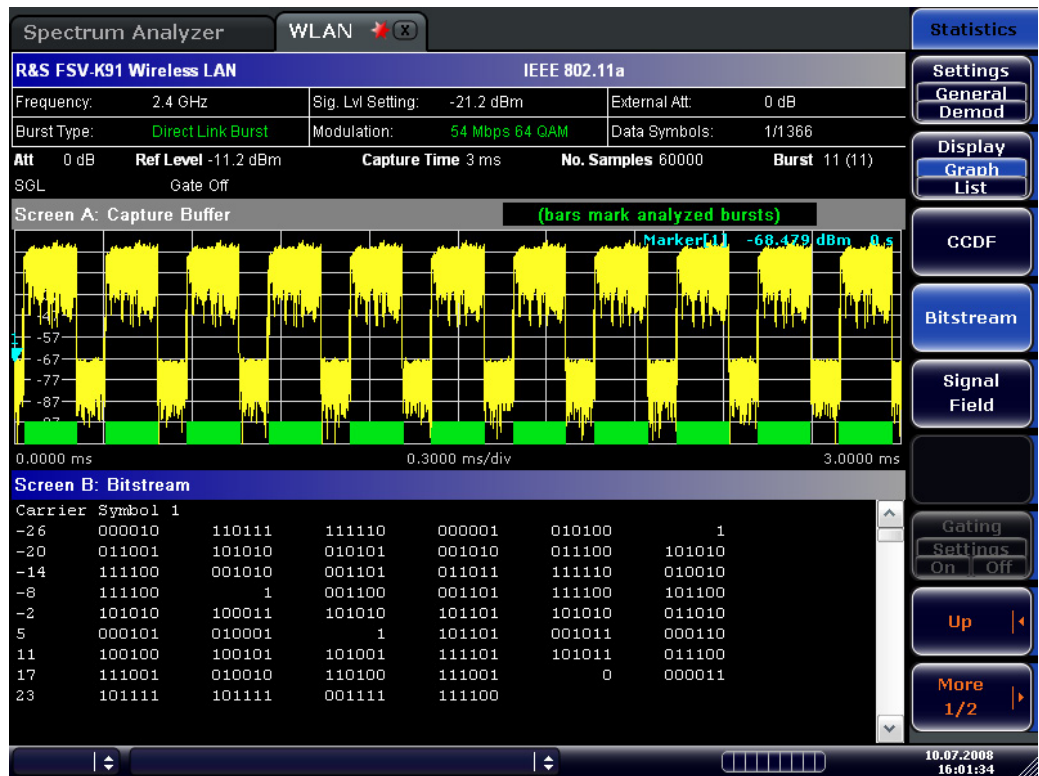


→ Remote: [CONF : BURS : STAT : CCDF](#)

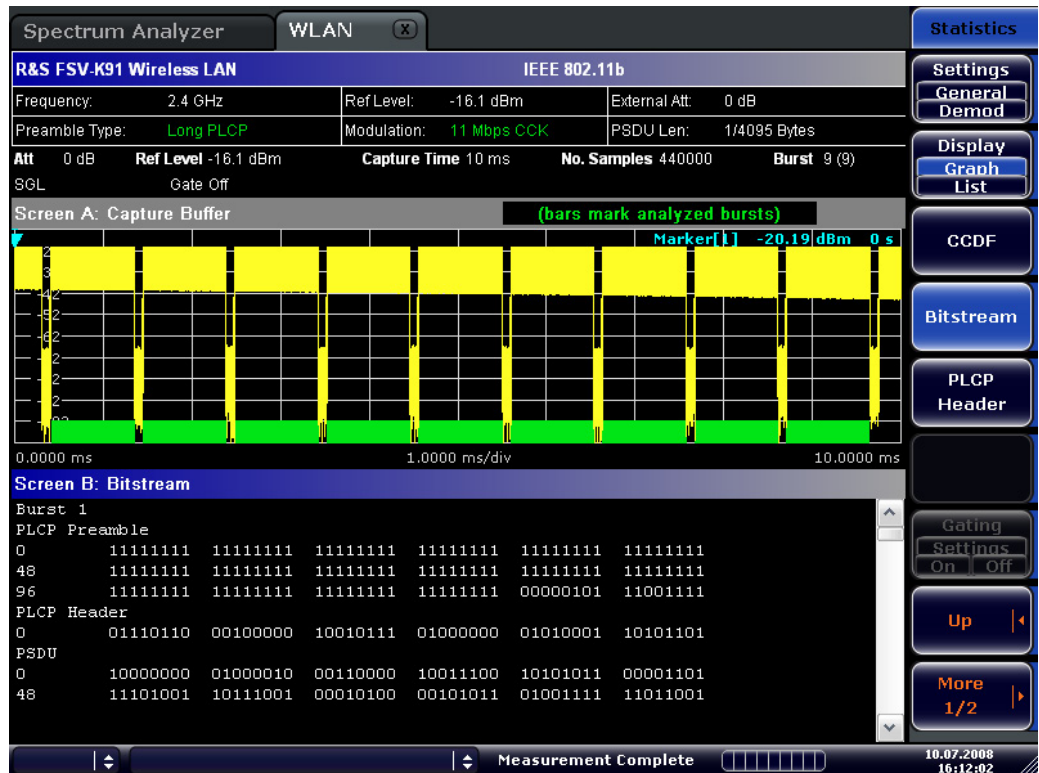
Bitstream

Sets the Bitstream result display. This result display shows the demodulated data stream.

- ◆ IEEE 802.11a, j, g (OFDM) :
The results are grouped by symbol and carrier.



- ◆ IEEE 802.11b or g (Single Carrier)
The results are grouped by burst.



→ Remote: [CONF : BURS : STAT : BSTR](#)

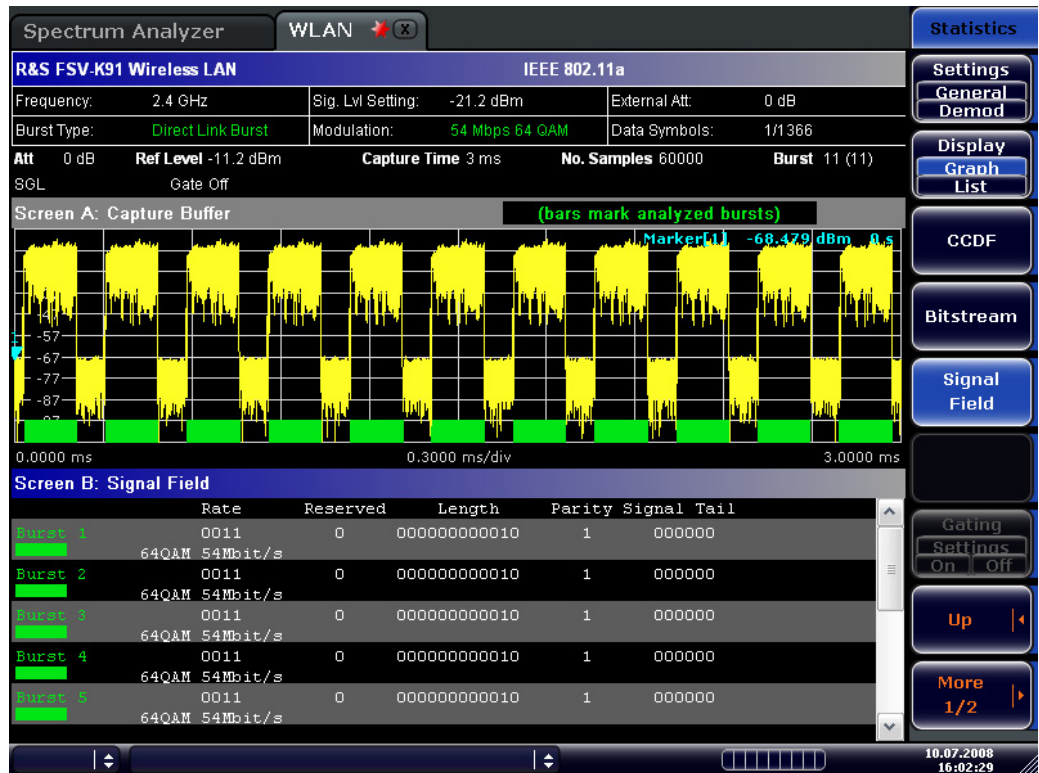
Signal Field (IEEE 802.11a, g, j - OFDM) ,

PLCP Header (IEEE 802.11b, g - Single Carrier)

Sets the Signal Field result display or the PLCP Header result display, depending on the selected standard.

Signal Field

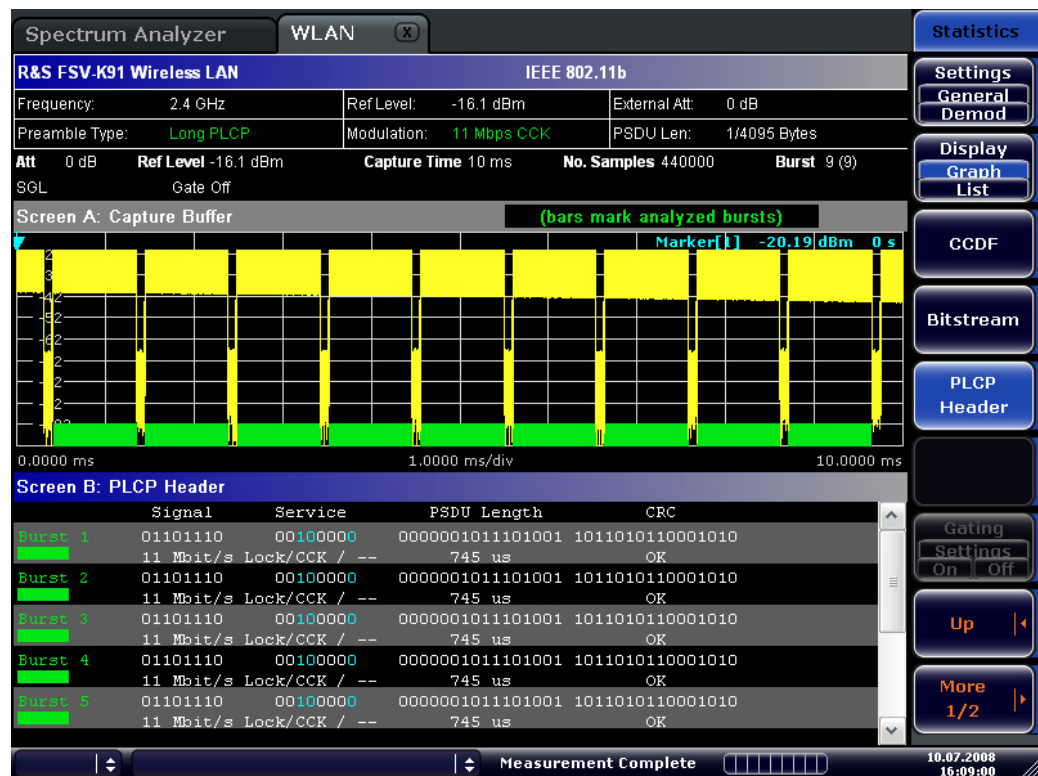
This result display shows the decoded data from the signal field of the burst. Therefore it is only available, if, in the "Demod Settings" dialog box, the "Signal Field Content" option is activated.



PLCP Header

This result display shows the decoded data from the PLCP header of the burst. The following details are listed:

Column header	Description	Example
Burst	number of the decoded burst A colored block indicates that the burst was successfully decoded.	Burst 1
Signal	signal field The decoded data rate is shown below.	00010100 2 MBits/s
Service	service field The currently used bits are highlighted. The text below explains the decoded meaning of these bits.	00000000 --/--
PSDU Length	length field The decoded time to transmit the PSDU is shown below.	000000001111000 120 µs
CRC	CRC field The result is displayed below ("OK" for passed or "Failed").	1110100111001110 OK



→ Remote: [CONF:BURS:STAT:SField](#)

13.4.2 Softkeys of the sweep menu – SWEEP key (Option R&S FSV-K91)

The following table shows all softkeys available in the sweep menu in "WLAN" mode ("SWEEP" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Meas Single/Cont
Auto Level
Refresh

Meas Single/Cont

Selects the sweep mode.

"Single" single sweep mode

"Cont" continuous sweep mode

→ Remote: [INIT:CONT OFF](#) (single sweep mode)

→ Remote: [INIT:CONT ON](#) (continuous sweep mode)

Auto Level

Starts an automatic level detection measurement. If this softkey is pressed while a measurement is running, the current measurement is aborted and the automatic level detection measurement is started. If the aborted measurement was a continuous measurement it is resumed after the automatic level detection is completed.

→ Remote: [CONF:POW:AUTO ON](#)

Refresh

Updates the current measurement results with respect to the current gate settings. This softkey is only available if the measurement results are effected by the gate settings (Spectrum FFT, PVT and CCDF) and if the gate settings are modified after a measurement result has been obtained.

13.4.3 Softkeys of the marker menu - MKR key (Option R&S FSV-K91)

The following table shows all softkeys available in the marker menu in "WLAN" mode ("MKR" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description. Close all settings dialog boxes before opening the marker menu.

Command
Marker 1
Unzoom
Marker Zoom
Marker Off

Marker 1

Opens a dialog box to adjust the marker. The contents of the dialog box depend on the type of graph the marker is adjusted to. After every change, the marker position in the trace and the marker information are updated.

- Remote: [CALC:MARK ON](#)
- Remote: [CALC:MARK:X 2ms](#)
- Remote: [CALC2:MARK:Y -2](#)
- Remote: [CALC:MARK:SYMB 2](#)
- Remote: [CALC:MARK:CARR -7](#)

Unzoom

Cancels the marker zoom.

- Remote: [CALC:MARK:FUNC:ZOOM 1](#)

Marker Zoom

Opens an edit dialog box to select the magnification factor for the zoom. The zoom facility is provided for the following result displays: Magnitude Capture Buffer, PVT, Constellation vs Symbol, Constellation vs Carrier. The maximum magnification depends on the type of result display.

→ Remote: [CALC:MARK:FUNC:ZOOM 3](#)

Marker Off

Switches off all makers in the active result display.

→ Remote: [CALC:MARK:AOFF](#)

13.4.4 Softkeys of the marker to menu – MKR-> key (Option R&S FSV-K91)

The following table shows all softkeys available in the marker-> menu in "WLAN" mode ("MKR"-> key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Peak
Min
MKR -> Trace

Peak (Spectrum Flatness result display)

Sets the marker to the peak value of the assigned trace.

→ Remote: [CALC:MARK:MAX](#)

Min (Spectrum Flatness result display)

Sets the marker to the minimum value of the assigned trace.

→ Remote: [CALC:MARK:MIN](#)

MKR -> Trace

Opens an edit dialog box to enter the number of the trace, on which the marker is to be placed. This softkey is available for all result displays with more than one trace.

→ Remote: [CALC:MARK:TRAC 2](#)

13.4.5 Softkeys of the lines menu – LIN key (Option R&S FSV-K91)

The following table shows all softkeys available in the lines menu in "WLAN" mode ("LINES" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

This menu is only available if the results are displayed in form of a list (for details see [Result summary list](#) and [Display List/Graph](#) softkey).

Command
Default Current
Default All

Default Current

Resets all limits for the current modulation scheme to the values specified in the selected standard.

→ Remote: see [CALCulate:LIMit Subsystem \(WLAN, |variable=K91\)](#)

Default All

Resets all limits for all modulation schemes to the values specified in the selected standard.

→ Remote: see [CALCulate:LIMit Subsystem \(WLAN, |variable=K91\)](#)

13.4.6 Softkeys of the trace menu – TRAC key (Option R&S FSV-K91)

The following table shows all softkeys available in the trace menu in "WLAN" mode ("TRACE" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Display List/Graph
Screen A/B
Screen Full/Split

Display List/Graph

For details refer to the [Display List/Graph](#) softkey in the WLAN menu.

Screen A/B

Selects the active screen for IQ measurement results in split and full screen mode. Only the markers of an active screen can be controlled.

→ Remote: [DISP:WIND1:SSEL](#)

Screen Full/Split

Changes the display between split and full screen for IQ measurement results. Frequency sweep measurement results are always displayed in full screen.

→ Remote: [DISP:FORM SING](#)

13.5 Remote Commands of the WLAN TX Measurements Option (R&S FSV-K91)

This section describes the remote commands for the WLAN TX Measurements option (R&S FSV-K91). The abbreviation WLAN stands for the Wireless LAN operating mode. For details on conventions used in this chapter refer to section "[Notation](#)" at the beginning of this chapter.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in section "[Remote Control – Description of Analyzer Commands](#)" or section "[Remote Control - Description of Basic Settings Commands](#)".

Subsystems of the WLAN TX Measurements option (R&S FSV-K91)

- ◆ "[ABORt Subsystem \(WLAN, |variable=K91\)](#)" on page 919
- ◆ "[CALCulate:BURSt Subsystem \(WLAN, |variable=K91\)](#)" on page 920
- ◆ "[CALCulate:LIMit Subsystem \(WLAN, |variable=K91\)](#)" on page 920
- ◆ "[CALCulate:MARKer Subsystem \(WLAN, |variable=K91\)](#)" on page 942
- ◆ "[CONFigure Subsystem \(WLAN, |variable=K91\)](#)" on page 951
- ◆ "[DISPlay Subsystem \(WLAN, |variable=K91\)](#)" on page 964
- ◆ "[FETCh Subsystem \(WLAN, |variable=K91\)](#)" on page 967
- ◆ "[FORMat Subsystem \(WLAN, |variable=K91\)](#)" on page 978
- ◆ "[INITiate Subsystem \(WLAN, |variable=K91\)](#)" on page 979
- ◆ "[INPut Subsystem \(WLAN, |variable=K91\)](#)" on page 979
- ◆ "[INSTrument Subsystem \(WLAN, |variable=K91\)](#)" on page 980
- ◆ "[MMEMory Subsystem \(WLAN, |variable=K91\)](#)" on page 980
- ◆ "[SENSe Subsystem \(WLAN, |variable=K91\)](#)" on page 981

13.5.1 ABORt Subsystem (WLAN, R&S FSV-K91)

The ABORt subsystem contains the commands for aborting triggered actions.

Commands of the ABORt Subsystem

- ◆ [ABORt](#)

ABORt

For details refer to "[ABORt](#)".

13.5.2 CALCulate:BURSt Subsystem (WLAN, R&S FSV-K91)

The CALCulate:BURSt subsystem checks the IQ measurement results.

Commands of the CALCulate:BURSt Subsystem

- ◆ [CALCulate<1|2>:BURSt:IMMEDIATE](#)

CALCulate<1|2>:BURSt:IMMEDIATE

This command forces the IQ measurement results to be recalculated according to the current settings.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC1: BURS
```

Starts the recalculation of the IQ measurement results.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

13.5.3 CALCulate:LIMit Subsystem (WLAN, R&S FSV-K91)

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks.

Commands of the CALCulate:LIMit Subsystem

- ◆ [CALCulate<1|2>:LIMit<1...8>:FAIL?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:ACPower:ACHannel?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:ACPower:ACHannel:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:ACPower:ALternate?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:ACPower:ALternate:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:ALL](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:ALL:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM\[:AVERage\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM\[:AVERage\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL\[:AVERage\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL\[:AVERage\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum:RESult?](#)

Remote Commands of the WLAN TX Measurements Option (R&S FSV-K91)

- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILOt\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILOt\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILOt:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILOt:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:FERRor\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:FERRor\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:IQOFset\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:IQOFset\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:IQOFset:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:IQOFset:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:SYMBOLerror\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:SYMBOLerror\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:SYMBOLerror:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:SYMBOLerror:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TFALI\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TFALI\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TFALI:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TFALI:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TRISe\]:AVERAge\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TRISe\]:AVERAge\]:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TRISe:MAXimum\]](#)
- ◆ [CALCulate<1|2>:LIMit<1>:BURSt:TRISe:MAXimum:RESult?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECK:X?](#)
- ◆ [CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECK:Y?](#)

CALCulate<1|2>:LIMit<1...8>:FAIL?

For option WLAN TX Measurements, R&S FSV-K91, the numeric suffixes <1...8> specify the limit lines as follows:

Suffix	Limit
1 to 2	These indexes are not used
3	ETSI Spectrum Mask limit line
4	Spectrum Flatness (Upper) limit line
5	Spectrum Flatness (Lower) limit line
6	IEEE Spectrum Mask limit line
7	PVT Rising Edge max limit
8	PVT Rising Edge mean limit
9	PVT Falling Edge max limit
10	PVT Falling Edge mean limit

For further details refer to "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)".

CALCulate<1|2>:LIMit<1>:ACPpower:ACHannel?

This command returns the ACP adjacent channel limit for IEEE 802.11j if defined. This command is a query only and thus has no *RST value.

Parameter

numeric value in dB

Example

```
CALC:LIM:ACP:ACH?
```

Returns the IEEE 802.11j ACP adjacent channel limit.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:ACPpower:ACHannel:RESult?

For details refer to "[CALCulate<1|2>:LIMit<1...8>:ACPpower:ACHannel:RESult?](#)".

CALCulate<1|2>:LIMit<1>:ACPpower:ALTErnate?

This command returns the ACP alternate channel limit for IEEE 802.11j if defined.

Parameter

numeric value in dB

Example

```
CALC:LIM:ACP:ALT?
```

Returns the IEEE 802.11j ACP alternate channel limit.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:ACPowEr:ALTernate:RESult?

For details refer to

["CALCulate<1|2>:LIMit<1...8>:ACPowEr:ALTernate<1...11>:RESult?"](#).

CALCulate<1|2>:LIMit<1>:BURSt:ALL

This command sets or returns all the limit values.

Parameter

The results are input or output as a list of values separated by ',' in the following (ASCII) format:

<average frequency error>, <max frequency error>,
 <average symbol error>, <max symbol error>,
 <average IQ offset>, <maximum IQ offset>,
 <average EVM all bursts>, <max EVM all bursts>,
 <average EVM data carriers >, <max EVM data carriers >
 <average EVM pilots >, <max EVM pilots >

**Note**

The units for the EVM results are specified with the UNIT : EVM command.

Example

CALC : LIM : BURSt : ALL ?

All limit values are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:ALL:RESUlt?

This command returns all the limit results.

This command is a query only and thus has no *RST value.

Parameter

For details on formats refer to "[CALCulate<1|2>:LIMit<1>:BURSt:ALL](#)" on page 923.

Example

```
CALC:LIM:BURS:ALL:RES?
```

All limit values are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM[:AVERAge]

This command sets the average Error Vector Magnitude Limit for the IEEE 802.11b standard.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM -25.0
```

Average EVM limit is set to -25 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM[:AVERAge]:RESUlt?

This command returns the average Error Vector Magnitude Limit result for the IEEE 802.11b standard.

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:RES?
```

Average EVM limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERAge]

This command sets the average Error Vector Magnitude Limit. This is a combined figure that represents the pilot, data and the free carrier.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:ALL -25.0
```

Average EVM for all carrier limit is set to -25.0 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL[:AVERAge]:RESult?

This command returns the average Error Vector Magnitude Limit result. This is a combined figure that represents the pilot, data and the free carrier.

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:ALL:RES?
```

Average EVM for all carrier limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum

This command sets the maximum Error Vector Magnitude Limit. This is a combined figure that represents the pilot, data and the free carrier.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:ALL:MAX?
```

Maximum EVM for all carrier limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:ALL:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude Limit result. This is a combined figure that represents the pilot, data and the free carrier."

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:ALL:MAX:RES?
```

Maximum EVM for all carrier limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERAge]

This command sets the average Error Vector Magnitude limit summary for the data carrier.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:DATA -30.0
```

Average EVM for data carrier limit is set to -30.0 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA[:AVERAge]:RESult?

This command returns the average Error Vector Magnitude limit result summary for the data carrier."

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:DATA:RES?
```

Average EVM for data carrier limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum

This command sets the maximum Error Vector Magnitude limit summary for the data carrier.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:DATA:MAX?
```

Maximum EVM for data burst limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:DATA:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude limit result summary for the data carrier."

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:DATA:MAX:RES?
```

Maximum EVM for data carrier limit result is returned Characteristics.

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:MAXimum

This command sets the maximum Error Vector Magnitude Limit for the IEEE 802.11b standard.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:MAX?
```

Maximum EVM limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude Limit result for the IEEE 802.11b standard.

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:MAX:RES?
```

Maximum EVM limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot[:AVERage]

This command sets the average Error Vector Magnitude limit summary for the pilot carriers.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:PIL -8.0
```

Average EVM for pilot carrier limit is set to -8.0 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot[:AVERage]:RESult?

This command returns the average Error Vector Magnitude limit result summary for the pilot carriers."

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:PIL:RES?
```

Average EVM for pilot carrier limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot:MAXimum

This command sets the maximum Error Vector Magnitude limit summary for the pilot carriers.

Parameter

numeric value in dB

Example

```
CALC:LIM:BURS:EVM:PIL:MAX?
```

Maximum EVM for pilot carrier limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:EVM:PILot:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude limit result summary for the pilot carriers."

This command is a query only and thus has no *RST value.

Return values

0 PASSED

1 FAILED

Example

```
CALC:LIM:BURS:EVM:PIL:MAX:RES?
```

Maximum EVM for pilot carrier limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]

This command sets the average frequency error limit.

Parameter

numeric value in Hertz

Example

```
CALC:LIM:BURS:FERR 10000
```

The average frequency error limit is set to 10 kHz

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:FERRor[:AVERage]:RESult?

This command returns the average frequency error limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:FERR:RES?
```

Average frequency error limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum

This command sets the maximum frequency error limit.

Parameter

numeric value in Hertz

Example

```
CALC:LIM:BURS:FERR:MAX?
```

Maximum frequency error limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:FERRor:MAXimum:RESult?

This command returns the maximum frequency error limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:FERR:MAX:RES?
```

Maximum frequency error limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERAge]

This command sets the average IQ Offset error limit.

Parameter

numeric value in dB: -1000000 to 1000000

Example

```
CALC:LIM:BURS:IQOF -10.0
```

Average IQ Offset error limit is set to -10.0 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset[:AVERAge]:RESult?

This command returns the average IQ Offset error limit result.

Example

```
CALC:LIM:BURS:IQOF:RES?
```

Average IQ Offset error limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum

This command sets the maximum IQ Offset error limit.

Parameter

numeric value in dB: -1000000 to 1000000

Example

```
CALC:LIM:BURS:IQOF:MAX 15.0
```

Maximum IQ Offset error limit is set to -15.0 dB

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:IQOFfset:MAXimum:RESult?

This command returns the maximum IQ Offset error limit result.

Example

```
CALC:LIM:BURS:IQOF:MAX:RES?
```

Maximum IQ Offset error limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror[:AVERage]

This command sets the average symbol error limit.

Parameter

numeric value in Hertz

Example

```
CALC:LIM:BURS:SYMB 10000
```

The average symbol error limit is set to 10kHz

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror[:AVERage]:RESult?

This command returns the average symbol error limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:SYMB:RES?
```

Average symbol error limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror:MAXimum

This command sets the maximum symbol error limit.

Parameter

numeric value in Hertz

Example

```
CALC:LIM:BURS:SYMB:MAX?
```

Maximum symbol error limit is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:SYMBolerror:MAXimum:RESult?

This command returns the maximum symbol error limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:SYMB:MAX:RES?
```

Maximum symbol error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TFALI[:AVERAge]

This command sets the average fall time limit.

Parameter

numeric value in seconds

Example

```
CALC:LIM:BURS:TFAL 0.000001
```

The average fall time limit is set to 1 µs

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TFALI[:AVERAge]:RESult?

This command returns the average fall time limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:TFAL1:RES?
```

Average fall time limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TFALI:MAXimum

This command sets the maximum fall time limit.

Parameter

numeric value in seconds

Example

```
CALC:LIM:BURS:TFALL:MAX 0.000001
```

The maximum fall time limit set to 1 µs.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TFALI:MAXimum:RESult?

This command returns the maximum fall time limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:TRIS:MAX:RES?
```

Maximum fall time limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TRISe[:AVERAge]

This command sets the average rise time limit.

Parameter

numeric value in seconds

Example

```
CALC:LIM:BURS:TRIS 0.000001
```

The average rise time limit is set to 1 μ s

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TRISe[:AVERAge]:RESult?

This command returns the average rise time limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:TRIS:RES?
```

The average rise time limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TRISe:MAXimum

This command sets the maximum rise time limit.

Parameter

numeric value in seconds

Example

```
CALC:LIM:BURS:TRIS:MAX 0.000001
```

Maximum rise time limit is set to 1 µs

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:BURSt:TRISe:MAXimum:RESult?

This command returns the maximum rise time limit result.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:BURS:TRIS:MAX:RES?
```

Maximum rise time limit result is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECK:X?

This command returns the X-value at the maximum overstepping of the spectrum mask limits.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:SPEC:MASK:CHECK:X?
```

Returns the frequency at the maximum overstepping.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:LIMit<1>:SPECtrum:MASK:CHECK:Y?

This command returns the Y-value at the maximum overstepping of the spectrum mask limits.

This command is a query only and thus has no *RST value.

Example

```
CALC:LIM:SPEC:MASK:CHECK:Y?
```

Returns the power at the maximum overstepping.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

13.5.4 CALCulate:MARKer Subsystem (WLAN, R&S FSV-K91)

The CALCulate:MARKer subsystem checks the marker functions of the instrument. The following subsystem is included:

["CALCulate:MARKer:FUNCTION Subsystem \(WLAN, |variable=K91\)" on page 949](#)

Commands of the CALCulate:MARKer Subsystem

- ◆ [CALCulate<1|2>:MARKer<1>:STATe\]](#)
- ◆ [CALCulate<1|2>:MARKer<1>:AOFF](#)
- ◆ [CALCulate<1|2>:MARKer<1>:BSYMBOL](#)
- ◆ [CALCulate<1|2>:MARKer<1>:CARRIER](#)

- ◆ [CALCulate<1|2>:MARKer<1>:MAXimum](#)
- ◆ [CALCulate<1|2>:MARKer<1>:MINimum](#)
- ◆ [CALCulate<1|2>:MARKer<1>:SYMBOL](#)
- ◆ [CALCulate<1|2>:MARKer<1>:TRACE](#)
- ◆ [CALCulate<1|2>:MARKer<1>:X](#)
- ◆ [CALCulate<1|2>:MARKer<1>:Y](#)

CALCulate<1|2>:MARKer<1>[:STATE]

This command switches the markers on or off.

Parameter

ON | OFF

Example

```
CALC1:MARK1:STATE ON
```

Switches the screen A marker ON.

```
CALC2:MARK1:STATE OFF
```

Switches the screen B marker OFF.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:AOFF

This command switches off all active markers in the specified measurement window. The window is set by the numeric suffix of CALCulate<1|2>.

Example

```
CALC1:MARK:AOFF
```

Switches off all markers in the screen A window.

```
CALC2:MARK:AOFF
```

Switches off all markers in the screen B window.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:BSYMBOL

This command positions the selected marker to the indicated symbol in the indicated burst. The first numeric value is the burst number and the second numeric value is the symbol number.

This command only applies to 802.11b standard for the following result displays:

- | |
|---------------------------|
| ◆ Constellation vs Symbol |
| ◆ EVM vs Symbol |

This command is a query only and thus has no *RST value.

Parameter

<numeric_value>,<numeric_value>

Example

```
CALC:MARK1:BSYM 2,10
```

Positions marker 1 to symbol 10 of burst 2.

```
CALC:MARK1:BSYM?
```

Outputs the burst and symbol values of marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:CARRier

This command positions the selected marker to the indicated carrier.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

<numeric_value>

Example

```
CALC:MARK:CARR -7
```

Positions marker 1 to carrier -7.

```
CALC:MARK:CARR?
```

Outputs the carrier value of marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:MAXimum

This command sets the selected marker to the maximum peak value in the current trace. This command is only available for the Spectrum Flatness result display.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC2:MARK:MAX
```

Set marker 1 in screen B to maximum value in trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:MINimum

This command sets the selected marker to the minimum peak value in the current trace. This command is only available for the Spectrum Flatnes result display. This command is an event and therefore has no *RST value and no query.

Example

```
CALC2:MARK:MIN
```

Set marker 1 in screen B to minimum value in trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:SYMBol

This command positions the selected marker to the indicated symbol.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

<numeric_value>

Example

```
CALC:MARK:SYMB 2
```

Positions marker 1 to symbol 2.

```
CALC:MARK:SYMB?
```

Outputs the symbol value of marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:TRACe

This command assigns the selected marker to the indicated measurement curve in the selected measurement window.

This command is only available for the following result displays:

- ◆ Constellation versus Carrier
- ◆ EVM vs Symbol
- ◆ Frequency Error vs Preamble
- ◆ Phase Error vs Preamble
- ◆ PVT Full Burst
- ◆ PVT Rising / Falling
- ◆ Spectrum Flatness
- ◆ Spectrum Mask, if Max Hold trace is displayed
- ◆ Spectrum ACP/ACPR, if Max Hold trace is displayed

Example

```
"CALC2:MARK:TRAC 2
```

Assigns marker 1 in screen B to trace 2.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:X

This command positions the selected marker to the indicated inphase (Constellation vs Symbol), frequency (Spectrum FFT, Spectrum Mask, Spectrum APCR), time (Magnitude Capture Buffer, Auto level, PVT Full Burst, PVT Rising / Falling), power (CCDF), sub-carrier (Constellation vs Carrier, EVM vs Carrier, Spectrum Flatness) or symbol (EVM vs Symbol) in the selected measurement window.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

<numeric_value> in Hz, s, dB

Example

```
CALC:MARK:X 2ms
```

Positions marker 1 to time 2ms.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:Y

This command positions the selected marker to the indicated quadrature (Constellation vs Symbol), magnitude of I or Q (Constellation vs Carrier), EVM (EVM vs Carrier) or abs (Spectrum Flatness) in the selected measurement window.

This command is query only for the following result displays:

- ◆ Auto Level
- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier
- ◆ EVM vs Symbol
- ◆ PVT Full
- ◆ PVT Rising / Falling
- ◆ Magnitude Capture Buffer
- ◆ Spectrum Mask
- ◆ Spectrum ACP/ACPR
- ◆ Spectrum FFT
- ◆ CCDF

Parameter

<numeric_value> in percent or dB

Example

```
CALC2:MARK:Y -2
```

Positions marker 1 in screen B to -2.

```
CALC:MARK:Y?
```

Outputs the measured value of marker 1.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

WLAN

13.5.4.1 CALCulate:MARKer:FUNCtion Subsystem (WLAN, R&S FSV-K91)

The measurement window is selected by CALCulate 1 (screen A) or 2 (screen B).

Commands of the CALCulate:MARKer:FUNCtion Subsystem

- ◆ [CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult\[:CURRent\]?](#)
- ◆ [CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult:MAXHold?](#)
- ◆ [CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM](#)

CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult[:CURRent]?

This command queries the current result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run, for there to be summary data available.

Results are output separated by commas in the following order:

- | |
|---|
| ◆ Power of main channel |
| ◆ Power of lower adjacent channel |
| ◆ Power of upper adjacent channel |
| ◆ Power of lower alternate adjacent channel 1 |
| ◆ Power of upper alternate adjacent channel 1 |
| ◆ Power of lower alternate adjacent channel 2 |
| ◆ Power of upper alternate adjacent channel 2 |

Adjacent channel power values are output in dB.

This command is a query only and thus has no *RST value.

Example

```
CALC:MARK:FUNC:POW:RES?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult:MAXHold?

This command queries the maximum result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run with more than one sweep, for there to be maximum summary data available.

For details on the output refer to

["CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult\[:CURRent\]?"](#) on page 949.

This command is a query only and thus has no *RST value.

Example

```
CALC:MARK:FUNC:POW:RES:MAXH?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM

This command sets the magnification factor for the zoom. It is only available for the following result displays:

- ◆ Constellation vs Carrier
- ◆ Constellation vs Symbol
- ◆ PVT
- ◆ Magnitude Capture Buffer

Parameter

<numeric_value>

Example

```
INIT:CONT OFF
Switches to single sweep mode
CALC:MARK:FUNC:ZOOM 3;*WAI
Activates zooming and waits for its end.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

WLAN

13.5.5 CONFigure Subsystem (WLAN, R&S FSV-K91)

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results are queried.

Commands of the CONFigure Subsystem

- ◆ [CONFigure:BURSt:CONStellation:CARRier:SElect](#)
- ◆ [CONFigure:BURSt:CONStellation:CARRier\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:CONStellation:CSYMBOL\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:EVM:ECARRier\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:EVM:ESYMBOL\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:PREamble\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:PREamble:SElect](#)
- ◆ [CONFigure:BURSt:PVT\[:IMMediate\]](#)
- ◆ [CONFigure:BURSt:PVT:AVERage](#)
- ◆ [CONFigure:BURSt:PVT:RPOWER](#)
- ◆ [CONFigure:BURSt:PVT:SElect](#)
- ◆ [CONFigure:BURSt:SPECTrum:ACPR\[:IMMediate\]](#)

- ◆ [CONFigure:BURSt:SPECtrum:FFT\[:IMMEDIATE\]](#)
- ◆ [CONFigure:BURSt:SPECtrum:FLATness\[:IMMEDIATE\]](#)
- ◆ [CONFigure:BURSt:SPECtrum:MASK\[:IMMEDIATE\]](#)
- ◆ [CONFigure:BURSt:SPECtrum:MASK:SElect](#)
- ◆ [CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]](#)
- ◆ [CONFigure:BURSt:STATistics:CCDF\[:IMMEDIATE\]](#)
- ◆ [CONFigure:BURSt:STATistics:SField\[:IMMEDIATE\]](#)
- ◆ [CONFigure:CHANnel](#)
- ◆ [CONFigure:POWer:AUTO](#)
- ◆ [CONFigure:POWer:AUTO:SWEEP:TIME](#)
- ◆ [CONFigure:POWer:EXpected:RF](#)
- ◆ [CONFigure:STANdard](#)

CONFigure:BURSt:CONStellation:CARRier:SElect

This remote control command is only available when Constellation vs Symbol measurement is selected. When the Constellation versus Symbol measurement is initiated, it will calculate the results of the selected carrier.

Parameter

-26 to 26 | ALL | PILOTS

Example

CONF: BURS: CONS: CARR: SEL -26

Carrier -26 is selected.

CONF: BURS: CONS: CARR: SEL 10

Carrier 10 is selected.

CONF: BURS: CONS: CARR: SEL ALL

All carriers are selected.

CONF: BURS: CONS: CARR: SEL PIL

Pilots only.

Characteristics

*RST value: ALL

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:CONStellation:CARRier[:IMMEDIATE]

This remote control command configures the measurement type to be Constellation vs Carrier. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF : BURS : CONS : CCAR
```

Configures the Constellation versus Carrier measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:CONStellation:CSYMBOL[:IMMEDIATE]

This remote control command configures the measurement type to be Constellation vs Symbol. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command

Example

```
CONF : BURS : CONS : CSYM
```

Configures the Constellation versus Symbol measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:EVM:ECARRIER[:IMMEDIATE]

This remote control command configures the measurement type to be EVM vs Carrier. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF : BURS : EVM : ECAR
```

Configures the EVM vs Carrier measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:EVM:ESYMBOL[:IMMEDIATE]

This remote control command configures the measurement type to be EVM vs Symbol. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF: BURS: EVM: ESYM
```

Configures the EVM vs Symbol measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PREamble[:IMMEDIATE]

This remote control command configures the measurement type to be Phase or Frequency vs Preamble. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF: BURS: PRE
```

Configures the preamble measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PREamble:SElect

This remote control command configures the interpretation of the preamble measurement results.

Parameter

PHASe | FREQuency

Example

```
CONF: BURS: PRE: SEL PHAS
```

Configures the Phase vs Preamble measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PVT[:IMMediate]

This remote control command configures the measurement type to be Power vs Time. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command.

Example

```
CONF: BURS: PVT
```

Configures the Power vs Time measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PVT:AVERage

This remote control command configures the measurement type to set the burst power averaging length to the desired value. This command is only valid when the selected standard is IEEE 802.11b.

Parameter

<numeric_value>

Example

```
CONF: BURS: PVT: AVER 31
```

Configures the burst power average length of 31.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PVT:RPOWer

This remote control command configures the use of either mean or maximum burst power as a reference power for the 802.11b PVT measurement.

Parameter

MEAN | MAXimum

Example

```
CONF: BURS: PVT: RPOW MEAN
```

Configures to use mean burst power as a reference power.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:PVT:SElect

This remote control configures how to interpret the Power vs Time measurement results.

Parameter	Description	Wireless LAN standard
EDGE	configures the measurement to be rising and falling edge	all
FALL	configures the measurement to be falling edge only	IEEE 802.11b & g (CCK)
FULL	configures the measurement to be full burst	IEEE 802.11a, j & g (OFDM) , IEEE 802.11 Turbo Mode
RISE	configures the measurement to be rising edge only	IEEE 802.11b & g (CCK)

Example

```
CONF: BURS: PVT: SEL FULL
```

Interprets the measurement results as full burst

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:SPECtrum:ACPR[:IMMediate]

This remote control command configures the measurement type to be ACPR (adjacent channel power relative) After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command.

Example

```
CONF: BURS: SPEC: ACPR
```

Configures the ACPR measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:SPECtrum:FFT[:IMMediate]

This remote control command configures the measurement type to be FFT (Fast Fourier Transform). After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command.

Example

```
CONF: BURS: SPEC: FFT
```

Configures the FFT measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:SPECtrum:FLATness[:IMMediate]

This remote control command configures the measurement type to be Spectrum Flatness. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command.

Example

```
CONF: BURS: SPEC: FLAT
```

Configures the Spectrum Flatness measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:SPECtrum:MASK[:IMMediate]

This remote control command configures the measurement type to be Spectrum Mask. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command

Example

```
CONF: BURS: SPEC: MASK
```

Configures the Spectrum Mask measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:SPECtrum:MASK:SELect

This remote control configures the interpretation of the Spectrum Mask measurement results. This command is only available for IEEE 802.11a.

Parameter

IEEE | ETSI

Example

```
CONF: BURS: SPEC: MASK: SEL ETSI
```

Interprets the measurement results using the ETSI standard.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:STATistics:BSTReam[:IMMEDIATE]

This remote control command configures the measurement type to be Bitstream. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF: BURS: STAT: BSTR
```

Configures the Bitstream measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:STATistics:CCDF[:IMMEDIATE]

This remote control command configures the measurement type to be CCDF (conditional cumulative distribution functions.). After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMEDIATE\]](#) command.

Example

```
CONF: BURS: STAT: CCDF
```

Configures the CCDF measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:BURSt:STATistics:SFIeld[:IMMediate]

This remote control command configures the measurement type to be Signal Field. After this command has been executed, the specified measurement will only be started when the user issues the [INITiate\[:IMMediate\]](#) command.

Example

```
CONF:BURSt:STAT:SFIeld
```

Configures the Signal Field measurement type.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:CHANnel

This remote control command is used to specify the input channel for which measurements are to be performed. This command will automatically cause the internal measurement frequency to be re-calculated.

Parameter

<numeric_value>

Example

```
CONF:CHAN 9
```

Specifies channel 9 as frequency measurement.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WLAN

CONFigure:POWer:AUTO

This remote control command is used to switch on or off automatic power level detection. When switched on, power level detection is performed at the start of each measurement sweep.

Parameter

ONCE | ON | OFF

If this command is issued with the ONCE parameter then the auto level routine is performed immediately one time.

Example

```
CONF:POW:AUTO ON
```

Configures the automatic detection of the input power level.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:POWer:AUTO:SWEep:TIME

This remote control command is used to specify the sweep time for the automatic power level detection.

Parameter

numeric value in seconds

Example

```
CONF:POW:AUTO:SWE:TIME 200MS
```

Configures a 200 ms sweep time for the auto-level detection.

Characteristics

*RST value: 100ms

SCPI: device-specific

Mode

WLAN

CONFigure:POWer:EXPected:RF

This remote control command is used to specify the mean power level of the source signal as supplied to the Analyzer RF input. This value will be overwritten if Auto Level is turned on.

Parameter

<numeric_value> in dBm

Example

```
CONF:POW:EXP:RF 9
```

Assumes an input signal strength of 9 dBm.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

CONFigure:STANdard

This remote control command specifies which Wireless LAN standard the option is configured to measure.

Parameter

- 0 IEEE 802.11a
- 1 IEEE 802.11b
- 2 IEEE 802.11j (10 MHz)
- 3 IEEE 802.11j (20 MHz)
- 4 IEEE 802.11g
- 5 Turbo

Example

```
CONF:STAN 0
```

Selects the IEEE 802.11a standard for the measurement.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WLAN

13.5.6 DISPlay Subsystem (WLAN, R&S FSV-K91)

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. In contrast to the basic device, the WLAN TX Measurements option supports the split screen modus.

Commands of the DISPlay Subsystem

- ◆ [DISPlay:FORMat](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:SSElect](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:TABLe](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:AUTO](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:PDIVision](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:RLEVel](#)
- ◆ [DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:RLEVel:OFFSet](#)

DISPlay:FORMat

This command sets the visible screen display type to full or split screen.

Parameter

SPLit | SINGLe

Example

```
DISP:FORM SINGLe
Sets the display to full screen.
```

Characteristics

*RST value: SPL
SCPI: device-specific

Mode

WLAN

DISPlay[:WINDow<1|2>]:SSElect

This command selects whether screen A or screen B is active. SSElect means Screen SElect.

Example

```
DISP:WIND1:SSEL
Sets the screen A active.
```

Characteristics

*RST value: 1
SCPI: device-specific

Mode

WLAN

DISPlay[:WINDow<1|2>]:TABLe

This command selects whether the results table is displayed.

Parameter

ON | OFF

Example

```
DISP:WIND1:TABL ON
```

Hides the results table

Characteristics

*RST value: ON

SCPI: device-specific

Mode

WLAN

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:AUTO

This command switches on or off automatic scaling of the Y-axis for the specified trace display. Automatic scaling sets the Y-axis to automatically scale to best fit the measurement results. This command is only available for the following result displays:

- ◆ EVM vs Carrier
- ◆ EVM vs Symbol.
- ◆ Frequency error vs Preamble
- ◆ Phase error vs Preamble

The numeric suffix at WINDow<1|2> must be 2 as the relevant results are always displayed in screen B. The numeric suffix at TRACe<1...3> must be 1.

Parameter

ON | OFF

Example

```
DISP:WIND2:TRAC:Y:SCAL:AUTO ON
```

switches on automatic scaling of the Y-axis for the active trace

Characteristics

*RST value: ON

Mode

WLAN

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:PDIVision

This command sets the size of each Y scale division for the specified trace display. Note that this command has no affect if automatic scaling of the Y-axis is enabled.

This command is only available for the following result displays:

- ◆ EVM vs Carrier
- ◆ EVM vs Symbol.
- ◆ Frequency error vs Preamble
- ◆ Phase error vs Preamble

The numeric suffix at WINDow<1|2> must be 2 as the relevant results are always displayed in screen B. The numeric suffix at TRACe<1...3> must be 1.

Parameter

<numeric_value>

Example

```
DISP:WIND2:TRAC:Y:SCAL:DPIV 2
```

Sets the Y scale division to size to 2.

Characteristics

*RST value: 3

Mode

WLAN

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel

This remote control command can be used to set the current internal instrument reference level used when performing measurements. The numeric suffix at WINDow<1|2> and TRACe<1...3> are irrelevant.

Parameter

numeric value in dB

Example

DISP:TRAC:Y:RLEV?

returns the current reference level in use

Characteristics

*RST value: -

Mode

WLAN

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel:OFFSet

For details refer to

["DISPlay\[:WINDow<1|2>\]:TRACe<1...6>:Y\[:SCALe\]:RLEVel:OFFSet"](#).

13.5.7 FETCh Subsystem (WLAN, R&S FSV-K91)

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSE subsystems.

Commands of the DISPlay Subsystem

- ◆ [FETCh:BURSt:ALL?](#)
- ◆ [FETCh:BURSt:COUNT?](#)
- ◆ [FETCh:BURSt:CRESt:AVERAge?](#)
- ◆ [FETCh:BURSt:CRESt:MAXimum?](#)
- ◆ [FETCh:BURSt:CRESt:MINimum?](#)
- ◆ [FETCh:BURSt:EVM:\[IEEE\]:AVERAge?](#)
- ◆ [FETCh:BURSt:EVM:\[IEEE\]:MAXimum?](#)
- ◆ [FETCh:BURSt:EVM:\[IEEE\]:MINimum?](#)
- ◆ [FETCh:BURSt:EVM:ALL:AVERAge?](#)
- ◆ [FETCh:BURSt:EVM:ALL:MAXimum?](#)
- ◆ [FETCh:BURSt:EVM:ALL:MINimum?](#)
- ◆ [FETCh:BURSt:EVM:DATA:AVERAge?](#)
- ◆ [FETCh:BURSt:EVM:DATA:MAXimum?](#)

Remote Commands of the WLAN TX Measurements Option (R&S FSV-K91)

- ◆ [FETCh:BURSt:EVM:DATA:MINimum?](#)
- ◆ [FETCh:BURSt:EVM:DIRect:AVERage?](#)
- ◆ [FETCh:BURSt:EVM:DIRect:MAXimum?](#)
- ◆ [FETCh:BURSt:EVM:DIRect:MINimum?](#)
- ◆ [FETCh:BURSt:EVM:PILot:AVERage?](#)
- ◆ [FETCh:BURSt:EVM:PILot:MAXimum?](#)
- ◆ [FETCh:BURSt:EVM:PILot:MINimum?](#)
- ◆ [FETCh:BURSt:FERRor:AVERage?](#)
- ◆ [FETCh:BURSt:FERRor:MAXimum?](#)
- ◆ [FETCh:BURSt:FERRor:MINimum?](#)
- ◆ [FETCh:BURSt:GIMBalance:AVERage?](#)
- ◆ [FETCh:BURSt:GIMBalance:MAXimum?](#)
- ◆ [FETCh:BURSt:GIMBalance:MINimum?](#)
- ◆ [FETCh:BURSt:IQOFfset:AVERage?](#)
- ◆ [FETCh:BURSt:IQOFfset:MAXimum?](#)
- ◆ [FETCh:BURSt:IQOFfset:MINimum?](#)
- ◆ [FETCh:BURSt:PAYLoad?](#)
- ◆ [FETCh:BURSt:PEAK?](#)
- ◆ [FETCh:BURSt:PREamble?](#)
- ◆ [FETCh:BURSt:QUADoffset:AVERage?](#)
- ◆ [FETCh:BURSt:QUADoffset:MAXimum?](#)
- ◆ [FETCh:BURSt:QUADoffset:MINimum?](#)
- ◆ [FETCh:BURSt:RMS\[:AVERage?\]](#)
- ◆ [FETCh:BURSt:RMS:MAXimum?](#)
- ◆ [FETCh:BURSt:RMS:MINimum?](#)
- ◆ [FETCh:BURSt:SYMBOLerror:AVERage?](#)
- ◆ [FETCh:BURSt:SYMBOLerror:MAXimum?](#)
- ◆ [FETCh:BURSt:SYMBOLerror:MINimum?](#)
- ◆ [FETCh:BURSt:TFALI:AVERage?](#)
- ◆ [FETCh:BURSt:TFALI:MAXimum?](#)
- ◆ [FETCh:BURSt:TFALI:MINimum?](#)
- ◆ [FETCh:BURSt:TRISe:AVERage?](#)
- ◆ [FETCh:BURSt:TRISe:MAXimum?](#)
- ◆ [FETCh:BURSt:TRISe:MINimum?](#)
- ◆ [FETCh:SYMBOL:COUNT?](#)

Further information

- ◆ [ASCII formats for returned values](#)

13.5.7.1 ASCII formats for returned values

The results are output as a list of result strings separated by commas.

Returned values for IEEE 802.11a, j, g(OFDM) & Turbo Mode

<preamble power>,
 <payload power>,
 <min rms power>,<average rms power>,<max rms power>,>,
 <peak power>,
 <min crest factor>,<average crest factor>,<max crest factor>,
 <min frequency error>,<average frequency error> ,<max frequency error>,
 <min symbol error> , <average symbol error> , <max symbol error>,
 <min IQ offset> , <average IQ offset> , <maximum IQ offset> ,
 <min gain imbalance> , <average gain imbalance> , <max gain imbalance> ,
 <min quadrature offset> , <average quadrature offset> , <max quadrature offset> ,
 <min EVM all bursts> , <average EVM all bursts> , <max EVM all bursts> ,
 <min EVM data carriers> , <average EVM data carriers > , <max EVM data carriers >
 <min EVM pilots> , <average EVM pilots > , <max EVM pilots >

Returned values for IEEE 802.11b & g (CCK)

<min rise time>,<average rise time>,<max rise time>,
 <min fall time>,<average fall time>,<max fall time>,
 <min rms power>,<average rms power>,<max rms power>,
 <min peak power>,<average peak power>,<max peak power>,
 <min crest factor>,<average crest factor>,<max crest factor>,
 <min frequency error>,<average frequency error> ,<max frequency error>,
 <min chip clock error> , <average chip clock error> , <max chip clock error> ,
 <min phase error> , <average phase error> , <max phase error> ,
 <min IQ offset> , <average IQ offset> , <maximum IQ offset> ,
 <min gain imbalance> , <average gain imbalance> , <max gain imbalance> ,
 <min quadrature offset> , <average quadrature offset> , <max quadrature offset> ,
 <min EVM IEEE> , <average EVM IEEE> , <max EVM IEEE> ,
 <min EVM Direct> , <average EVM Direct > , <max EVM Direct >

FETCh:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by commas in ASCII format. For details on the format refer to "[ASCII formats for returned values](#)" on page 969. The units for the EVM results are specified with the `UNIT:EVM` command.

Example

```
FETCh:BURSt:ALL?
```

All calculated results are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:COUNt?

This command returns the number of analyzed bursts.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:COUN?
```

The analyzed number of bursts are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:CRESt[:AVERAge?] / FETCh:BURSt:CRESt:MAXimum? / FETCh:BURSt:CRESt:MINimum?

This command returns the average, minimum or maximum determined CREST factor (= ratio of peak power to average power) in dB.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:CRESt:MAX?
```

The maximum calculated crest factor from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:EVM:[IEEE]:AVERAge? / FETCh:BURSt:EVM:[IEEE]:MAXimum? / FETCh:BURSt:EVM:[IEEE]:MINimum?

This command returns the Error Vector Magnitude measurement results summary (average, minimum or maximum value) in dB for the IEEE 802.11b standard. This result is the value before filtering.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: EVM: MAX?
```

The maximum EVM recorded before filtering.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

**FETCH: BURSt: EVM: ALL: AVERAge? / FETCH: BURSt: EVM: ALL: MAXimum? /
FETCH: BURSt: EVM: ALL: MINimum?**

This command returns the Error Vector Magnitude measurement results summary (average, minimum or maximum value) in dB. This is a combined figure that represents the pilot, data and the free carrier.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: EVM: ALL: MAX?
```

The maximum EVM recorded for all measurement carrier is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

**FETCH: BURSt: EVM: DATA: AVERAge? / FETCH: BURSt: EVM: DATA: MAXimum? /
FETCH: BURSt: EVM: DATA: MINimum?**

This command returns the Error Vector Magnitude measurement results summary for the data carrier (average, minimum or maximum value) in dB.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: EVM: DATA: MAX?
```

The maximum EVM recorded for the data carrier is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:EVM:DIRect:AVERage? / FETCh:BURSt:EVM:DIRect:MAXimum? / FETCh:BURSt:EVM:DIRect:MINimum?

This command returns the Error Vector Magnitude measurement results summary (average, minimum or maximum value) in dB for the IEEE 802.11b standard. This result is the value after filtering.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: EVM: DIR: MAX?
```

The maximum EVM recorded after filtering.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:EVM:PILot:AVERage? / FETCh:BURSt:EVM:PILot:MAXimum? / FETCh:BURSt:EVM:PILot:MINimum?

This command returns the Error Vector Magnitude measurement results summary for the EVM pilot carrier (average, minimum or maximum value) in dB.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: EVM: PIL: MAX?
```

The maximum EVM recorded for the EVM pilot carrier is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:FERRor:AVERage? / FETCh:BURSt:FERRor:MAXimum? / FETCh:BURSt:FERRor:MINimum?

This command returns the measured average, minimum or maximum frequency errors in Hertz.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: FERR: MAX?
```

The maximum frequency error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:GIMBalance:AVERage? / FETCh:BURSt:GIMBalance:MAXimum? / FETCh:BURSt:GIMBalance:MINimum?

This command returns the measured average, minimum or maximum IQ Imbalance errors in dB.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: GIMB: MAX?
```

The maximum IQ Imbalance error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:IQOffset:AVERage? / FETCh:BURSt:IQOffset:MAXimum? / FETCh:BURSt:IQOffset:MINimum?

This command returns the measured average, minimum or maximum IQ Offset errors in dB.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: IQOF: MAX?
```

The maximum IQ Offset error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:PAYLoad?

This command returns the measured power in the payload of the burst.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: PAYL?
```

The burst payload power is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:PEAK?

This command returns the Peak power in dBm measured during the measurement time.

Example

```
FETC: BURS: PEAK?
```

The calculated peak power from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:PREamble?

This command returns the measured power in the burst preamble.

This command is a query only and thus has no *RST value.

Example

```
FETC: BURS: PRE?
```

The burst preamble power is returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:QUADoffset:AVERage? / FETCh:BURSt:QUADoffset:MAXimum? / FETCh:BURSt:QUADoffset:MINimum?

This command returns the accuracy in terms of the phase error of symbols within a burst.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:QUAD:MAX?
```

The maximum angle error recorded for a symbol during the measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:RMS[:AVERage?] / FETCh:BURSt:RMS:MAXimum? / FETCh:BURSt:RMS:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm measured during the measurement.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:RMS:MAX?
```

The maximum calculated RSM burst power from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

**FETCh:BURSt:SYMBolerror:AVERAge? / FETCh:BURSt:SYMBolerror:MAXimum?
/ FETCh:BURSt:SYMBolerror:MINimum?**

This command returns the percentage of symbols that were outside permissible de-modulation range within a burst.

Example

```
FETC:BURS:SYMB:MAX?
```

The maximum number of symbols that were out of range per burst.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

**FETCh:BURSt:TFALI:AVERAge? / FETCh:BURSt:TFALI:MAXimum? /
FETCh:BURSt:TFALI:MINimum?**

This command returns the average, minimum or maximum burst fall time in seconds.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:TFAL:MAX?
```

The maximum calculated fall time from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:BURSt:TRISe:AVERAge? / FETCh:BURSt:TRISe:MAXimum? / FETCh:BURSt:TRISe:MINimum?

This command returns the average, minimum or maximum burst rise time in seconds.

This command is a query only and thus has no *RST value.

Example

```
FETC:BURS:TRIS:MAX?
```

The maximum calculated rise time from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

FETCh:SYMBol:COUNt?

This command returns the number of symbols for each analyzed burst as a comma separated list.

This command is a query only and thus has no *RST value.

Example

```
FETC:SYMB:COUN?
```

The analyzed number of symbols for each burst are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

13.5.8 FORMat Subsystem (WLAN, R&S FSV-K91)

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

Commands of the FORMat Subsystem

- ◆ [FORMat\[:DATA\]](#)

FORMat[:DATA]

For details refer to section "[Remote Control - Description of Basic Settings Commands](#)", [FORMat Subsystem](#).

13.5.9 INITiate Subsystem (WLAN, R&S FSV-K91)

The INITiate subsystem configures the instrument prior to a measurement being carried out. It is basically used to tell the instrument which measurement is to be performed and takes any necessary step to set up the instrument for the measurement.

Commands of the INITiate Subsystem

- ◆ [INITiate:IMMediate](#)
- ◆ [INITiate:CONTInuous](#)

INITiate[:IMMediate]

For details refer to "[INITiate<1|2>\[:IMMediate\]](#)".

INITiate:CONTInuous

For details refer to "[INITiate<1|2>:CONTInuous](#)".

13.5.10 INPut Subsystem (WLAN, R&S FSV-K91)

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

Commands of the INPut Subsystem

- ◆ [INPut:ATTenuation](#)

INPut:ATTenuation

For details refer to "[INPut<1|2>:ATTenuation](#)".

13.5.11 INSTRument Subsystem (WLAN, R&S FSV-K91)

The INSTRument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

Commands of the INSTRument Subsystem

- ◆ [INSTRument\[:SElect\]](#)
- ◆ [INSTRument:NSElect](#)

INSTRument[:SElect]

Parameter

WLAN (WLAN TX Measurements option, R&S FSV-K91)

For further details refer to section "[Remote Control - Description of Basic Settings Commands](#)", [INSTRument subsystem](#).

INSTRument:NSElect

Parameter

16 (WLAN TX Measurements option, R&S FSV-K91)

For further details refer to section "[Remote Control - Description of Basic Settings Commands](#)", [INSTRument subsystem](#).

13.5.12 MMEMory Subsystem (WLAN, R&S FSV-K91)

The MMEMory (mass memory) subsystem provides commands to store and load IQ data.

Commands of the MMEMory Subsystem

- ◆ [MMEMory:LOAD:IQ:STATe](#)
- ◆ [MMEMory:STORe:IQ:STATe](#)

MMEMory:LOAD:IQ:STATe

This command loads the IQ data from the specified .iqw file.

Parameter

1,<file_name>

Example

```
MMEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'
```

Loads IQ data from the specified file.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

WLAN

MMEMory:STORe:IQ:STATe

This command stores the IQ data to the specified .iqw file.

Parameter

1,<file_name>

Example

```
MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'
```

Stores IQ data to the specified file.

Characteristics

*RST value: -
 SCPI: device-specific

Mode

WLAN

13.5.13 SENSE Subsystem (WLAN, R&S FSV-K91)

The SENSE command is used to set and get the values of parameters in the remote instrument. The get variant of the SENSE command differs from set in that it takes no parameter values (unless otherwise stated) but is followed by the character '?' and will return the parameter's value in the same format as it is set.

Commands of the SENSE Subsystem

- ◆ [\[SENSe\]:BURSt:COUNt](#)
- ◆ [\[SENSe\]:BURSt:COUNt:STATe](#)
- ◆ [\[SENSe\]:IDEMod:BANalyze:DURation:EQUal](#)
- ◆ [\[SENSe\]:IDEMod:BANalyze:DURation:MAX](#)
- ◆ [\[SENSe\]:IDEMod:BANalyze:DURation:MIN](#)
- ◆ [\[SENSe\]:IDEMod:CESTimation](#)
- ◆ [\[SENSe\]:IDEMod:FILTer:CATalog?](#)
- ◆ [\[SENSe\]:IDEMod:FILTer:MODulation](#)
- ◆ [\[SENSe\]:IDEMod:FORMat\[:BContent\]:AUTo](#)
- ◆ [\[SENSe\]:IDEMod:FORMat:BANalyze](#)
- ◆ [\[SENSe\]:IDEMod:FORMat:BANalyze:BTYPe](#)
- ◆ [\[SENSe\]:IDEMod:FORMat:BANalyze:DBYTeS:EQUal](#)

Remote Commands of the WLAN TX Measurements Option (R&S FSV-K91)

- ◆ [\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:MAX](#)
- ◆ [\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:MIN](#)
- ◆ [\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:EQUal](#)
- ◆ [\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MAX](#)
- ◆ [\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MIN](#)
- ◆ [\[SENSe:\]DEMod:FORMat:BTRate](#)
- ◆ [\[SENSe:\]DEMod:FORMat:SIGSymbol](#)
- ◆ [\[SENSe:\]FREQuency:CENTer](#)
- ◆ [\[SENSe:\]POWer:ACHannel:MODE](#)
- ◆ [\[SENSe:\]SWAPiq](#)
- ◆ [\[SENSe:\]SWEep:COUNT](#)
- ◆ [\[SENSe:\]SWEep:EGATE](#)
- ◆ [\[SENSe:\]SWEep:EGATE:HOLDoff\[:TIME\]](#)
- ◆ [\[SENSe:\]SWEep:EGATE:HOLDoff:SAMPle](#)
- ◆ [\[SENSe:\]SWEep:EGATE:LENGth\[:TIME\]](#)
- ◆ [\[SENSe:\]SWEep:EGATE:LENGth:SAMPle](#)
- ◆ [\[SENSe:\]SWEep:EGATE:LINK](#)
- ◆ [\[SENSe:\]SWEep:TIME](#)
- ◆ [\[SENSe:\]TRACKing:LEVel](#)
- ◆ [\[SENSe:\]TRACKing:PHASe](#)
- ◆ [\[SENSe:\]TRACKing:TIME](#)

Further information

- ◆ [Analysis modulation format](#)

13.5.13.1 Analysis modulation format

Parameter	Standard	Description
'BPSK'	Alias for BI-Phase shift keying at higher data rate for selected standard	
'BPSK3'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 3 Mbps
'BPSK6'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 6 Mbps
'BPSK9'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 9 Mbps
'BPSK45'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 4.5 Mbps
'CCK11'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 11 Mbps
'CCK55'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 5.5 Mbps
'DBPSK'	IEEE 802.11b & g (Single Carrier)	Differential BI-Phase shift keying
'DQPSK'	IEEE 802.11b & g (Single Carrier)	Differential Quadrature phase shift keying
'PBCC11'	IEEE 802.11b & g (Single Carrier)	PBCC at 11 Mbps
'PBCC22'	IEEE 802.11g (Single Carrier)	PBCC at 11 Mbps
'PBCC55'	IEEE 802.11b & g (Single Carrier)	PBCC at 5.5 Mbps
'QAM16'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM64'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM1612'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 12 Mbps
'QAM1618'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 18 Mbps
'QAM1624'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 24 Mbps
'QAM1636'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 36 Mbps
'QAM6424'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 24 Mbps
'QAM6427'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 27 Mbps

Remote Commands of the WLAN TX Measurements Option (R&S FSV-K91)

'QAM6448'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 48 Mbps
'QAM6454'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 54 Mbps
'QPSK'	Alias for Quadrature phase shift keying at higher data rate for selected standard	
'QPSK6'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 6 Mbps
'QPSK9'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 9 Mbps
'QPSK12'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 12 Mbps
'QPSK18'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 18 Mbps

[SENSe:]BURSt:COUNT

This command defines the number of bursts that will be analyzed by the measurement. This parameter is ignored if the setting for the [\[SENSe:\]BURSt:COUNT:STATe](#) parameter is off.

Parameter

<numeric_value>

Example

```
BURSt:COUNT 16
```

Sets the number of bursts to 16.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WLAN

[SENSe:]BURSt:COUNT:STATe

When this command is set to on, the burst count parameter will be used by the measurement, otherwise the burst count parameter will be ignored.

Parameter

ON | OFF

Example

```
BURSt:COUNT:STATe ON
```

Sets the burst count state to ON

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:BANalyze:DURation:EQUal

When this command is set to ON then only bursts of equal length will take part in the PVT analysis. When this command is set to true the value specified by the [\[SENSe:\]DEMod:BANalyze:DURation:MIN](#) command specifies the duration that a burst must last in order to take part in measurement analysis.

Parameter

ON | OFF

Example

```
DEM: BAN: DUR: EQU ON
```

Only bursts of equal length will take part in the measurement analysis.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:BANalyze:DURation:MAX

This command specifies the maximum duration in microseconds required for bursts to qualify for measurement analysis. Only bursts with the specified duration will be used in the measurement analysis.

This value will not have any immediate effect if the

[\[SENSe:\]DEMod:BANalyze:DURation:EQUal](#) command has been set to true as in this case no range of durations is allowed and only bursts with exactly the duration specified by the [\[SENSe:\]DEMod:BANalyze:DURation:MIN](#) command shall take part in measurement analysis

Parameter

<numeric_value>

Example

```
DEM: BAN: DUR: MAX 1300
```

Only bursts which have a maximum duration of 1300 microseconds are analyzed.

Characteristics

*RST value: 5464

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:BANalyze:DURation:MIN

This command specifies the duration in microseconds required for bursts to qualify for measurement analysis. Only bursts with the specified duration will be used in the measurement analysis.

If the [\[SENSe:\]DEMod:BANalyze:DURation:EQUal](#) command has been set to true then this command specifies the exact duration required for a burst to take part in measurement analysis.

If the [\[SENSe:\]DEMod:FORMat:BANalyze:DBYTes:EQUal](#) command is set to false this command specifies the minimum duration required for a burst to take part in measurement analysis.

Parameter

<numeric_value>

Example

```
DEMod:BAN:DUR:MIN 45
```

Only bursts which last 48 microseconds are analyzed.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:CESTimation

This command defines whether channel estimation will be done in preamble and payload (if set to 1) or only in preamble (if set to 0). The effect of this is most noticeable for the EVM measurement results, where the results will be improved when this feature is enabled.

However, this functionality is not supported by the IEEE 802.11 standard and must be disabled if the results are to be strictly measured against the standard.

Parameter

ON | OFF

Example

```
DEMod:CEST ON
```

Specifies that the IQ measurement results will use channel estimation in preamble & payload.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FILTer:CATalog?

This command reads the names of all available filters. The file names are output without file extension. Syntax of output format: filter_1,filter_2, ... ,filter_n.

This command is a query only and thus has no *RST value.

Example

```
DEM:FILT:CAT?
Reads all filter names
```

Characteristics

*RST value: 0
SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FILTer:MODulation

This command selects the TX and RX filters. The names of the filters correspond to the file names; a query of all available filters is possible by means of the [\[SENSe:\]DEMod:FILTer:CATalog?](#) command.

Parameter

<string>,<string>
DEF_TX: default transmit filter, DEF_RX: default receive filter

Example

```
DEM:FILT:MOD 'DEF_TX','DEF_RX'
DEF_TX is selected for the TX filter and DEF_RX for the RX filter
```

Characteristics

*RST value: AUTO,AUTO
SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat[:BContent]:AUTO

When this command is set to ON then the signal symbol field of the burst is analyzed to determine the modulation scheme of the first burst. When this field is set to ON only bursts which match the modulation scheme are considered in results analysis.

Parameter

ON | OFF

Example

DEM:FORM:AUT ON

Specifies that the signal symbol field should be decoded.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze

The remote control command sets the analysis modulation format that will be assumed when the measurement is performed. If the [\[SENSe:\]DEMod:FORMat:SIGSymbol](#) parameter has been set to ON, this command can be used to measure only certain burst types within a measurement sequence.

ParameterFor details refer to "[Analysis modulation format](#)" on page 982.**Example**

DEM:FORM:BAN 'QAM16'

Only bursts that are of the QAM16 modulation format are analyzed.

Characteristics

*RST value: QAM64

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze:BTYPe

This remote control command specifies the type of burst to be analyzed. Only bursts of the specified type take part in measurement analysis.

Parameter

DIRECT	IEEE 802.11a, IEEE 802.11j (10MHz), IEEE 802.11j (20MHz), IEEE 802.11g, 802.11 OFDM Turbo - Direct Link Burst
LONG-OFDM	IEEE 802.11g - Long DSSS OFDM
SHORT-OFDM	IEEE 802.11g - Short DSSS OFDM
LONG	IEEE 802.11b, IEEE 802.11g - Long PLCP Burst
SHORT	IEEE 802.11b, IEEE 802.11g - Short PLCP Burst

Example

```
DEMod:FORM:BAN:BTYPe 'DIRECT'
```

Only DIRECT bursts are analyzed.

Characteristics

*RST value: DIRECT

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze:DBYTeS:EQUal

When this command is set to ON then only bursts of equal length will take part in the measurement analysis. The number of data bytes that a burst must have in order to take part in measurement analysis is specified by the [\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:MIN](#) command.

Parameter

ON | OFF

Example

```
DEMod:FORM:BAN:DBYTeS:EQU ON
```

Only bursts of equal length will take part in the measurement analysis.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze:DBYTeS:MAX

This command specifies the maximum number of data bytes required for bursts to qualify for measurement analysis. Only bursts with the specified number of data bytes will be used in the measurement analysis.

This value will not have any immediate effect if the

[\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:EQUal](#) command has been set to ON. In this case, no range of symbols is allowed and only bursts with exactly the number of data bytes specified by the

[\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:MIN](#) command shall take part in measurement analysis.

Parameter

<numeric_value>

Example

```
DEM:FORM:BAN:DBYTeS:MAX 1300
```

Only bursts which contain a maximum of 1300 data bytes are analyzed.

Characteristics

*RST value: 64

SCPI: device-specific

Mode: WLAN

[SENSe:]DEMod:FORMat:BANalyze:DBYTeS:MIN

This command specifies the number of data bytes required for bursts to qualify for measurement analysis. Only bursts with the specified number of data bytes will be used in the measurement analysis.

If the [\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:EQUal](#) command has been set to ON, this command specifies the exact number of data bytes required for a burst to take part in measurement analysis. If the

[\[SENSe:\]DEMod:FORMat:BANalyze:DBYTeS:EQUal](#) command is set to OFF, this command specifies the minimum number of data bytes required for a burst to take part in measurement analysis.

Parameter

<numeric_value>

Example

```
DEM:FORM:BAN:DBYTeS:MIN 16
```

Only bursts which contain 16 data bytes are analyzed.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze:SYMBOLs:EQUal

When this command is activated then only bursts of equal length will take part in the measurement analysis. When this command is set to true the value specified by the [\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:MIN](#) command specifies the number of symbols that a burst must have in order to take part in analysis.

Parameter

ON | OFF

Example

```
DEMod:FORM:BAN:SYM:EQU ON
```

Only bursts of equal length will take part in analysis.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:BANalyze:SYMBOLs:MAX

This command specifies the maximum number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

This value will not have any immediate effect if the

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:EQUal](#) command has been set to true as in this case no range of symbols is allowed and only bursts with exactly the number of symbols specified by the

[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:MIN](#) command shall take place in measurement analysis.

Parameter

<numeric_value>

Example

```
DEMod:FORM:BAN:SYM:MAX 1300
```

Only bursts which contain a maximum symbol count of 1300 are analyzed.

Characteristics

*RST value: 64

SCPI: device-specific

Mode

WLAN

[SENSE:]DEMod:FORMat:BANalyze:SYMBols:MIN

This command specifies the number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

When the [\[SENSE:\]DEMod:FORMat:BANalyze:SYMBols:EQUal](#) command has been set to true then this command specifies the exact number of symbols required for a burst to take part in measurement analysis. When the [\[SENSE:\]DEMod:FORMat:BANalyze:SYMBols:EQUal](#) command is set to false this command specifies the minimum number of symbols required for a burst to take part in measurement analysis.

Parameter

<numeric_value>

Example

```
DEM:FORM:BAN:SYM:MIN 16
```

Only bursts which contain a symbol count of 16 are analyzed.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

WLAN

[SENSE:]DEMod:FORMat:BTRate

The remote control command is used to specify the bit rate for IEEE 802.11b signals.

This command can be used as an alternative to

[\[SENSE:\]DEMod:FORMat:BANalyze](#). The bit rate can be set as follows:

Parameter

10	1 Mbit/s
20	2 Mbit/s
55	5.5 Mbit/s
110	11 Mbit/s

Example

```
DEM:FORM:BTR 20
```

Configures to demodulate 2 Mbit/s signals

Characteristics

*RST value: 10 (= 1mbit)

SCPI: device-specific

Mode

WLAN

[SENSe:]DEMod:FORMat:SIGSymbol

If this command is set to ON, the signal symbol field of the burst is analyzed to determine the details of the burst. Only burst which match the supplied burst type and modulation are considered in results analysis. For IEEE 802.11b this command can only be queried as the decoding of the signal field is always performed for the IEEE 802.11b standard.

Parameter

ON | OFF

Example

```
DEM:FORM:SIGS ON
```

Specifies that the signal symbol field should be decoded.

Characteristics

*RST value: -

SCPI: device-specific

Mode

WLAN

[SENSe:]FREQuency:CENTer

For details refer to "[\[SENSe<1|2>:\]FREQuency:CENTer](#)".

[SENSe:]POWer:ACHannel:MODE

This command sets the ACP measurement mode for the IEEE 802.11j standard to either absolute or relative.

Parameter

ABS Absolute measurement

REL Relative measurement

Example

```
POW:ACH:MODE ABS
```

Sets the ACP measurement to absolute mode

Characteristics

*RST value: REL

SCPI: device-specific

Mode

WLAN

[SENSe:]POWer:SEM:CLASs

This command sets the Spectrum Emission Mask (SEM) power class index. The index represents the power classes to be applied. The index is directly related to the entries displayed in the power class drop down combo box, within the SEM settings configuration page.

Example

```
POW:ACH:SEM:CLAS 0
```

Sets the SEM power class to automatic

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WLAN

[SENSe:]POWer:SEM

This command sets the Spectrum Emission Mask (SEM) measurement type. This is either IEEE, ETSI Spectrum mask or a user defined file.

Parameter

IEEE

ETSI

User

Example

```
POW:SEM ETSI
```

Sets the SEM ETSI measurement type

Characteristics

*RST value: IEEE

SCPI: device-specific

Mode

WLAN

[SENSe:]SWAPiq

This command defines whether or not the recorded IQ pairs should be swapped (I<->Q) before being processed.

Parameter

ON | OFF

Example

SWAP ON

Specifies that IQ values should be swapped.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:COUNT

This command specifies the number of sweeps for Spectrum Mask and Spectrum ACPR measurements.

Parameter

<numeric_value>

Example

SWEep:COUNT 64

Sets the number of sweeps to 64.

Characteristics

*RST value: 1

SCPI: conform

Mode

WLAN

[SENSe:]SWEep:EGATe

For details refer to "[\[SENSe<1|2>:\]SWEep:EGATe](#)".

[SENSe:]SWEep:EGATe:HOLDoff[:TIME]

This command defines the gate delay in the capture buffer in time units. The range of this value is dependent on the last run measurement.

Parameter

<numeric_value>

Example

```
SWE:EGAT:HOLD 125us
```

Sets a delay of 125µs in the capture buffer.

Characteristics

*RST value: 100µs

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:EGATe:HOLDoff:SAMPle

This command defines the gate delay in the capture buffer as a number of samples. The range of this value is dependent on the last run measurement.

Parameter

<numeric_value>

Example

```
SWE:EGAT:HOLD:SAMP 2500
```

Sets a delay of 2500 samples in the capture buffer.

Characteristics

*RST value: 2000

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:EGATe:LENGth[:TIME]

This command defines the gate time in the capture buffer in time units. The range of this value is dependent on the last run measurement.

Parameter

<numeric_value>

Example

```
SWE:EGAT:LENG 20ms
```

Sets a gate length of 20 milliseconds between sweeps.

Characteristics

*RST value: 400µs

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:EGATe:LENGth:SAMPle

This command defines the gate time in the capture buffer as a number of samples. The range of this value is dependent on the last run measurement.

Parameter

<numeric_value>

Example

```
SWE:EGAT:LENG:SAMP 200000
```

Sets a gate length of 200000 samples in the capture buffer.

Characteristics

*RST value: 8000

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:EGATe:LINK

This command links together the movement of the gating lines and the capture buffer marker.

Parameter

ON | OFF

Example

```
SWE:EGAT:LINK ON
```

Links the gating lines as marker with the gating line delay and length are changed gate position.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

WLAN

[SENSe:]SWEep:TIME

The *RST value for the WLAN TX Measurements option (K91) is 1 ms.
For further details refer to "[\[SENSe<1|2>:\]SWEep:TIME](#)".

[SENSe:]TRACking:LEVel

This command defines whether or not the measurement results should be compensated for level.

Parameter

ON | OFF

Example

```
TRAC:LEV ON
```

Specifies that the measurement results should be compensated for level.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

WLAN

[SENSe:]TRACking:PHASe

This command defines whether or not the measurement results should be compensated for phase.

Parameter

ON | OFF

Example

```
TRAC:PHAS ON
```

Specifies that the measurement results should be compensated for phase.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

WLAN

[SENSe:]TRACking:TIME

This command defines whether or not the measurement results should be compensated for time.

Parameter

ON | OFF

14 Firmware Option WiMAX, WiBro Measurements R&S FSV-K93

14.1 Overview of Firmware Option R&S FSV-K93

This manual contains all information about the operation of an R&S FSV equipped with Application Firmware R&S FSV-K93. It covers operation via menus and the remote control commands for WiMAX, WiBro measurements.

This manual consists of 5 chapters:

Chapter 1.1	Gives a brief overview over the document structure.
Chapter 1.2	Describes the measurement setup for WiMAX, WiBro measurements.
Chapter 1.3	Describes the overall instrument functions and provides further information.
Chapter 1.4	Shows all softkeys available in the WiMAX, WiBro menu. This chapter also presents the remote control commands associated with each softkey function.
Chapter 1.5	Describes all remote control commands defined for the WiMAX, WiBro measurement.

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware R&S FSV-K93. For all other descriptions, please refer to the description of the base unit.

14.2 WiMAX, WiBro Measurements (Option R&S FSV-K93)

The R&S FSV-K93 application extends the functionality of the R&S FSV spectrum analyzer to enable WiMAX and WiBro TX-measurements according to the standards

- ◆ IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode (R&S FSV-K93).
The short form 'IEEE 802.16-2004 OFDM' is used in this document, to reference this standard.
- ◆ IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode (R&S FSV-K93 only).
The short form 'IEEE 802.16e-2005 OFDMA' is used in this document, to reference this standard.
- ◆ IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro (R&S FSV-K93 only).
The short form 'WiBro' is used in this document, to reference this standard.

14.2.1 Basic measurement examples

This section provides step-by-step instruction for working through an ordinary measurement. The following steps are described:

1. "[Setting up the measurement](#)"
2. "[Performing the level detection](#)"
3. "[Performing the main measurement](#)"

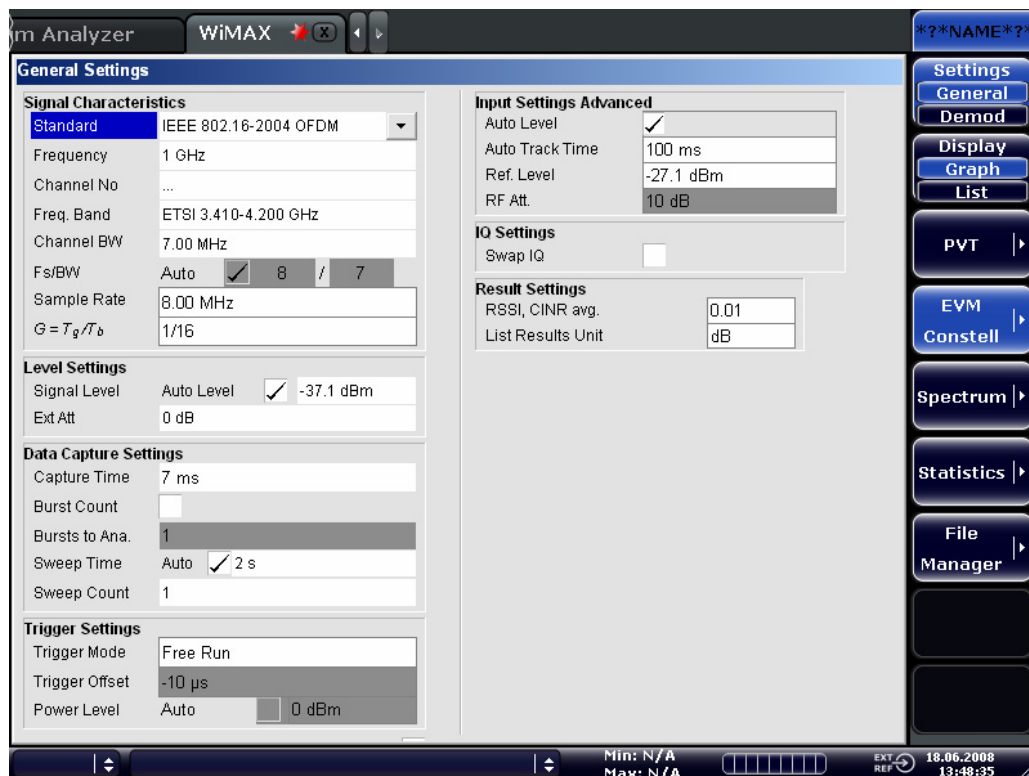
Test setup

In this example, a DUT using IEEE 802.16-2004 is be used.

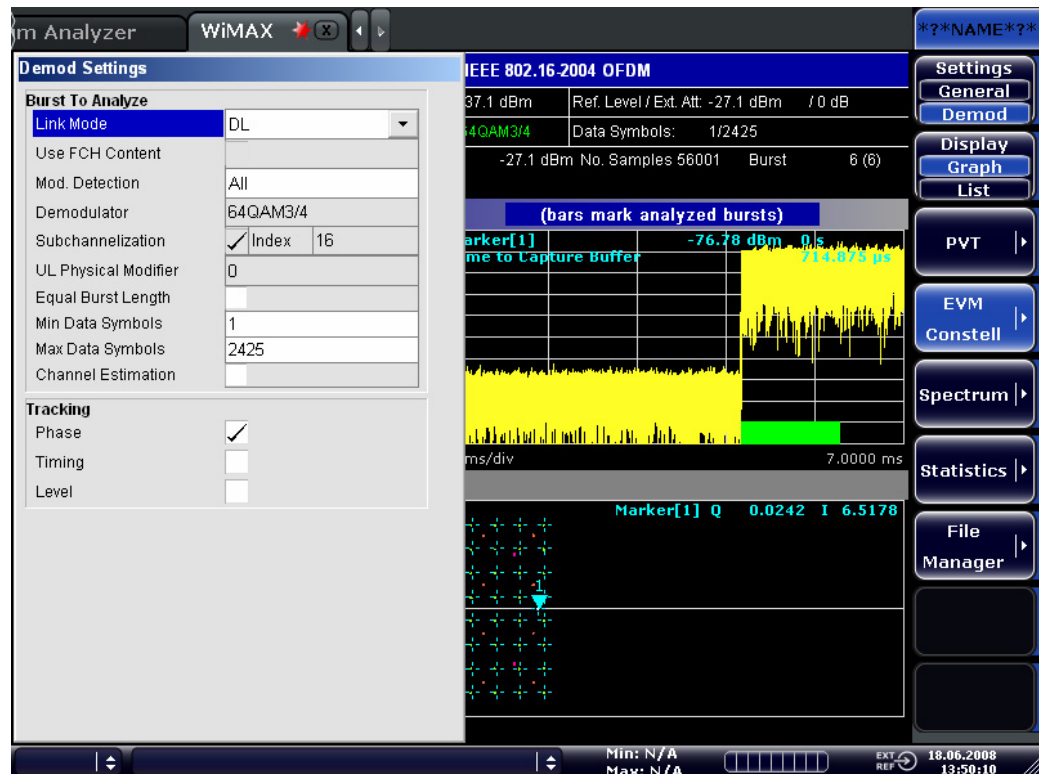
Connect the DUT to the R&S FSV using the RF input of the R&S FSV. The DUT generates a signal modulated using 16QAM 2/3.

14.2.1.1 Setting up the measurement

1. Activate the "WiMAX" mode (for details refer to chapter "Instrument Functions", section "[Measurement Mode Selection - MODE Key](#)").
2. Press the "Settings General"/"Demod" softkey once to select and open the "General Settings" dialog box.



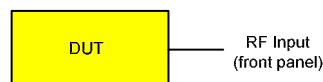
- a) In the "Frequency" field, enter the desired frequency to measure. If a frequency is entered, which maps to a specific channel, the "Channel No" field updates.
 - b) In the "Frequency Band" field, select the signal to be analyzed. The target band is either one of the bands given as example in the IEEE 802.16-2004 standard or an unspecified band.
 - c) In the "Channel BW" or "Sampling Rate" field depending on the characteristics of the signal to be analyzed, select a value. The second parameter is derived from the first according to the standard .
 - d) In the "G" = "Tg"/"Tb" field, select a useful time ratio according to the characteristics of the signal to be analyzed.
 - e) Under "Level Settings", deactivate the "Auto Lev" option. In this example, the level detection measurement is executed manually (for details see Performing the level detection).
4. Press the "Settings General"/"Demod" softkey twice to select and open the "Demod Settings" dialog box.



- In the "Link Mode" field, select the link mode of the bursts to be analyzed.
- In the "Demodulator" field, select the used modulation scheme.

14.2.1.2 Performing the level detection

- Connect the DUT to the RF input of the R&S FSV.



- Start the level detection measurement by pressing the "SWEEP" key and then the "Auto Level" softkey.

During the level detection measurement the text "Running" is displayed in the status bar at the bottom of the screen.

After successful level detection, the status message "Measurement Complete" is displayed, the signal level field for the selected input displays the detected signal level and the Magnitude Capture Buffer (screen A) displays the zero span trace obtained during the measurement sequence.

An automatic level detection can be performed in two ways:

- Once by pressing the Auto Level softkey in the sweep menu.
- At the start of each measurement sweep by activating the "Auto Level" option in the "General Settings" dialog box under "Level Settings".

14.2.1.3 Performing the main measurement

1. Select single sweep measurements by pressing the "SWEEP" hardkey and then the "Run" softkey to select "Single".
2. Start the measurement by pressing the "RUN" hardkey.
During the measurement, the status message "Running" is displayed. Measurement results are updated once the measurement has completed. The results are displayed in graphical form. The display can be toggled to a tabular list of measurement points by pressing the "Display Graph / List" softkey (in the WiMAX / WiBro menu or trace menu).

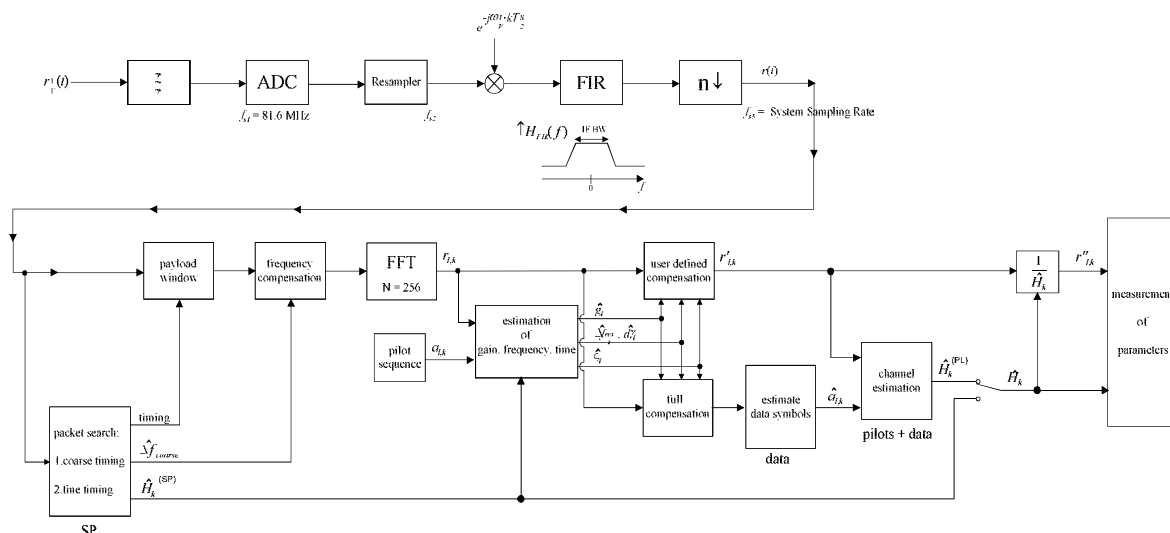
14.2.2 Signal Processing of the IEEE 802.16-2004 OFDM measurement application

Abbreviation	Description
$N_{FFT} = 256$	FFT length
$a_{l,k}$	symbol from the alphabet at symbol-index l of sub carrier k
EVM_k	error vector magnitude of sub carrier k
EVM	error vector magnitude of current packet
g	signal gain
Δf	frequency deviation between Tx and Rx
l	symbol index $l = [1, nof_Symbols]$
$nof_symbols$	number of symbols of payload
H_k	channel transfer function of sub carrier k
k	channel index $k = [-128, 127]$
K_{mod}	modulation dependent normalization factor
ζ	relative clock error of reference oscillator
$r_{l,k}$	received symbol at symbol-index l of sub carrier k
	$Pilots = \{-88, -63, -38, -13, 13, 38, 63, 88\}$

This description gives a rough view of the IEEE 802.16-2004 OFDM measurement application signal processing. Details are disregarded in order to get a concept overview.

A diagram of the interesting blocks is shown in "Figure 1". First the RF signal is down-converted to the IF frequency $f_{IF} = 20.4$ MHz. The resulting IF signal $r_{IF}(t)$ is shown on the left-hand side of the figure. After bandpass filtering, the signal is sampled by an Analog to Digital Converter (ADC) at a sampling rate of $f_{s1} = 81.6$ MHz. This digital sequence is resampled to the new sampling frequency of $f_{s2} = 80$ MHz which is a multiple of the Nyquist rate (20 MHz). The subsequent digital down-converter shifts the IF signal to the complex base band. In the next step the base band signal is filtered by a FIR filter. To get an idea, the rough transfer function is plotted in the figure. This filter fulfils two tasks: first it suppresses the IF image frequency, secondly it attenuates the aliasing frequency bands caused by the subsequent down-sampling. After filtering, the sequence is sampled down by the factor of 4. Thus the sampling rate of the down-sampled sequence $r(i)$ is the Nyquist rate of $f_{s3} = 20$ MHz. Up to this point the digital part is implemented in an ASIC.

Figure 51: Signal processing of the IEEE 802.16 OFDM measurement application



In the lower part of the figure the subsequent digital signal processing is shown. In the first block the packet search is performed. This block detects the Short Preamble (SP) and recovers the timing. The coarse timing is detected first. This search is implemented in the time domain. The algorithm is based on cyclic repetition within the SP after $N = N_{FFT}/2 = 128$ samples. Note this cyclic repetition occurs also in the Long Preamble (LP). Numerous treatises exist on this subject, e.g. [1]-[3]. Furthermore a coarse estimate Δf_{coarse}^3 of the Rx-Tx frequency offset Δf is derived from the metric in [6]. This can easily be understood because the phase of $r(i) \cdot r^*(i + N)$ is determined by the mod 2π frequency offset. As the frequency deviation Δf can exceed several bins (distance between neighbor sub-carriers) the SP is further used to solve this $n2\pi$ [offset over several bins] ambiguities.

3 In this paper the hat generally describes an estimate. Example: \hat{x} is the estimate of x.

After the coarse timing calculation the time estimate is improved by the fine timing calculation. This is achieved by first estimating the coarse frequency response $\hat{H}_k^{(SP)}$, with $k = [-100, 100]$ denoting the channel index of the occupied sub-carriers. First the FFT of the SP is calculated. After the FFT calculation the known symbol information of the SP sub-carriers is removed by dividing by the symbols. The result is a coarse estimate \hat{H}_k of the channel transfer function. In the next step the complex channel impulse response is computed by an IFFT. Next the energy of the windowed impulse response (the window size is equal to the guard period) is calculated for every trial time. Afterwards the trial time of the maximum energy is detected. This trial time is used to adjust the timing.

Now the position of the SP is known and the starting point of the useful part of the first payload symbol can be derived. In the next block this calculated time instant is used to position the payload window. Only the payload part is windowed. This is sufficient because the payload is the only subject of the subsequent measurements.

In the next block the windowed sequence is compensated by the coarse frequency estimate $\Delta\hat{f}_{coarse}$. This is necessary because otherwise inter channel interference (ICI) would occur in the frequency domain.

The transition to the frequency domain is achieved by an FFT of length 256. The FFT is performed symbol-wise for every of the *nof_symbols* symbols of the payload. The calculated FFTs are described by $r_{l,k}$ with

- the symbol index $l = [1, \text{nof_symbols}]$ and
- the channel index $k = [-128, 127]$.

In case of an additive white Gaussian noise (AWGN) channel the FFT is described by [4], [5]

$$r_{l,k} = K_{\text{mod}} \cdot a_{l,k} \cdot g_l \cdot H_k \cdot e^{j(\text{phase}_l^{(\text{common})} + \text{phase}_{l,k}^{(\text{timing})})} + n_{l,k} \quad (30)$$

with

- the modulation-dependent normalization factor K_{mod}
- the alphabet symbol $a_{l,k}$ at symbol-index l of sub-carrier k
- the gain g_l at the symbol l in relation to the reference gain $g = 1$ at the Short Preamble (SP)
- the channel frequency response H_k at the Short Preamble (SP)
- the common phase drift $\text{phase}_l^{(\text{common})}$ of all sub-carriers at symbol l (see below)
- the phase $\text{phase}_{l,k}^{(\text{timing})}$ of sub-carrier k at symbol l caused by the timing drift (see below)
- the independent Gaussian distributed noise samples $n_{l,k}$

The common phase drift in equation (29) is given by

$$phase_l^{(\text{common})} = 2\pi \cdot N_s / N \cdot \Delta f_{rest} T \cdot l + d\gamma_l \quad (31)$$

with

- $N_s = N_g + N_b$ being the number of Nyquist samples of the symbol period
- $N = N_b = 256$ being the number of Nyquist samples of the useful part of the symbol
- Δf_{rest} being the (not yet compensated) frequency deviation
- $d\gamma_l$ being the phase jitter at the symbol l

In general, the coarse frequency estimate $\hat{\Delta f}_{coarse}$ (see "Figure 1") is not error-free. Therefore the remaining frequency error Δf_{rest} represents the not yet compensated frequency deviation in $r_{i,k}$. Consequently the overall frequency deviation of the device under test (DUT) is calculated by $\Delta f = \hat{\Delta f}_{coarse} + \Delta f_{rest}$. Remark: The only motivation for dividing the common phase drift in equation (11) into two parts is to be able to calculate the overall frequency deviation of the DUT.

The reason for the phase jitter $d\gamma_l$ in equation (11) may be different. The nonlinear part of the phase jitter may be caused by the phase noise of the DUT oscillator. Another reason for nonlinear phase jitter may be the increase of the DUT amplifier temperature at the beginning of the burst. Please note that besides the nonlinear part the phase jitter $d\gamma_l$ also contains a constant part. This constant part is caused by the not yet compensated frequency deviation Δf_{rest} . To understand this, please keep in mind that the measurement of the phase starts at the first symbol $l = 1$ of the payload. In contrast the channel frequency response H_k in equation (29) represents the channel at the Short Preamble of the preamble.

Consequently the not yet compensated frequency deviation Δf_{rest} produces a phase drift between the Short Preamble and the first symbol of the payload. Therefore this phase drift appears as a constant value ("DC value") in $d\gamma_l$.

Referring to the IEEE 802.16-2004 measurement standard *Chapter 8.3.10.1.2*

"Transmitter constellation error and test method" [6], the common phase drift

$phase_l^{(\text{common})}$ must be estimated and compensated from the pilots. Therefore the "symbol wise phase tracking" (Tracking Phase) is activated as the default setting of the R&S FSV-K93.

Furthermore the timing drift in equation (29) is given by

$$phase_{l,k}^{(\text{timing})} = 2\pi \cdot N_s / N \cdot \xi \cdot k \cdot l \quad (32)$$

with ξ being the relative clock deviation of the reference oscillator. Normally a symbol-wise timing jitter is negligible and thus not modeled in equation (32). There may be situations where the timing drift has to be taken into account. This is illustrated by an example: In accordance to [6] the allowed clock deviation of the DUT is up to $\xi_{\max} = \pm 8$ ppm. Furthermore the maximal length of a frame $nof_symbols = 2420$ symbols⁴ is assumed. From equations (29) and (32), it results that the phase drift of the highest sub-carrier $k = 100$ in the last symbol $l = nof_symbols$ is to-do degrees. Even in the noise-free case, this would lead to symbol errors. The example shows that it is actually necessary to estimate and compensate the clock deviation, which is accomplished in the next block.

Referring to the IEEE 802.16-2004 measurement standard [6], the timing drift $phase_{l,k}^{(\text{timing})}$ is not part of the requirements. Therefore the "time tracking" (Tracking Time) is not activated as the default setting of the R&S FSV-K93.

The time tracking option should rather be seen as a powerful analyzing option.

In addition the tracking of the gain g_l in equation (29) is supported for each symbol in relation to the reference gain $g = 1$ at the time instant of the Short Preamble (SP). At this time the coarse channel transfer function $\hat{H}_k^{(SP)}$ is calculated. This makes sense since the sequence $r'_{l,k}$ is compensated by the coarse channel transfer function $\hat{H}_k^{(SP)}$ before estimating the symbols. Consequently a potential change of the gain at the symbol l (caused, for example, by the increase of the DUT amplifier temperature) may lead to symbol errors especially for a large symbol alphabet M of the MQAM transmission. In this case the estimation and the subsequent compensation of the gain are useful.

Referring to the IEEE 802.16-2004 measurement standard [6], the compensation of the gain g_l is not part of the requirements. Therefore the "gain tracking" (Tracking Gain) is not activated as the default setting of the R&S FSV-K93.

The unknown deviations of gain, frequency and time are calculated by an optimum maximum likelihood procedure, which works well even at low signal to noise ratios with the Cramer Rao Bound being reached. After estimation of these parameters, the received signal is fully compensated for the decision of the ideal reference signal $\hat{a}_{l,k}$ and compensated according to the user settings to get the measurement signal $r'_{l,k}$. Then the measurement signal is equalized by the inverse channel transfer function. According to the chosen setting, either the preamble estimation of the channel transfer function or a data aided estimation using the ideal reference signal is used. According to the IEEE 802.16-2004 measurement standard [6], the coarse channel estimation $\hat{H}_k^{(SP)}$ (from the short preamble) has to be used for equalization. Therefore the default setting of the R&S FSV-K93 is equalization from the coarse channel estimate derived from the short preamble.

In the last block the measurement variables are calculated. The most important variable is the error vector magnitude

4 Assuming the maximal System Sampling Rate $F_s = 32\text{MHz}$.

$$EVM_k = \sqrt{\frac{1}{nof_Symbols} \cdot \sum_{l=1}^{nof_Symbols} |r''_{l,k} - K_{mod} \cdot a_{l,k}|^2} \quad (33)$$

of the sub-carrier k of the current packet. Furthermore the packet error vector magnitude

$$EVM = \sqrt{\frac{1}{200} \cdot \sum_{\substack{k=-100 \\ (k \neq 0)}}^{100} EVM_k^2} \quad (34)$$

is derived by averaging the squared EVM_k versus k . Finally the average error vector magnitude

$$\overline{EVM} = \sqrt{\frac{1}{nof_packets} \sum_{counter=1}^{nof_packets} EVM^2(counter)} \quad (35)$$

is calculated by averaging the packet EVM of all $nof_packets$ detected packets. This parameter is equivalent to the so-called "RMS average of all errors $Error_{RMS}$ " of the IEEE 802.16-2004 measurement commandment (see [6], Chapter 8.3.10.1.2).

14.2.2.1 Analysis Steps

Preamble related result	Remark
Rough frequency estimation	In case of subchannelization, a rough frequency estimation is obtained by exploiting the cyclic prefix of the OFDM symbols.
Preamble power	
Preamble EVM	Uses payload channel estimation for equalization.
Frequency error vs. preamble	
Phase error vs. preamble	
Channel estimation	Used for equalizing
Payload related result	Remark
Fine frequency estimation	Estimation on pilots used for phase correction if 'Phase Tracking' is selected. Phase tracking needs at least one pilot. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
Clock offset estimation	Estimation on pilots used for timing correction if 'Timing Tracking' is selected. Timing tracking needs at least two pilots. In case of subchannelization, the value shown in the result summary table is estimated on pilots and data.
IQ Offset	Power at spectral line 0 normalized to the total transmitted power.
Gain Imbalance	Estimation not available in case of subchannelization.
Quadrature Error	Estimation not available in case of subchannelization.
Payload channel estimation	Combined with the preamble channel estimation.
Burst related result	Remark
EVM All carriers EVM Data carriers EVM Pilot carriers	According to standard normalized to the average power of all 200 used carriers.
Burst Power	
Crest Factor	

14.2.2.2 Subchannelization

Subchannelization can be used in uplink bursts to allocate only a subset of the available OFDM sub carriers. The measurement software can distinguish between downlink bursts, uplink bursts without subchannelization and uplink bursts with a selectable subchannel index. Thus it is possible to analyze the complete WirelessMAN traffic with one capture buffer shot.

14.2.2.3 Synchronization

The synchronization of uplink bursts using subchannelization is performed after the synchronization on standard downlink and uplink preambles:

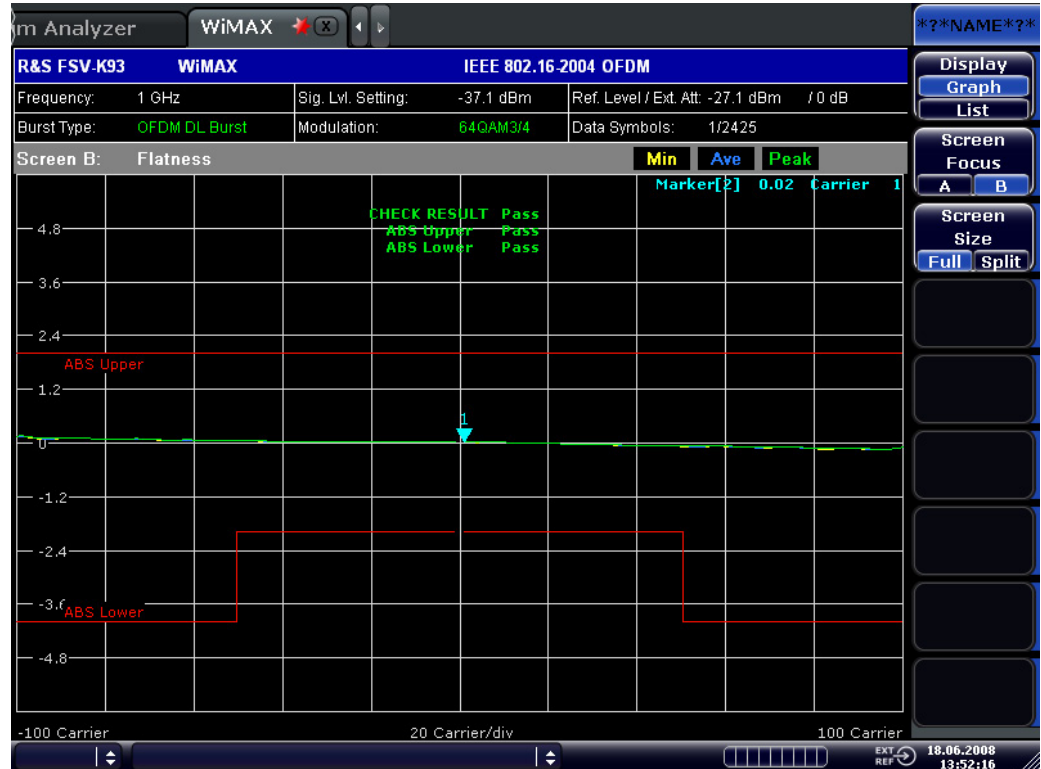
1. Synchronization of downlink and uplink bursts without subchannelization.
2. Pre-analysis of the bursts without subchannelization to determine their length.
3. Extraction of TX power areas without already detected bursts.
4. Synchronization of uplink bursts with the selected subchannel index.

In the following sections, the influence of subchannelization on results is discussed.

14.2.2.4 Channel Results

The standard requires an interpolation of order 0 for the channel estimation on unallocated sub carriers, i.e. the estimated channel coefficient of the nearest allocated sub carrier shall be used for those sub carriers not part of the allocated subchannels. For the derived channel results like group delay or flatness difference, the unallocated carriers are not taken into account.

Figure 52: Spectrum Flatness



14.2.2.5 Frequency and Clock Offset

The measurement software allows selectable compensation of phase, timing and gain errors based on pilot estimations. However, in case of subchannelization the number of pilots is decreased. Bursts with odd subchannel indices do not provide pilots at all.

The following table lists the restrictions on the tracking ability for subchannelization:

Tracking	Subchannel Index		
	16 (8 Pilots) 8, 24 (4 Pilots) 4, 12, 20, 28 (2 Pilots)	2, 6, 10, 14, 18, 22, 26, 30 (1 Pilot)	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31 (No Pilot)
Phase	Available	Available	Available, but uses rough frequency offset estimation from the synchronization step only
Timing	Available	Not available	Not available
Gain	Available	Available	Not available

While the tracking functionality has to use pilot based estimates, the actual results for frequency and clock offset in the result summary can be data aided. In case of subchannelization the final estimation of frequency and clock offset is done using the already decided data sequence, which gives stable results even without pilots.

14.2.2.6 EVM

The error vector magnitude of a single constellation point is defined by

$$\text{EVM}(l,k) = \sqrt{\frac{|r(l,k) - a(l,k)|^2}{\frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |a(l,k)|^2}}$$

where $r(l,k)$ is the received constellation point and $a(l,k)$ is the transmitted constellation point at the l^{th} symbol and carrier number k .

In case of subchannelization, it is required by the standard to include the unallocated carriers k_{unalloc} by assuming $a(l, k_{\text{unalloc}}) = 0$ in the denominator of the EVM calculation. Thus the EVM All Carriers result for one burst in the result summary equals

$$\text{EVM_All_Carr} = \sqrt{\frac{\frac{1}{L} \sum_{l=1}^L \frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |r(l,k) - a(l,k)|^2}{\frac{1}{L} \sum_{l=1}^L \frac{1}{N_{\text{used}}} \sum_{\substack{k=-N_{\text{used}}/2 \\ k \neq 0}}^{k=N_{\text{used}}/2} |a(l,k)|^2}}$$

where L is the number of symbols in the burst.

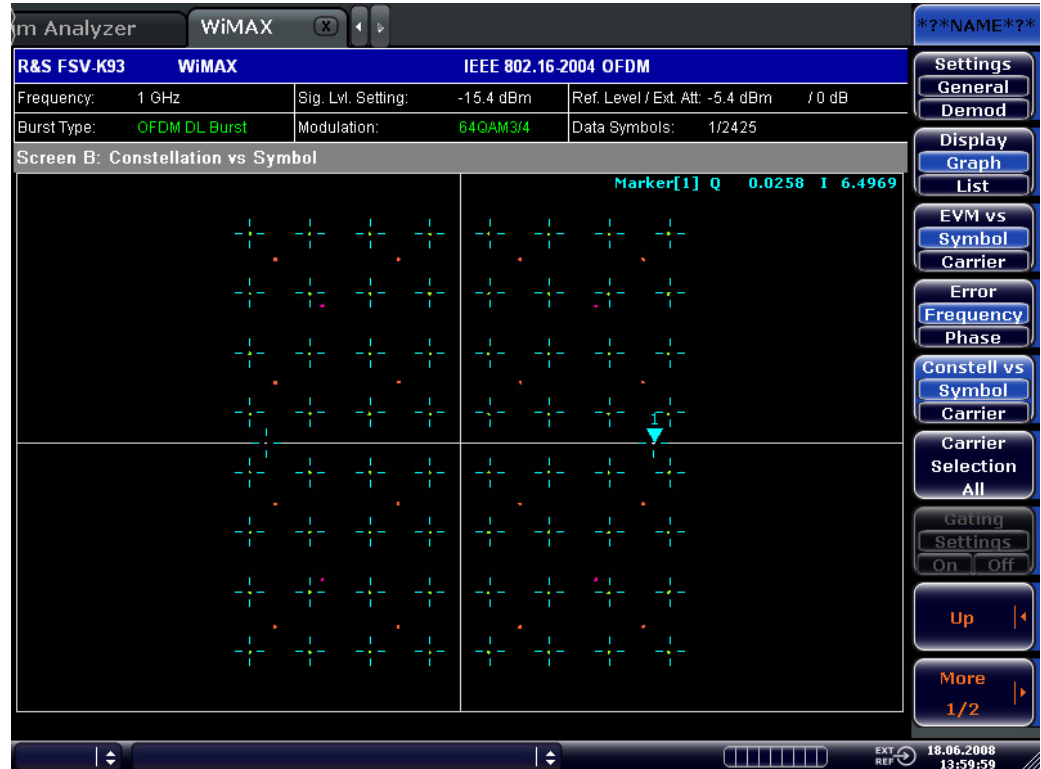
This definition is according to the relative constellation error defined in the IEEE 802.16-2004 standard.

Using the equations above, the error power is normalized by the average transmitted power in all 200 carriers. Please notify that by this definition the same absolute error power leads to different EVM results depending on the number of allocated carriers in case of subchannelization.

14.2.2.7 IQ Impairments

IQ imbalance in an OFDM transmitter or receiver leads to an interference of the symbols $a_{l,-k}$ with the symbols $a_{l,k}$. In case of subchannelization, the used sub carriers are always situated in such a way, that $a_{l,-k} = 0$, if $a_{l,k} \neq 0$. There is no impact of IQ imbalance on the actually allocated carriers of a subchannelization transmission. The effect can only be seen on the unallocated carriers and yields a pattern around the origin of the constellation diagram.

Figure 53: Constellation vs Symbol



The unsymmetrical allocation of the sub carriers prevents a measurement of gain imbalance and quadrature error in case of subchannelization. The influence of the occupied carriers $a_{l,k}$ on the unoccupied carriers $a_{l,-k}$ could be measured, but there is no possibility to distinguish them from an unknown channel coefficient.

14.2.2.8 RSSI

See [6] section "8.3.9.2 RSSI mean and standard deviation". The Received Signal Strength Indication [RSSI] is basically the preamble power. The result summary provides the RSSI statistics according to the standard. A possible method to compute RSSI[k] at the antenna connector is given in [6] equation (87). RSSI[k] is the RSSI measurement based on the k-th signal/preamble.

The RSSI statistics of the *result summary* is calculated as follows:

1. RSSI row:
2. Statistic {min, mean, max} of the $R[k]=\text{RSSI}[k]$.
3. The mean value is $\hat{\mu}_{\text{RSSI dBm}}[k]$ according to [6] formula (89).
4. RSSI Standard Deviation row:
5. $\hat{\sigma}_{\text{RSSI dB}}$ according to [6] formula (91).

14.2.2.9 CINR

See [6] section "8.3.9.3 CINR mean and standard deviation". The result summary provides the Carrier Interference Noise Ratio [CINR] statistics according to the standard. One possible method to estimate the CINR of a single message is to compute the ratio of the sum of signal power and the sum of residual error for each data sample, using equation [6] (92).

$$CINR[k] = \frac{\sum_{n=0}^{N-1} |s[k, n]|^2}{\sum_{n=0}^{N-1} |r[k, n] - s[k, n]|^2}$$

with

r[k,n]	received/measured sample n within message k
s[k,n]	corresponding detected/reference sample (with channel state weighting)
	corresponding to received symbol n

The CINR statistics of the *result summary* is calculated as follows:

1. CINR row:
2. Statistic {min, mean, max} of the CINR[k].
3. The mean value is $\hat{\mu}_{CINR\ dB}[k]$ according to [6] formula (94).
4. CINR Standard Deviation row
5. $\hat{\sigma}_{CINR\ dB}$ according to [6] formula (96).

14.2.2.10 Literature

[1]	Speth, Classen, Meyr: "Frame synchronization of OFDM systems in frequency selective fading channels", VTC '97, pp. 1807-1811
[2]	Schmidl, Cox: "Robust Frequency and Timing Synchronization of OFDM", IEEE Trans. on Comm., Dec. 1997, pp. 1613-621
[3]	Minn, Zeng, Bhargava: "On Timing Offset Estimation for OFDM", IEEE Communication Letters, July 2000, pp. 242-244
[4]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM - Part I", IEEE Trans. On Comm. VOL. 47, NO 11, Nov. 1999
[5]	Speth, Fechtel, Fock, Meyr: "Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM - Part II", IEEE Trans. On Comm. VOL. 49, NO 4, April. 2001
[6]	IEEE 802.16-2004, Part 16: Air Interface for Fixed Broadband Wireless Access Systems; 1 October 2004; Medium Access Control (MAC) and Physical Layer (PHY) specifications

14.2.3 Signal Processing of the IEEE802.16-2005 OFDMA/WiBro measurement application

Symbol	Description
$a_{l,k}, \hat{a}_{l,k}$	data symbol (actual, decided)
Δf_{res}	residual carrier frequency offset
$\Delta f, \hat{\Delta f}_{\text{coarse}}$	carrier frequency offset between transmitter and receiver (actual, coarse estimate)
ζ	relative sampling frequency offset
g_l	gain
$H_{l,k}, \hat{H}_{l,k}$	channel transfer function (actual, estimate)
i	time index
$\hat{i}_{\text{coarse}}, \hat{i}_{\text{fine}}$	timing estimate (coarse, fine)
$k, k_p, k_d, k_{\text{ch}_n}$	subcarrier index (general, pilot, data, subchannel n)
l	OFDM symbol index
N_{FFT}	length of FFT
N_g	number of samples in cyclic prefix (guard interval)
N_s	number of Nyquist samples
N_{sc}	number of subcarriers
n	subchannel index, subframe index
$n_{l,k}$	noise sample
Φ_l	common phase error
$\Delta Q, \hat{\Delta Q}$	I/Q imbalance (actual, estimate)
$r(i)$	received sample in the time domain
$r'_{l,k}, r''_{l,k}, r'''_{l,k}, r''''_{l,k}$	received sample (uncompensated, fully compensated, partially compensated, equalized) in the frequency domain
T	useful symbol time
T_g	guard time
T_s	symbol time

Abbreviation	Description
AWGN	additive white Gaussian noise
BER	bit error rate
CFO	carrier frequency offset
CINR	carrier to interference and noise ratio
CIR	channel impulse response
CP	cyclic prefix (guard interval)
CPE	common phase error
CTF	channel transfer function
DL	downlink
EVM	error vector magnitude
FFT	fast Fourier transformation
IF	intermediate frequency
ISI	intersymbol interference
OFDM	orthogonal frequency division multiplexing
OFDMA	orthogonal frequency division multiple access
PAPR	peak to average power ratio
RSSI	received signal strength indicator
SFO	sampling frequency offset
UL	uplink

14.2.3.1 Introduction

The following description provides a brief overview of the digital signal processing used in the IEEE 802.16 OFDMA measurement application.

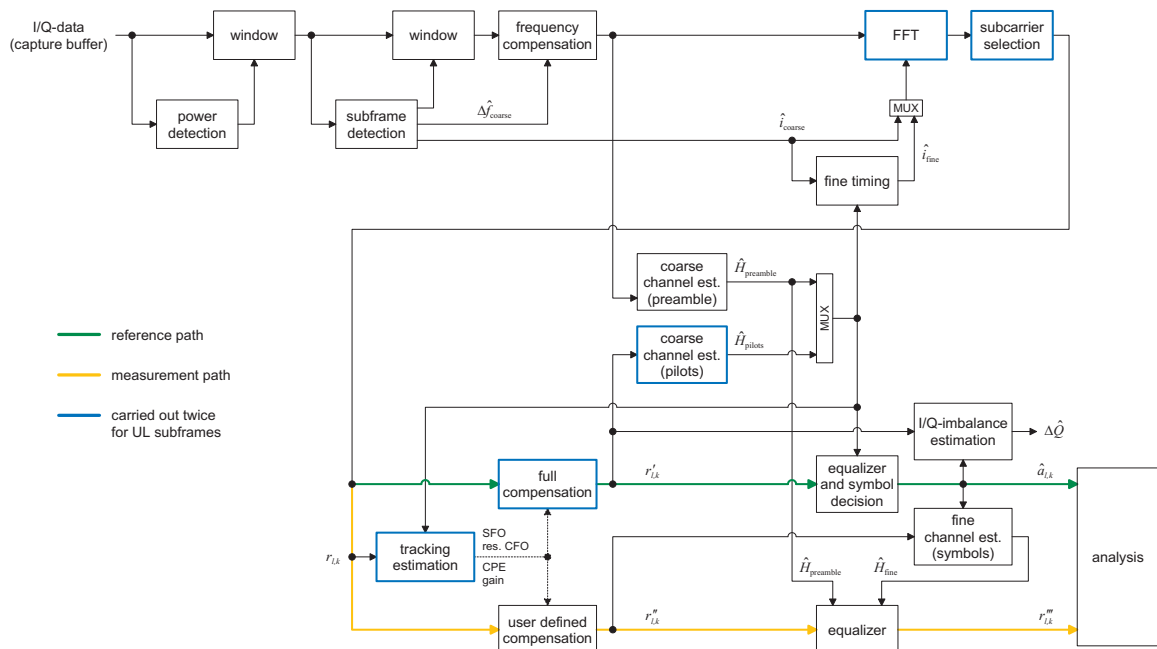
From the received IF signal as the point of origin to the actual analysis results like EVM or CINR, the digital signal processing can be divided into four major groups:

◆ Data capturing	
◆ " Synchronisation "	(OFDMA measurement application)
◆ " Channel Estimation / Equalization "	(OFDMA measurement application)
◆ " Analysis "	(OFDMA measurement application)

The description of the IEEE802.16-2005 OFDMA/WiBro measurement signal processing is structured accordingly.

14.2.3.2 Signal Processing Block Diagram

Figure 54: Signal processing of the IEEE 802.16 OFDMA measurement application



The block diagram in "Figure 4" shows the OFDMA measurement application from the capture buffer containing the I/Q data to the actual analysis block. Outcome of the fully compensated reference path (green) are the estimates $\hat{a}_{l,k}$ of the transmitted data symbols $a_{l,k}$. Depending on the user defined compensation, the received samples $r'''_{l,k}$ of the measurement path (orange) still contain the transmitted signal impairments of interest. The analysis block reveals these impairments by comparing the reference and the measurement path. Prior to the analysis, diverse synchronization and channel estimation tasks have to be accomplished.

14.2.3.3 Synchronisation

The first of the synchronization tasks is to detect areas of sufficient power within the captured I/Q data stream. The subframe detection block determines the beginning and end of each subframe and coarsely estimates both timing and carrier frequency offset. The fine timing block prior to the FFT allows a timing improvement using a level-based search for the beginning and end of the coarsely estimated channel impulse response. In the DL the coarse estimate of the CIR can be directly obtained from the preamble. Other than that the UL consists only of payload information with scattered pilots in the subcarrier-symbol plane, thus several OFDM symbols have to be observed to get a reliable estimate of the CIR. Since the OFDM symbols need to be phase synchronized prior to the channel estimation, the blue blocks in "Figure 4" have to be carried out twice. In the first iteration the timing estimate \hat{i}_{coarse} is used to position the window of the FFT. Having found the pilot-based estimate of the CIR, the fine timing estimate \hat{i}_{fine} is used in the second iteration.

After the time to frequency transformation by an FFT of length N_{FFT} , the tracking estimation block is used to estimate the following:

relative sampling frequency offset ζ
 residual carrier frequency offset Δf_{res}
 common phase error Φ_l
 gain g_l

Corresponding to [3] and [4], the uncompensated samples $r_{l,k}$ can be expressed as

$$r_{l,k} = g_l \cdot a_{l,k} \cdot H_{l,k} \cdot \underbrace{e^{j\Phi_l}}_{\text{CPE}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \zeta \cdot k \cdot l}}_{\text{SFO}} \cdot \underbrace{e^{j2\pi \cdot N_s / N_{\text{FFT}} \cdot \Delta f_{\text{res}} \cdot T \cdot l}}_{\text{res. CFO}} + n_{l,k} \quad (36)$$

with

data symbol $a_{l,k}$ on subcarrier k at OFDM symbol l

channel transfer function $H_{l,k}$

number of Nyquist samples N_s within the symbol time T_s

useful symbol time $T = T_s - T_g$

independent and Gaussian distributed noise sample $n_{l,k}$

Within one OFDM symbol both the CPE and the residual CFO respectively cause the same phase rotation for each subcarrier, while the rotation due to the SFO linearly depends on the subcarrier index. A linear phase increase in symbol direction can be observed for the residual CFO as well as the SFO.

The results of the tracking estimation block are used to compensate the samples $r_{l,k}$. While a full compensation is performed in the reference path, the signal impairments that are of interest to the user are left uncompensated in the measurement path.

14.2.3.4 Channel Estimation / Equalization

According to "Figure 4", there are two coarse and one fine channel estimation blocks. Which of the two coarse estimation blocks is used depends on the link direction. For DL subframes the coarse channel estimation is based on the preamble and directly follows the coarse frequency compensation block. The pilot-based estimation for UL subframes is tapped behind the full compensation block of the reference path. Both of the coarse estimation blocks use available training symbols to determine initial estimates $\hat{H}_{l,k}$ of the channel transfer function at fixed positions in the subcarrier-symbol plane. Based on these nodes, the missing CTF values are obtained by interpolation in both time and frequency direction. The coarse estimation results are used for the above mentioned fine timing and to equalize the samples $r'_{l,k}$ of the reference path prior to symbol decision. Based on the decided data symbols, a fine channel estimation is performed and then used to equalize the partially compensated samples of the measurement path.

14.2.3.5 Analysis

The analysis block of the OFDMA measurement application allows to calculate a variety of measurement variables.

EVM

The most important variable is the error vector magnitude (EVM).

$$EVM_{l,k} = \left| \frac{r_{l,k}^m - \hat{a}_{l,k}}{\hat{a}_{l,k}} \right| \quad (37)$$

on subcarrier k at OFDM symbol l . The subsequent average values can be derived from (37).

EVM of subchannel n at OFDM symbol l :

$$EVM_{l,\text{subchannel } n} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_{k_{\text{ch } n}} EVM_{l,k_{\text{ch } n}}^2} \quad (38)$$

EVM of all pilot subcarriers:

$$EVM_{\text{pilots}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \sum_{k_p} EVM_{l,k_p}^2} \quad (39)$$

EVM of all data subcarriers:

$$EVM_{\text{data}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \sum_{k_d} EVM_{l,k_d}^2} \quad (40)$$

EVM of all used subcarriers:

$$EVM_{\text{all}} = \sqrt{\frac{1}{N_{\text{sc}}} \sum_l \left[\sum_{k_p} EVM_{l,k_p}^2 + \sum_{k_d} EVM_{l,k_d}^2 \right]} \quad (41)$$

The number of subcarriers respectively taken into account is denoted by N_{sc} .

CINR

The carrier to interference and noise ratio is determined for each subframe n . The computation is based on the partially compensated samples $r_{l,k}''$, the decided symbols $\hat{a}_{l,k}$, and the channel estimates \hat{H}_k (DL: preamble and fine; UL: fine).

$$CINR(n) = \frac{\sum_l \sum_k |\hat{a}_{l,k} \cdot \hat{H}_k|^2}{\sum_l \sum_k |r_{l,k}'' - \hat{a}_{l,k} \cdot \hat{H}_k|^2} \quad (42)$$

Further CINR statistics are defined in the standards [5], [6].

$$\hat{\mu}_{\text{CINR}}(n) = \begin{cases} CINR(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\mu}_{\text{CINR}}(n-1) + \alpha_{\text{avg}} \cdot CINR(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\text{CINR}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{CINR}}(n) \text{ dB} \quad (43)$$

$$\hat{\chi}_{\text{CINR}}^2(n) = \begin{cases} CINR^2(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\chi}_{\text{CINR}}^2(n-1) + \alpha_{\text{avg}} \cdot CINR^2(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\text{CINR}}^{(\text{dB})}(n) = 5 \cdot \log(\hat{\chi}_{\text{CINR}}^2(n) - \hat{\mu}_{\text{CINR}}^2(n)) \text{ dB}$$

RSSI

The received signal strength indicator is determined for each subframe n . The computation is based on the time domain samples $r(i)$ extracted by the subframe detection block.

$$RSSI(n) \sim \overline{|r(i)|^2} \quad (44)$$

Further RSSI statistics are defined in the standard [5], [6].

$$\hat{\mu}_{\text{RSSI}}(n) = \begin{cases} RSSI(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\mu}_{\text{RSSI}}(n-1) + \alpha_{\text{avg}} \cdot RSSI(n) & n > 0 \end{cases}$$

$$\hat{\mu}_{\text{RSSI}}^{(\text{dB})}(n) = 10 \cdot \log \hat{\mu}_{\text{RSSI}}(n) \text{ dB} \quad (45)$$

$$\hat{\chi}_{\text{RSSI}}^2(n) = \begin{cases} RSSI^2(0) & n = 0 \\ (1 - \alpha_{\text{avg}}) \cdot \hat{\chi}_{\text{RSSI}}^2(n-1) + \alpha_{\text{avg}} \cdot RSSI^2(n) & n > 0 \end{cases}$$

$$\hat{\sigma}_{\text{RSSI}}^{(\text{dB})}(n) = 5 \cdot \log(\hat{\chi}_{\text{RSSI}}^2(n) - \hat{\mu}_{\text{RSSI}}^2(n)) \text{ dB}$$

I/Q Imbalance

The I/Q imbalance estimation block allows to evaluate the *modulator gain balance* = $|1 + \Delta Q|$ (46)

and the

$$\text{quadrature mismatch} = \arg\{1 + \Delta Q\} \quad (47)$$

respectively based on the block's estimate $\Delta \hat{Q}$.

Other Measurement Variables

Without going into detail, the OFDMA measurement application additionally provides the following results:

- ◆ Burst power
- ◆ Constellation diagram
- ◆ Group delay
- ◆ I/Q offset
- ◆ PAPR
- ◆ Pilot BER
- ◆ Spectral flatness

14.2.3.6 Literature

- [1] Speth, M., Classen, F., and Meyr, H.: Frame Synchronization of OFDM Systems in Frequency Selective Fading Channels. IEEE VTC'97, May 1997, pp. 1807-1811.
- [2] Schmid, T. M. and Cox, D. C.: Robust Frequency and Timing Synchronization of OFDM. IEEE Trans. on Commun. Vol. 45 (1997) No. 12, pp. 1613-1621.
- [3] Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for Wireless Broad-Band Systems Using OFDM - Part I. IEEE Trans. on Commun. Vol. 47 (1999) No. 11, pp. 1668-1677.
- [4] Speth, M., Fechtel, S., Fock, G., and Meyr, H.: Optimum Receiver Design for OFDM-Based Broadband Transmission - Part II: A Case Study. IEEE Trans. on Commun. Vol. 49 (2001) No. 4, pp. 571-578.
- [5] IEEE 802.16-2004™: Air Interface for Fixed Broadband Wireless Access Systems (2004).
- [6] IEEE Std 802.16e™-2005 and IEEE Std 802.16™-2004/Cor1-2005: Air Interface for Fixed and Mobile Broadband Wireless Access Systems (2006)

14.3 Instrument Functions WiMAX, WiBro Measurements (Option R&S FSV-K93)

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93) extends the functionality of the R&S FSV to enable WiMAX IEEE 802.16e, WiBro Measurements according to the IEEE standards listed below. It includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- ◆ WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
 - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode
The short form IEEE 802.16-2004 OFDM is used in this section to reference this standard. The corresponding remote control mode is OFDM.
- ◆ WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
 - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode
The short form IEEE 802.16e-2005 OFDMA is used in this section to reference this standard. The corresponding remote control mode is OFDMA.
 - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro
The short form IEEE 802.16e-2005 WiBro is used in this section to reference this standard. The corresponding remote control mode is WiBro.

TX measurements of a WiMAX Device Under Test (DUT) according to the standards specified for the device are performed:

- ◆ Modulation formats
 - IEEE 802.16-2004: BPSK (IEEE 802.16-2004 OFDM), QPSK, 16QAM, 64QAM
- ◆ Modulation measurements
 - Constellation diagram
 - Constellation diagram per OFDM carrier
 - I/Q offset and I/Q imbalance
 - Carrier and symbol frequency errors
 - Modulation error (EVM) per OFDM carrier or symbol
 - Amplitude response and group-delay distortion (spectral flatness)
- ◆ Amplitude statistics (CCDF) and crest factor
- ◆ Frequency and Phase error vs Symbol
- ◆ Transmit spectrum mask
- ◆ Adjacent Channel Power (absolute and relative)
- ◆ FFT, also over a selected part of the signal, e.g. preamble
- ◆ Payload bit information
- ◆ Capture time selectable up to 50 ms, multiple sweeps possible for large number of bursts

To open the measurement menu

- ◆ If the "WiMAX" mode is not the active measurement mode, press the "MODE" key and activate the "WiMAX" option.
- ◆ If the "WiMAX" mode is already active, press the "MENU" or "MEAS" key. The measurement menu is displayed.
To exit the "WiMAX" measurement mode, select another option.

14.3.1 Menu and softkey description

- ◆ ["Softkeys of the WiMAX, WiBro menu"](#) (WiMAX mode) on page 1033
- ◆ ["Softkeys of the sweep menu – SWEEP key"](#) (WiMAX mode) on page 1088
- ◆ ["Softkeys of the marker menu - MKR key"](#) (WiMAX mode) on page 1089
- ◆ ["Softkeys of the marker to menu – MKR-> key"](#) (WiMAX mode) on page 1090
- ◆ ["Softkeys of the lines menu – LIN key"](#) (WiMAX mode) on page 1090
- ◆ ["Softkeys of the trace menu – TRAC key"](#) (WiMAX mode) on page 1091

The file, setup, and print menus are provided as described for the base unit. For details refer to the corresponding menu descriptions. The span and bandwidth menus are not available in the "WiMAX" mode.

The "FREQ", "AMPT" and "TRIG" keys open the "General Settings" or the "Demod Settings" dialog box. For details refer to the Settings General/Demod softkey description (measurement menu).

14.3.2 Further information

- ◆ ["Measurement and result displays"](#) on page 1026
- ◆ ["Measurement settings"](#) on page 1027
- ◆ ["Result summary list"](#) on page 1028
- ◆ ["Result display graph"](#) on page 1030
- ◆ ["To transfer the current R&S SMU WiMAX settings via LAN"](#) on page 1032
- ◆ ["Title bar information"](#) on page 1032
- ◆ ["Status bar information"](#) on page 1032

14.3.2.1 Measurement and result displays

The WiMAX IEEE 802.16 OFDM, OFDMA Measurements option provides two main measurement types:

- ◆ IQ measurements (based on captured IQ data)
 - Power vs Time (see "[PVT](#)" softkey)
 - EVM vs Symbol, EVM vs Carrier (see "[EVM vs Symbol/Carrier](#)" softkey)
 - Phase vs Preamble, Frequency vs Preamble (see "[Error Frequency/Phase](#)" softkey)
 - Spectrum Flatness (see "[Spectrum Flat./Diff./Group Delay](#)" softkey)
 - Spectrum Group Delay (see "[Spectrum Flat./Diff./Group Delay](#)" softkey)
 - Spectrum Flatness Adjacent Carrier Power Difference (see "[Spectrum Flat./Diff./Group Delay](#)" softkey)
 - Spectrum FFT (see "[Spectrum FFT](#)" softkey)
 - Constellation vs Symbol (see "[Constell vs Symbol/Carrier](#)" softkey)
 - Constellation vs Carrier (IEEE 802.16-2004 OFDM only, see "[Constell vs Symbol/Carrier](#)" softkey)
 - Conditional Cumulative Distribution Function (see "[CCDF](#)" softkey)
 - Bit Stream (see "[Bitstream](#)" softkey)
- ◆ frequency sweep measurements
 - Spectrum Mask (see "[Spectrum IEEE/ETSI](#)" softkey)
 - Spectrum ACP/ACPR (see "[ACPR Abs/Rel](#)" softkey)

For current restrictions refer to Current restrictions to the IEEE 802.16e-2005 OFDMA/WiBro signal to be analyzed.

The measurement result display is divided into two panes:

- ◆ "[Measurement settings](#)"
- ◆ Result displays

The results can be displayed in form of a list or a graph (see also Display Graph softkey).

- ◆ "[Result summary list](#)"
- ◆ "[Result display graph](#)"

14.3.2.2 Measurement settings

The overall measurement settings used to obtain the current measurement results are displayed below the title bar (see "[Figure 5 Measurement settings](#)"). The following settings are listed:

Setting	Description	Restrictions
Frequency	The frequency of the measured input signal.	
Burst Type	The type of burst being analyzed.	IEEE 802.16-2004 OFDM only
Zone/Seg	The zone and segment being analyzed	IEEE 802.16e-2005 OFDMA/WiBro only
Signal Level	The expected mean signal level for the input signal.	
Modulation	Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Mod". "Detection" field is set to "ALL", "ALL" is displayed. Shows the active setting selected in the "Demod Settings" dialog box, "Demodulator" list. If the "Modulation Analysis Scope" field is set to "ALL", "ALL" is displayed.	IEEE 802.16-2004 OFDM only IEEE 802.16e-2005 OFDMA/WiBro only
External Att	The attenuation (positive values) or gain (negative values) applied to the signal externally (i.e. before the RF or IQ connector of the spectrum analyzer), e.g.: External Att = 10 dB means that before the RF connector of the R&S FSV a 10 dB attenuator is used External Att = -20 dB means that before the RF connector of the R&S FSV a amplifier with 20 dB gain is used.	
Data Symbols	Shows the minimum and maximum number of data symbols that a burst may have to be considered in results analysis .	IEEE 802.16-2004 OFDM only
Zone Offset / Length	A combined display of the offset and length of the analyzed zone	IEEE 802.16e-2005 OFDMA/WiBro only

Figure 55: Measurement settings for IEEE 802.16-2004 OFDM (example)

R&S FSV-K93	WiMAX	IEEE 802.16-2004 OFDM			
Frequency:	1 GHz	Sig. Lvl. Setting:	-15.4 dBm	Ref. Level / Ext. Att:	-5.4 dBm / 0 dB
Burst Type:	OFDM DL Burst	Modulation:	64QAM3/4	Data Symbols:	1/2425

Figure 56: Measurement settings for IEEE 802.16e-2005 OFDMA/WiBro (example)

R&S FSV-K93	WiMAX	IEEE 802.16e-2005 OFDMA			
Frequency:	1 GHz	Sig. Lvl Set:	-14.8 dBm	Ref. Level / Ext. Att:	-4.81 dBm / 0 dB
Zone / Seg:	DL-PUSC, ID=A, Seg=0	Modulation:	ALL	Zone Offset / Len:	1 / 26 Symbols

14.3.2.3 Result summary list

If the results are displayed in tabular form (Display Graph/List softkey), the result summary list is displayed. It shows the overall measurement results and provides limit checking for result values in accordance with the selected standard. Result values which are within the limit as specified by the standard are displayed in green. Result values which are outside of the limits specified by the standard are displayed in red with a '*' to the left. Results which have no limits specified by the standard are displayed in white. Limit values are displayed in white (not bold) and can be modified, when focused, via the keypad. Limits are modified for the currently selected modulation scheme. Each modulation scheme may have its own set of user defined limits. To reset the limit values to the values specified in the standard, use the lines menu ("LINES" key).

◆ IEEE 802.16-2004 OFDM

The results displayed in this list are for the entire measurement. If a specific number of bursts have been requested which requires more than one sweep, the result summary list is updated at the end of each sweep. The number of bursts measured and the number of bursts requested are displayed to show the progress through the measurement. The Min / Mean / Max columns show the minimum, mean or maximum values of the burst results.

Figure 57: Result summary list for IEEE 802.16-2004 OFDM (example)

Result Summary						
	Min	Mean	Limit	Max	Limit	Unit
EVM All Carriers	-52.12	-51.36	-31.00	-51.06	-31.00	dB
EVM Data Carriers	-52.04	-51.33		-51.03		dB
EVM Pilot Carriers	-54.72	-52.12		-50.48		dB
IQ Offset	-60.47	-60.47	-15.00	-60.47	-15.00	dB
Gain Imbalance	-0.01	-0.01		-0.01		dB
Quadrature Error	-0.014	-0.014		-0.014		°
Freq. Err	0.01	0.01	± 8000	0.01	± 8000	Hz
Clock Error	0.00	0.00	± 8	0.00	± 8	ppm
Burst Power	-17.90	-17.89		-17.88		dBm
Crest Factor	7.90	9.41		9.82		dB
RSSI	-14.90	-14.90		-14.90		dBm
RSSI Stnd. Dev.		-37.26				dB
CINR	17.27	17.27		17.27		dB
CINR Stnd. Dev.		16.55				dB

◆ IEEE 802.16e-2005 OFDMA, WiBro

For these measurement results, the minimum, mean, and maximum is taken over the analyzed zones of the current capture buffer content.

Two lists are available:

- Result Summary of Analyzed Subframes (list 1)
- Result Summary of Analyzed Zone / Segment (list 2)

Figure 58: Result summary list for IEEE 802.16e-2005 OFDMA/WiBro (example)

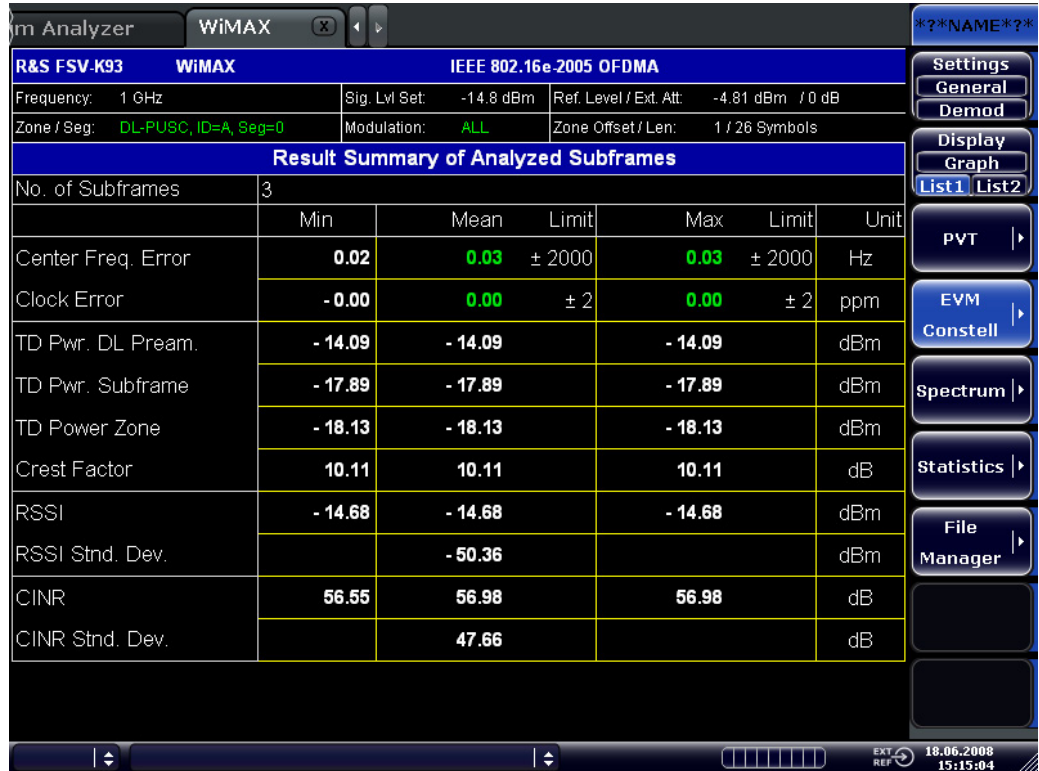


Figure 59 Result summary list 2 for IEEE 802.16e-2005 OFDMA/WiBro (example)

Result Summary of Analyzed Zone / Segment						
Zones/Segments	Min	Mean	Limit	Max	Limit	Unit
BER Pilots	0.00	0.00	0.00	0.00	0.00	%
EVM Data & Pilots	-51.96	-51.93	-30.00	-51.91	-30.00	
EVM Data	-51.64	-51.62	-30.00	-51.58	-30.00	
EVM Pilots	-54.36	-54.30		-54.18		
Unmod. Subcar. Err.	-66.37	-66.13		-65.99		dB
IQ Offset	-58.88	-58.82	-15.00	-58.74	-15.00	
Gain Imbalance	-0.01	-0.01		-0.01		
Quadrature Err	-0.017	-0.015		-0.014		°
Power DL Preamble	-8.50	-8.50		-8.50		dBm
Power Data & Pilots	-17.03	-17.03		-17.03		dBm
Power Data	-17.51	-17.51		-17.51		dBm
Power Pilots	-15.03	-15.03		-15.03		dBm

For details regarding how the results are calculated refer to the Operating Manual of the base unit, chapter “[Advanced Measurement Examples](#)”.

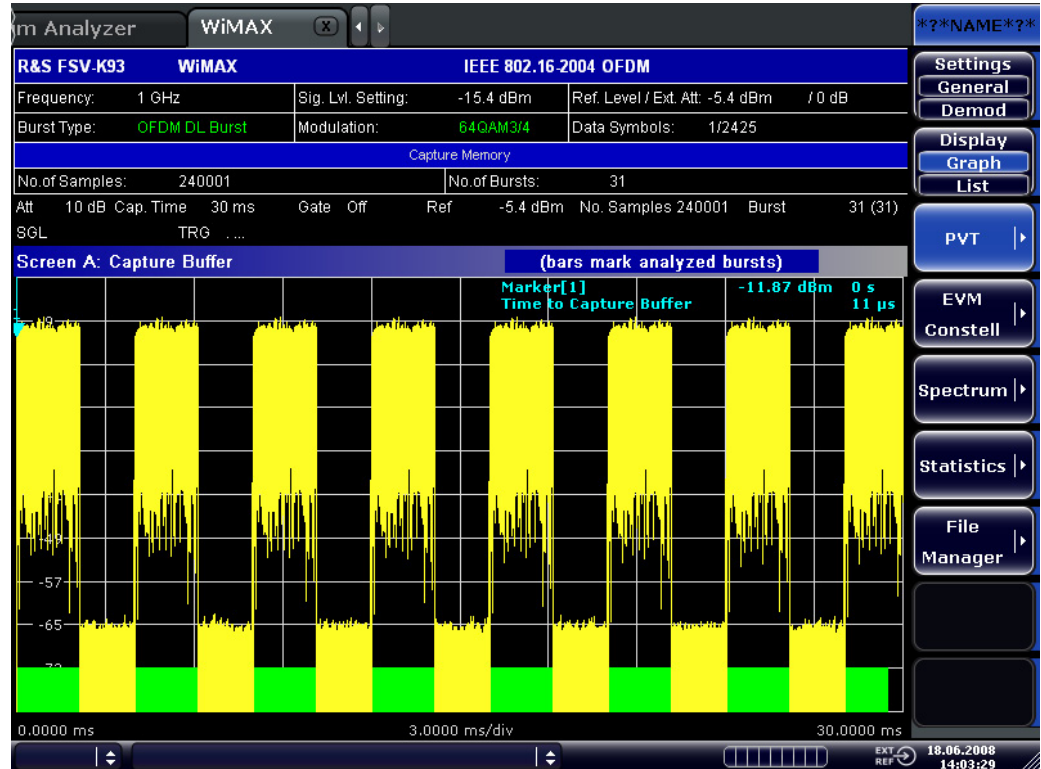
14.3.2.4 Result display graph

◆ IQ measurements

If the results are displayed in graphical form (Display Graph/List softkey), additionally to the selected graphical result display, the Magnitude Capture Buffer (power profile) display is provided for all IQ measurements. The different result displays are described with the corresponding softkey.

The Magnitude Capture Buffer display shows the complete range of captured data for the last sweep. All analyzed bursts are identified with a green bar at the bottom of the Magnitude Capture Buffer display. Only those bursts match the required criteria. The gate delay line ("GD") and gate length line ("GL") are displayed in red color.

Figure 60: Magnitude capture buffer results (example)



All IQ measurements process the same signal data and as such all IQ measurement results are available after a single IQ measurement execution.

IQ measurements can be run in split screen mode (allowing both the Magnitude Capture Buffer display and the selected IQ measurement results to be displayed simultaneously) or in full screen mode (with either the Magnitude Capture Buffer display or the selected IQ measurement results displayed).

If measuring OFDMA or WiBro measurements, the time from the start of the capture buffer to the start of the first frame is also displayed in the Magnitude Capture buffer. This time is marked with a vertical blue line, with the result displayed at the top of the graph.

- ◆ frequency sweep measurements

The frequency sweep measurements use different signal data to IQ measurements and as such it is not possible to run an IQ measurement and then view the results in the frequency sweep measurements and vice-versa. Also because each of the frequency sweep measurements uses different settings to obtain signal data it is not possible to run a frequency sweep measurement and view the results of another frequency sweep measurement.

All frequency sweep measurements are run in full screen mode.

14.3.2.5 To transfer the current R&S SMU WiMAX settings via LAN

Prerequisite: The Windows Firewall of the R&S SMU is switched off.

1. Press the Settings General/Demod softkey to open the "General Settings" dialog box.
2. Under "Signal Characteristics" in the Standard list, select the "IEEE 802"."16e"- "2005 OFDMA" or "IEEE 802"."16e"- "2005 WiBro" standard.
3. Open the "Advanced Settings" dialog box
4. Under "Setup" in the SMU Address field specify the TCP/IP address of the R&S SMU.
5. Press the "More >" softkey to change into the side menu.
6. Press the File Manager softkey to open the File Manager.
7. Under "Folders", select the "SMU" entry.
8. Under "Files", select the "Current SMU WiMAX Settings" entry using the "RIGHTARROW" key.
9. Press the "Recall" softkey.
10. The selected WiMAX setting file is transferred from the R&S SMU to the R&S FSV.

14.3.2.6 Title bar information

The title bar displays the following information:

- ◆ standard applicable to the current measurement

14.3.2.7 Status bar information

The status bar displays the following information:

- ◆ parameter values
If a parameter in a settings dialog box is selected, the minimum and maximum values for the selected parameter are displayed.
If a Boolean parameter in a dialog box is selected, the minimum and maximum values are displayed as N/A for not applicable.
- ◆ measurement status
During the measurement, the current measurement status along with detailed information about the progress is displayed.
- ◆ error messages (with red background)
- ◆ warning messages (with yellow background)

14.4 WiMAX, WiBro measurements (Option R&S FSV-K93)

14.4.1 Softkeys of the WiMAX, WiBro menu (Option R&S FSV-K93)

The following table shows all softkeys available in the WiMAX menu. It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Menu / Command	Command
Settings General/Demod	
Display Graph/List	
PVT	Settings General/Demod
	Display Graph/List
	Full Burst
	Start End
	Burst Selection
	Full Subframe
	Rising/Falling
	More >
	Gating Settings On/Off
	Import
	Export
	R&S Support
EVM Constell	Settings General/Demod
	Display Graph/List
	EVM vs Symbol/Carrier
	Error Frequency/Phase
	Constell vs Symbol/Carrier
	Carrier Selection
	Constell Selection
	More >
	Gating Settings On/Off
	Import
	Export
	Y-Axis/Div
	R&S Support
Spectrum	Settings General/Demod
	Display Graph/List
	Spectrum Flat./Diff./Group Delay
	Spectrum IEEE/ETSI
	Spectrum Emission Mask
	Spectrum FFT
	ACPR Abs/Rel
	More >
	Gating Settings On/Off

Menu / Command	Command
	SEM Settings
	ACP Settings
	Import
	Export
	R&S Support
Statistics	Settings General/Demod
	Display Graph/List
	CCDF
	Bitstream
	Burst Summary
	Bit Selection
	More >
	same contents as PVT side menu
File Manager >	

Settings General/Demod

Opens the "[General Settings](#)" or the "[Demod Settings](#)" dialog box. Screenshots of the dialog boxes are provided in chapter "[Basic measurement examples](#)".

Alternatively, the "General Settings" dialog box is opened as follows:

- ◆ "FREQ" key, with focus on the "Frequency" field
- ◆ "AMPT" key, with focus on the "Signal Level" ("RF") field
- ◆ "TRIG" key, with focus on the "Trigger Mode" field

General Settings dialog box:

In the "General Settings" dialog box, all settings related to the overall measurement can be modified. The right pane with the advanced settings is only displayed if the "Advanced Settings" option is activated. The "General Settings" dialog box contains the following elements:

Pane	Field / List or Softkey	Standard Restrictions
Signal Characteristics	Standard	
	Frequency	
	Channel No	IEEE 802.16-2004 OFDM
	Frequency Band	
	FFT Size NFFT	IEEE 802.16e-2005 OFDMA/WiBro
	Channel BW	
	Fs/BW to Std	
	Sample Rate	
Level Settings	G = Tg/Tb	
	Signal Level	
	Auto Level	
Data Capture Settings	Ext Att	
	Capture Time	
	Burst Count	IEEE 802.16-2004 OFDM
	Bursts to Ana.	IEEE 802.16-2004 OFDM
	Capture Count	IEEE 802.16e-2005 OFDMA/WiBro
	No. Subframes	IEEE 802.16e-2005 OFDMA/WiBro
	Sweep Time	
Trigger Settings	Sweep Count	
	Trigger Mode	
	Trigger Offset	
	Power Level	
	Auto Level	
Input Settings Advanced	Auto Level	
	Auto Track Time	
	Ref Level	
	RF Att.	
IQ Settings	Swap IQ	
Result Settings	RSSI, CINR avg.	
	List Results Unit	IEEE 802.16-2004 OFDM
Setup	SMU Address	IEEE 802.16e-2005 OFDMA/WiBro

Demod Settings dialog box:

In the "Demod Settings" dialog box, the settings associated with the signal modulation can be modified. The content of the "Demod Settings" dialog box depends on the selected standard:

◆ IEEE 802.16-2004 OFDM

The settings under "**Burst to Analyze**" specify the characteristics of the bursts to be considered in the measurement results. Only the bursts which meet the criteria specified in this group will be included in measurement analysis. The settings under "Tracking" allow various errors in measurement results to be compensated for.

For IEEE 802.16-2004 OFDM, the "Demod Settings" dialog box contains the following elements:

Pane	Field, List or Softkey	Standard Restrictions
Burst to Analyze	Link Mode	IEEE 802.16-2004 OFDM
	Use FCH Content	IEEE 802.16-2004 OFDM
	Mod. Detection	IEEE 802.16-2004 OFDM
	Demodulator	IEEE 802.16-2004 OFDM
	Subchannelization	IEEE 802.16-2004 OFDM
	UL Phys. Modifier	IEEE 802.16-2004 OFDM
	Equal Burst Length	IEEE 802.16-2004 OFDM
	Min Data Symbols	IEEE 802.16-2004 OFDM
	Max Data Symbols	IEEE 802.16-2004 OFDM
	Channel Estimation	IEEE 802.16-2004 OFDM
Tracking	Phase	IEEE 802.16-2004 OFDM
	Timing	IEEE 802.16-2004 OFDM
	Level	IEEE 802.16-2004 OFDM

◆ IEEE 802.16e-2005 OFDMA/WiBro

The "Demod Settings" dialog box contains three tabs. Use the left/right arrow keys to navigate between the tabs.

On the "**Demod Settings**" tab, the channel estimation range is set. The settings under "Bursts to Analyze" specify the characteristics of the bursts to be considered in the measurement results. The settings under "Tracking" allow various errors in measurement results to be compensated for.

On the "**Frame Global**" tab, the common settings associated with the frame to be analyzed can be modified.

On the "**Frame Config**" tab, the settings associated with the frame configuration can be modified. The "Zone"/"Segment List" and the "Burst List" are displayed.

The content of the selected list is graphically displayed under the "Zone"/"Segment Map" and the "Burst Map", respectively. To edit "Frame Config" tab, softkeys are available (see the table below).

For IEEE 802.16e-2005 OFDMA/WiBro the "Demod Settings" dialog box contains the following elements:

Tab	Pane	Field, List or Softkey	Standard Restrictions	
Demod Settings	Channel Estimation Range	Downlink (DL)	IEEE 802.16e-2005 OFDMA/WiBro	
		Uplink (UL)	IEEE 802.16e-2005 OFDMA/WiBro	
	Bursts to Analyze	Modulation Analysis Scope	IEEE 802.16e-2005 OFDMA/WiBro	
		Demodulator	IEEE 802.16e-2005 OFDMA/WiBro	
		Tracking Settings	Phase	IEEE 802.16e-2005 OFDMA/WiBro
	Timing		IEEE 802.16e-2005 OFDMA/WiBro	
	Level		IEEE 802.16e-2005 OFDMA/WiBro	
	Channel Est. based on			
		Pilots for Tracking DL		
		Pilots for Tracking UL	IEEE 802.16e-2005 OFDMA/WiBro	
	Advanced	FFT Offs Rel to CP Center	IEEE 802.16e-2005 OFDMA/WiBro	
	Frame Global	Frame	Use for analysis	IEEE 802.16e-2005 OFDMA/WiBro
			File Name	
IDCell				
DL Subframe		Preamble Mode	IEEE 802.16e-2005 OFDMA/WiBro	
		Preamble Index	IEEE 802.16e-2005 OFDMA/WiBro	
		Used Subchannel Bitmap	IEEE 802.16e-2005 OFDMA/WiBro	
UL Subframe		UL Control Region Len	IEEE 802.16e-2005 OFDMA/WiBro	
		Frame Number		
		Allocated Subchannel Bitmap	IEEE 802.16e-2005 OFDMA/WiBro	
		Frame Config	List Zone/Burst	IEEE 802.16e-2005 OFDMA/WiBro
Copy Zone/Burst	IEEE 802.16e-2005 OFDMA/WiBro			
Insert Zone/Burst	IEEE 802.16e-2005 OFDMA/WiBro			
New Zone/Burst	IEEE 802.16e-2005 OFDMA/WiBro			
New Segment	IEEE 802.16e-2005 OFDMA/WiBro			
Delete Zone/Burst	IEEE 802.16e-2005 OFDMA/WiBro			
File Manager	IEEE 802.16e-2005 OFDMA/WiBro			

Standard (General Settings dialog box)

Displays a list of all installed standards to select the WiMAX / WiBro standard. This is necessary to ensure that the measurements are performed according to the specified standard with the correct limit values and limit lines.

→ Remote: [CONF:STAN 0](#)

Frequency (General Settings dialog box)

Specifies the center frequency of the signal to be measured. If the frequency is modified, the "Channel No" field is updated accordingly.

→ Remote: [FREQ:CENT 100MHz](#)

Channel No (General Settings dialog box)

Specifies the channel to be measured. If the "Channel No" field is modified, the center frequency is derived according to the section in the standard mentioned below and updated.

- ◆ For the Licensed Bands {ETSI, MMDS, WCS}:
Channel numbers are supported according to IEEE Std 802.16-2004 "8.3.10.2 Transmitter channel bandwidth and RF carrier frequencies". For the target frequency bands see IEEE Std 802.16-2004 "B.1 Targeted frequency bands".
 - ◆ For the License Exempt Bands {U-NII, CEPT}:
Channel numbers are supported according to IEEE Std 802.16-2004 "8.5.1 Channelization".
- Remote: [CONF:CHAN 9](#)

Frequency Band (General Settings dialog box)

Specifies the relationship between the "[Channel BW](#)" and the "[Sample Rate](#)" parameters.

- Remote: [CONF:WIM:FBAN ETSI](#)

FFT Size N_{FFT} (General Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the maximum number of carriers supported by the signal to be measured.

- Remote: [CONF:WIM:NFFT FFT2048](#)

Channel BW (General Settings dialog box)

Specifies the bandwidth of the channel to be measured.

- Remote: [BAND:CHAN 7MHZ](#)

F_s/BW to Std (General Settings dialog box)

Specifies the ration of the Sample Rate (F_s) to Channel Bandwidth (BW). This ration can either be set to auto (as specified by the selected standard), or manually specified.

- Remote: [CONF:WIM:FSBW:AUTO OFF](#)
- Remote: [CONF:WIM:FSBW:FS 2.5](#)
- Remote: [CONF:WIM:FSBW:BW 1.5](#)

Sample Rate (General Settings dialog box)

Specifies the sample rate used for IQ measurements.

- Remote: [TRACE:IQ:SRAT 2000000](#)

G = T_g/T_b (General Settings dialog box)

Specifies the guard time ratio.

- Remote: [CONF:WIM:IGR 16](#)

Signal Level (General Settings dialog box)

Specifies the expected mean level of the RF input signal. If an automatic level detection measurement has been executed the signal level (RF) is updated.

→ Remote: [CONF:POW:EXP:RF 9](#)

Auto Level (General Settings dialog box)

Activates or deactivates the automatic setting of the reference level for measurements.

On The reference level is measured automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times. For details about automatic level detection refer to "[Performing the level detection](#)".

Off The reference level is defined manually in the "[Signal Level](#)" field.

→ Remote: [CONF:POW:AUTO 1](#)

→ Remote: [CONF:POW:AUTO:SWE:TIME 200MS](#)

Ext Att (General Settings dialog box)

Specifies the external attenuation or gain applied to the RF signal. A positive value indicates attenuation, a negative value indicates gain. All displayed power level values are shifted by this value.

→ Remote: [DISP:TRAC:Y:RLEV:OFFS 10](#)

Capture Time (General Settings dialog box)

Specifies the time (and therefore the amount of data) to be captured in a single measurement sweep.

→ Remote: [SWE:TIME 10ms](#)

Burst Count (General Settings dialog box)

Activates or deactivates a specified number of bursts for capture and analysis.

On The data analysis is performed over a number of consecutive sweeps until the required number of bursts has been captured and analyzed.

Off The data analysis is performed on a single measurement sweep.

→ Remote: [BURS:COUN:STAT ON](#)

Bursts to Ana. (General Settings dialog box)

Specifies the number of bursts to be measured, if the "[Burst Count](#)" option is activated. If the number of bursts of the specified type is not contained in a single measurement sweep, the measurement sweeps continue until the requested number of bursts have been captured.

→ Remote: [BURS:COUN 16](#)

Sweep Time (General Settings dialog box)

Specifies the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements:

- ◆ If the "Auto" option is activated, the sweep time is calculated automatically.
- ◆ If the "Auto" option is deactivated, specify the sweep time.
- Remote: [SWE:ACPR:TIME 1S](#)
- Remote: [SWE:ACPR:TIME:AUTO OFF](#)

Sweep Count (General Settings dialog box)

Specifies the number of sweeps to be performed for Spectrum ACP/ACPR and Spectrum Mask measurements.

- Remote: [SWE:COUNT 64](#)

Trigger Mode (General Settings dialog box)

Sets the source of the trigger for the measurement sweep.

- "Free Run" The measurement sweep starts immediately.
- "External" The measurement sweep starts if the external trigger signal meets or exceeds the external trigger level (a fixed value that cannot be altered) at the input connector EXT TRIGGER/GATE IN on the rear panel.
- "Power" The measurement sweep starts if the signal power meets or exceeds the specified power trigger level.

- Remote: [TRIG:MODE IMM](#)

Trigger Offset (General Settings dialog box)

Specifies the time offset between the trigger signal and the start of the sweep. A negative value indicates a pre-trigger. This field is not available in the "Free Run" trigger mode.

- Remote: [TRIG:HOLD 500us](#)

Power Level (General Settings dialog box)

Specifies the trigger level if the Power trigger mode is set (see "[Trigger Mode](#)" field).

- Remote: [TRIG:LEV:POW 10 DBM](#)

Auto Level (General Settings dialog box)

Activates or deactivates the automatic measurement of the power trigger level if the "Power" trigger mode is set (see "[Trigger Mode](#)" field).

- On The power trigger level is measured automatically at the start of each measurement sweep. This ensures that the power trigger level is always set at the optimal level for obtaining accurate results but will result in a slightly increased measurement times.
- Off The power trigger level is defined manually in the "[Power Level](#)" field.

- Remote: [TRIG:LEV:POW:AUTO ON](#)

Auto Level (General Settings dialog box)

Activates or deactivates the automatic setting of the reference level for measurements.

On The reference level is measured automatically at the start of each measurement sweep. This ensures that the reference level is always set at the optimal level for obtaining accurate results but will result in slightly increased measurement times. For details about automatic level detection refer to "[Performing the level detection](#)".

Off The reference level is defined manually in the "[Auto Level](#)" field.

- Remote: [CONF:POW:AUTO 1](#)
- Remote: [CONF:POW:AUTO:SWE:TIME 200MS](#)

Auto Track Time (General Settings dialog box)

Specifies the sweep time used for the automatic level measurements.

- [Remote: CONF:POW:AUTO:SWE:TIME 200MS](#)

Ref Level (General Settings dialog box)

Specifies the reference level to use for measurements. If the reference level is modified, the signal level is updated accordingly (depending on the currently selected standard and measurement type). If you select a Ref. Level manually, the "[Auto Level](#)" is deactivated.

- Remote: [DISP:TRAC:Y:RLEV?](#)

RF Att. (General Settings dialog box)

Specifies the settings for the attenuator. This field is only editable if the "[Auto Level](#)" option is deactivated. If the "[Auto Level](#)" option is activated, the RF attenuator setting is coupled to the reference level setting.

- Remote: [INP:ATT 30dB](#)

Swap IQ (General Settings dialog box)

Activates or deactivates the inverted I/Q modulation.

On I and Q signals are interchanged.

Off Normal I/Q modulation.

- Remote: [SWAP ON](#)

RSSI, CINR avg. (General Settings dialog box)

Specifies the mean and standard deviation for the RSSI and CINR results (see IEEE Std 802.16-2004 "8.3.9.2 RSSI mean and standard deviation", "8.3.9.3 CINR mean and standard deviation").

- Remote: [CONF:WIM:AVER 0.1](#)

List Results Unit (General Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the units for the results in the results summary table.

- Remote: [UNIT:TABL DB](#)

SMU Address (General Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the R&S FSV to download the frame zone setup directly.

→ Remote: [SYST:COMM:TCP:ADDR 192.168.1.1](#)

Burst Type (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the type of burst to be included in measurement analysis. Only one burst type can be selected for the measurement results. The "OFDM" burst type is supported.

Link Mode (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the link mode of bursts that are to be included in measurement analysis. The following link mode types are supported:

"UL" Up Link

"DL" Down Link

→ Remote: [CONF:WIM:LMOD UL](#)

Use FCH Content (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Activates or deactivates the decoding of the captured burst data FCH field.

OFF This is the default setting and cannot be altered currently.

ON Only the bursts with a modulation format matching the format specified in the "Demodulator" list are included in the results analysis.

→ Remote: --

Mod. Detection (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the demodulation of the signal. The following values are supported:

"None" No modulation detection is performed. The signal will be analyzed according to the "Demodulator" setting. Therefore the "Demodulator" setting must match with the modulation format of the subframe. This setting excludes the analysis of multiple modulation formats in a subframe.

"First Symbol" The first data symbol specifies the modulation format, i.e. the signal will be analyzed according to the modulation format of the first data symbol. This setting supports multiple modulation formats in a subframe.

If "First Symbol" is selected, the "Demodulator" setting is disabled and is automatically updated with the modulation scheme detected in the first symbol.

- "User" Only bursts matching the setting in the "Demodulator" list are analyzed. This setting supports multiple modulation formats in a subframe.
- "All" All bursts individual payload modulations are analyzed accordingly. This setting is useful to get an overview of the signal content.

→ Remote: [DEM:FORM:AUTO FIRS](#)

Demodulator (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Defines the modulation format for signal analysis if the Mod. Detection is set to None or User (see "[Link Mode](#)" field).

The measurement application does not distinguish between different coding rates for the same modulation format. If the signal to be analyzed contains the profiles (modulation format A, coding rate B) and (modulation format C, coding rate D), the signal to be analyzed must hold the following condition in order to produce correct measurement results:

$$[A == C \Rightarrow B == D]$$

→ Remote: [DEM:FORM:BAN '16QAM1/2](#)

Subchannelization (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Activates or deactivates the subchannelization, if the "Up Link" mode is set (see "[Link Mode](#)" field). If activated, the subchannel index of uplink bursts is analyzed, defined by the "[Index](#)" field.

→ Remote: [SUBC:STAT ON](#)

Index (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Defines the subchannelization index of uplink bursts to be analyzed. Subchannelization index 16 is the default subchannel with full occupation.

→ Remote: [SUBC 12](#)

UL Phys. Modifier (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies a common UL physical modifier for all uplink bursts.

→ Remote: [SUBC:ULPH 1](#)

Equal Burst Length (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Activates or deactivates the burst selection for measurement analysis according to the range or specific number of data symbols/bytes.

On Only bursts with exactly the number of symbols specified in the "[Data Symbols](#)" field are considered for measurement analysis.

Off Only bursts within the range of data symbols specified by the "[Min Data Symbols](#)" and "[Max Data Symbols](#)" fields are considered for measurement analysis.

→ Remote: [DEM:FORM:BAN:SYMB:EQU ON](#)

Data Symbols (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the number of symbols that a burst must have to be considered for measurement analysis. This field is only available if the "[Equal Burst Length](#)" option is activated.

→ Remote: [DEM:FORM:BAN:SYMB:MIN 16](#)

Min Data Symbols (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the minimum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "[Equal Burst Length](#)" option is deactivated.

→ Remote: [DEM:FORM:BAN:SYMB:MIN 16](#)

Max Data Symbols (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies the maximum number of data symbols that a burst must have to be considered in measurement analysis. This field is only available if the "[Equal Burst Length](#)" option is deactivated.

→ Remote: [DEM:FORM:BAN:SYMB:MAX 1300](#)

Channel Estimation (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Specifies how accurately the EVM results are calculated.

"Preamble" The channel estimation is performed in the preamble as required in the standard.

"Payload" The channel estimation is performed in the payload.

→ Remote: [DEM:CEST ON](#)

Phase (Demod Settings dialog box)

Activates or deactivates the compensation for the phase error. If activated, the measurement results are compensated for phase error on a per-symbol basis.

→ Remote: [TRAC:PHAS ON](#)

Timing (Demod Settings dialog box)

Activates or deactivates the compensation for the timing error. If activated, the measurement results are compensated for timing error on a per-symbol basis.

→ Remote: [TRAC:TIME ON](#)

Level (Demod Settings dialog box, IEEE 802.16-2004 OFDM)

Activates or deactivates the compensation for the level error. If activated, the measurement results are compensated for level error on a per-symbol basis.

→ Remote: [TRAC:LEV ON](#)

Channel Est. based on (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Channel Estimation based on is used to specify if the processing of the Channel Estimation uses the user selected Phase, Timing and Level settings or whether these settings are determined by the DSP, in which case all tracking options are used.

→ Remote: [SENS:TRAC:CEST USER | FULL](#)

Downlink (DL) (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies how channel estimation is performed for downlink signals.

"Preamble Only"	The channel estimation is performed in the preamble only.
"Preamble and Payload"	The channel estimation is performed in the preamble and in the payload (payload comprises pilots and data).
"Payload Only"	The channel estimation is performed in the payload only.

→ Remote: [DEM:CEST PREAMPAYL](#)

Uplink (UL) (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Displays the channel estimation performed for uplink signals.

This field is for information purposes only as channel estimation for uplink signals are always performed in payload only (payload comprises pilots and data).

→ Remote: --

Modulation Analysis Scope (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Displays the modulation formats to be analyzed.

This field is for information purposes only as all detected modulation schemes are analyzed.

→ Remote: --

Demodulator (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Displays the modulation scheme detected in the analyzed signal. For signals using multiple modulation schemes, the modulation scheme with the highest data rate is displayed. The field also indicates the limits that are applied to the EVM results in the table or results.

This field is for information purposes only.

→ Remote: [DEM:FORM:BAN?](#)

Pilots for Tracking DL (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies how, for downlink signals, the pilot sequence is determined for tracking purposes.

"According to Standard"	The pilot sequence is computed according to the standard.
"Detected"	The pilot sequence uses the values detected in the signal.

→ Remote: [TRAC:PIL DET](#)

Pilots for Tracking UL (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Displays how, for uplink signals, the pilot sequence is determined for tracking purposes.

This field is for information purposes only as tracking is performed according to the selected standard.

→ Remote: --

FFT Offs Rel to CP Center (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Adds an offset to the FFT starting point determined by the application.

The setting range is from -100% to +100% of the cyclic prefix (CP) length. In the case of 0%, the optimal FFT starting point, determined by the application, is used. This is the default setting.

→ Remote: [FFT:OFF 0](#)

Use for analysis (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

The option specifies whether the analysis should be performed using the current user-defined configuration, or whether automatic determination of the frame configuration should be performed.

◆ Predefined MAP:

Uses the current user-defined configuration

◆ Signal MAP:

Performs an additional initial sweep to determine the configuration from the signal.

Automatic detection of the frame configuration requires several measurement parameters to be correctly configured:

Frequency, Sample Rate / Channel Bandwidth, FFT size, Guard Time, IDCell and Preamble Index (if not in the range 0 - 96).

The current release supports Signal MAP determination for DL signals only.

**Note**

Loading a WiMAX file automatically sets "Predefined MAP"

File Name (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Displays the name of the loaded *.WIMAX settings file. If no file is loaded the '...' is displayed.

This field is for information purposes only.

→ Remote: --

IDCell (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the downlink IDCell number and affects the definition of the preamble sequence (in conjunction with the used segments according to the "[Used Subchannel Bitmap](#)" setting), the pilot sequence of the first zone and the subchannel definition of the first zone.

→ Remote: [CONF:WIM:DLSF:IDC 0](#)

Preamble Mode (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies how the preamble index is calculated.

"Auto" The preamble index is automatically calculated according to the "[IDCell](#)" and "[Used Subchannel Bitmap](#)" parameters.

"User" The preamble index can be specified manually, i.e. the preamble pattern is chosen according to the standard using the "[Preamble Index](#)" parameter.

→ Remote: [CONF:WIM:DLSF:PMOD AUTO](#)

Preamble Index (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the preamble pattern (according to the standard) to be used, if the "[Preamble Mode](#)" parameter is set to "User".

→ Remote: [CONF:WIM:DLSF:PIND 31](#)

Used Subchannel Bitmap (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Assigns subchannel groups to segments, see [802.16e-2005], page 360, table 268a "Subchannel index of the six subchannel groups". This table defines how many subchannels are available for the "Burst List" ("Frame Config" tab) belonging to the corresponding segment of a DL-PUSC zone (with Use All Subchannels being false). In the burst list - corresponding to the segment - this selection controls the height of the white area in the burst map.

→ Remote: [CONF:WIM:DLSF:SEGM1 63](#)

UL Control Region Len (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

UL Control Region Length specifies the length, in symbols, of a control region to be found at the start of any UL zone.

The control region will not be analysed, but the length must be specified to allow synchronisation.

→ Remote: [CONF:WIM:ULSF:CRLength](#)

Frame Number (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the number of the frame to be analyzed. For UL subframe analysis, the frame number must be constant for the signal to be analyzed.

→ Remote: [CONF:WIM:ULSF:FRAM 0](#)

Allocated Subchannel Bitmap (Demod Settings dialog box, IEEE 802.16e-2005 OFDMA/WiBro)

Specifies the subchannels to be analyzed.

This parameter is for information purposes only as all subchannels are used in the UL subframe.

→ Remote: --

List Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)

Sets the focus on the ["Zone"/"Segment List"](#) or the ["Burst List"](#) to enter and modify data. To insert, copy, and delete rows, use the softkeys available with the "Frame Config" tab.

The content of the selected list is graphically displayed under the ["Zone"/"Segment Map"](#) and the ["Burst Map"](#) respectively.

The "Zone"/"Segment List" contains the following columns:

Column	Description
ID	Provides a unique ID for the zone. This parameter is read only. If there are any errors in the zone/segment configuration, the background is displayed in red color.
Bursts	Pressing the rotary knob or the "ENTER" key with focus on this field changes the focus to the "Burst List" and displays the Burst Map .
Analyze	Defines the zone/segment to be analyzed. Only one zone/segment can be selected for analysis at any given time.
Zone	Defines the zone type. The following types are supported: DL-PUSC, DL-FUSC, DL-AMC 2 x 3, UL-PUSC, UL-AMC 2 x 3
Segment	Defines the segment for a DL-PUSC zone. For DL-FUSC zones, this parameter has no effect.
Length	Defines the length in OFDMA symbols of the zone. The zone length must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.
Offset	Defines the offset in OFDMA symbols from the start of the subframe. The first DL-PUSC zone starts with 1. The first UL-PUSC zone starts with 0.
PermBase	Specifies the permbase that is required for the calculation of the subchannel - physical carrier assignment permutation.
PRBS_ID	Specifies the permbase ID that is required for the calculation of the pilot sequence.

Figure 61: Definition of the Zone Offset [green arrow] and the Zone Length [violet arrow] parameters from the Zone/Segment List

Demod Settings | Frame Global | Frame Config

Zone/Segment List

ID	Bursts	Analyze	Zone	Segment	Length	Offset	PermBase	PRBS_ID
A	...	✓	DL_PUSC	0	22	1	0	0

Burst List (Zone/Segment ID = A)

ID	Modulation	No. of Subc	No. of Symb	Offset Subc	Offset Symb	Power [dB]	Burst Type
0	QPSK1/2	2	2	0	0	0	DATA
1	QPSK1/2	8	2	2	0	0	DATA
2	16QAM3/4	7	8	0	2	0	DATA
3	64QAM2/3	3	8	7	2	0	DATA

Zone/Segment Map. 1 DL-Zones[22 Symbols], 0 UL-Zones [0 Symbols]

1 22 Symbols

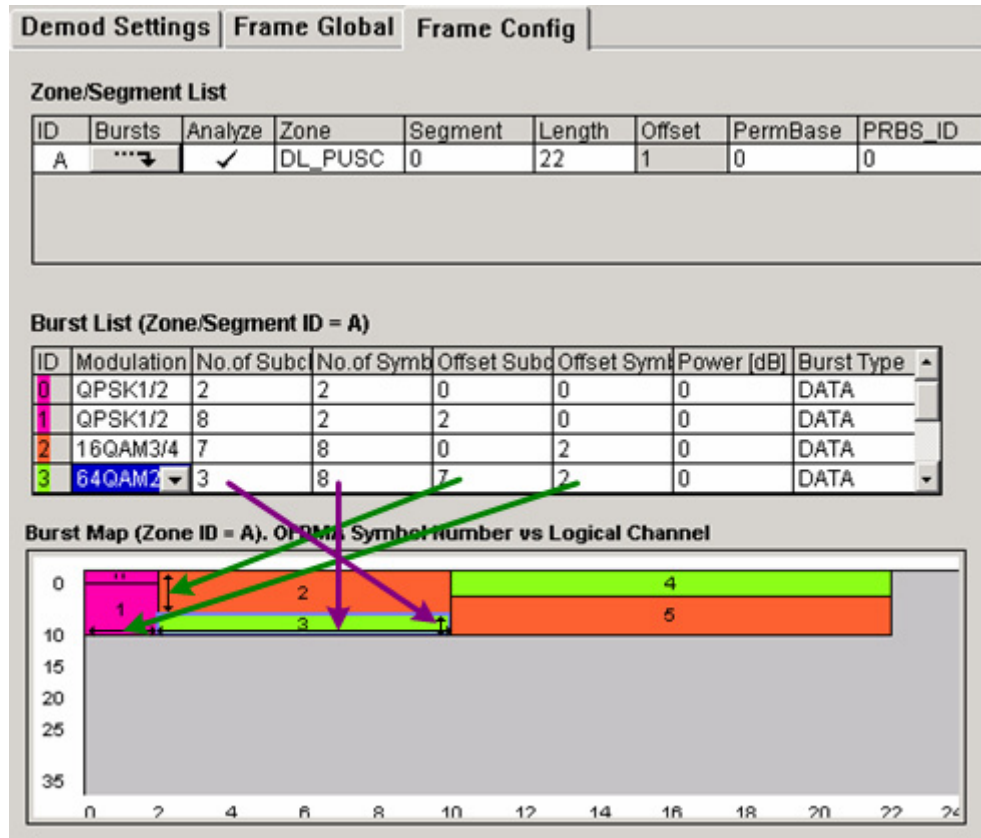
D L P r e s

DL_PUSC, Seg = 0
Zone/Seg ID = A

The "Burst List" contains the following parameters, depending on the zone selection:

Column	Description	Zone restrictions
ID	Provides a unique ID for the burst. This parameter is read only. The background color of this parameter reflects the modulation of the burst. If there are any errors in the burst configuration then the background of this item will be red.	
Modulation	Defines the modulation format of the burst. In the " Burst Map ", identical modulation formats are displays in the same color.	
No. of Subch.	Defines the number of logical subchannels occupied by the burst.	DL_FUSC, DL_PUSC
No. of Symb.	Defines the number of OFDMA symbols occupied by the burst. It must be a multiple of the symbol numbers per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start.	DL_FUSC, DL_PUSC
Duration [Slots]	Specifies the unit of time for the allocating bandwidth.	UL_PUSC
Auto	If selected, the Offset Subch. and the Offset Symb. parameters are set automatically.	UL_PUSC
Offset Subch.	Defines the offset in logical subchannels from subchannel 0.	
Offset Symb.	Defines the offset in OFDMA symbols. It must be a multiple of the number of symbols per slot. If this is not the case, an error message is displayed in the status bar and the measurement does not start. The start of the zone defines symbol 0.	
Power[dB]	Defines the boosting factor of the burst.	
Burst Type	Defines the burst type from the protocol layer perspective.	DL_FUSC, DL_PUSC

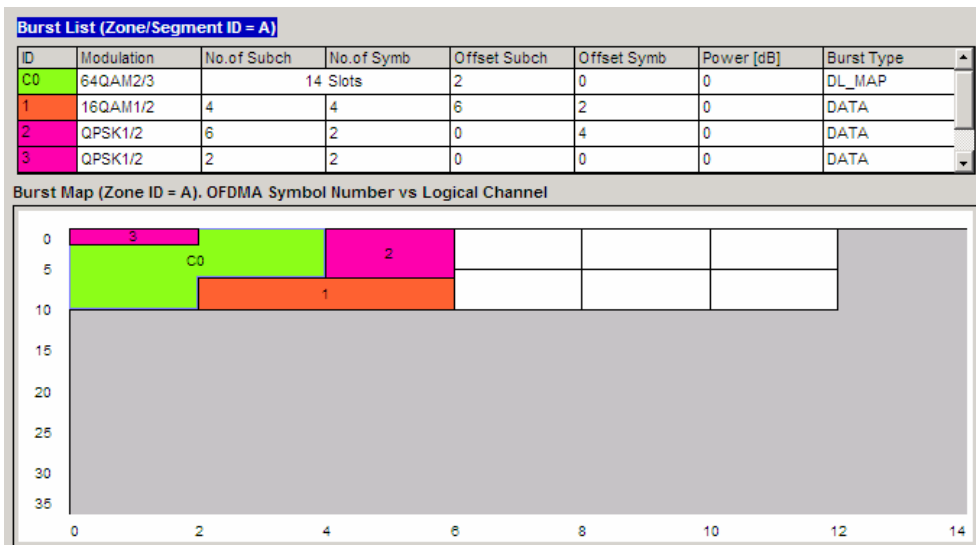
Figure 62: Definition of the Burst Offset [green arrows] and the Burst Length [violet arrows] parameters from the Burst List



Note

If a burst is specified as DL_MAP, the number of slots is specified instead of the number of subchannels and symbols for the burst.

Figure 63: Zone containing a wrapping DL_MAP burst (C0). Note the shape of the burst, which fills the available symbols in the first column (of two symbols), and then uses the second column.

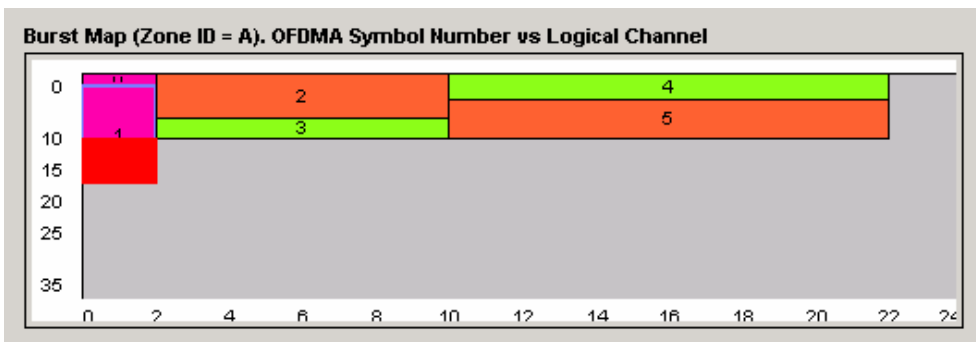


The "Zone"/"Segment Map" and the "Burst Map" display panes are located at the bottom of the "Frame Config" tab. They display a graphical view of the selected "Zone"/"Segment List".

- "Zone"/"Segment Map"
Displays a graphical view of the selected ["Zone"/"Segment List"](#).
- "Burst Map"
Displays a graphical view of the selected ["Burst List"](#). The background color of each burst in the diagram match the modulation format of the burst. Any burst that is incorrectly configured is displayed with a red background. The measurement does only start if the frame definition is correct.

Example:

The "Burst Map" with burst 1 exceeds the available amount of logical subchannels. The area causing the problem is highlighted red.



The configuration is corrected by doing one of the following:

- c) Reducing the number of subchannels for burst 1 in the "Burst List".
 - d) Assigning more subchannels to the zone/segment to which burst 1 belongs.
 - e) Increasing NFFT.
- Remote: `CONFigure:WIMax:ZONE<1...26> . . .`, for details see [CONFigure Subsystem \(WiMAX/WiBro, K93\)](#)

Copy Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)

Copies the selected zone or burst to the clipboard.

Insert Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)

Pastes the zone or burst below the focused zone or burst.

New Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)

Inserts a new zone or burst below the focused zone or burst.

- Remote: `CONF:WIM:ZONE1:CONT ON,DLFUSC,0,10,0,0,0` (zone)
- Remote: `CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,1D2,5,10,20,0,0,0,DATA` (burst)

New Segment (IEEE 802.16e-2005 OFDMA/WiBro)

Inserts a new segment below the focused zone/segment. This softkey is only available, if the focus is on the ["Zone"/"Segment List"](#).

Delete Zone/Burst (IEEE 802.16e-2005 OFDMA/WiBro)

Deletes the focused zone or burst.

- Remote: `CONF:WIM:ZONE1:DEL` (zone)
- Remote: `CONF:WIM:ZONE1:BURS1:DEL` (burst)

Display Graph/List

Configures the result display. The measurement results are displayed either in form of a list of measurement points or as a graphical trace.

For details on the result displays refer to ["Result summary list"](#) on page 1028 and ["Result display graph"](#) on page 1030.

- Remote: `DISP:TABL OFF`
- Remote: for result queries see section ["FETCh Subsystem \(WiMAX / WiBro, K93\)"](#)

PVT

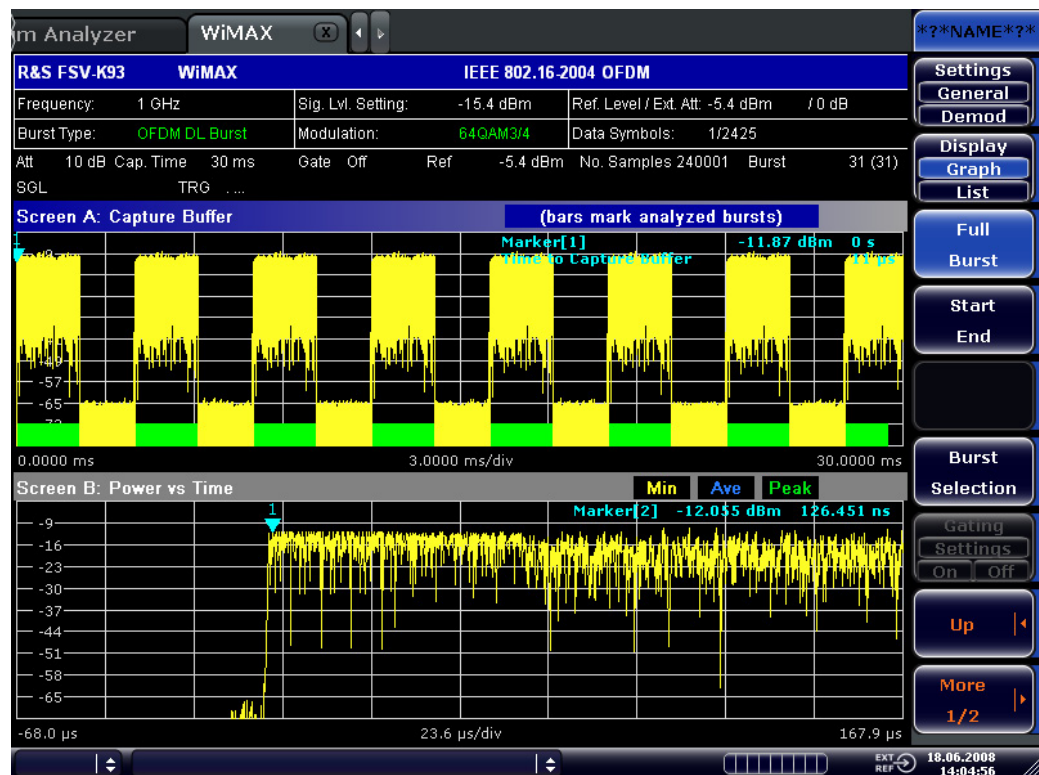
Opens the PVT submenu to select the Power vs Time measurement results.

The PVT result displays show the measured input data over the full range or over complete bursts, displayed within the gating lines if gating is switched on. The results are displayed as a single burst. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the "[Refresh](#)" softkey in the sweep menu.

→ Remote: [CONF: BURS: PVT](#)

Full Burst (IEEE 802.16-2004 OFDM)

Displays the PVT results in a single graph with all burst data being displayed ("Display Graph" selected), or in a list ("Display List" selected).

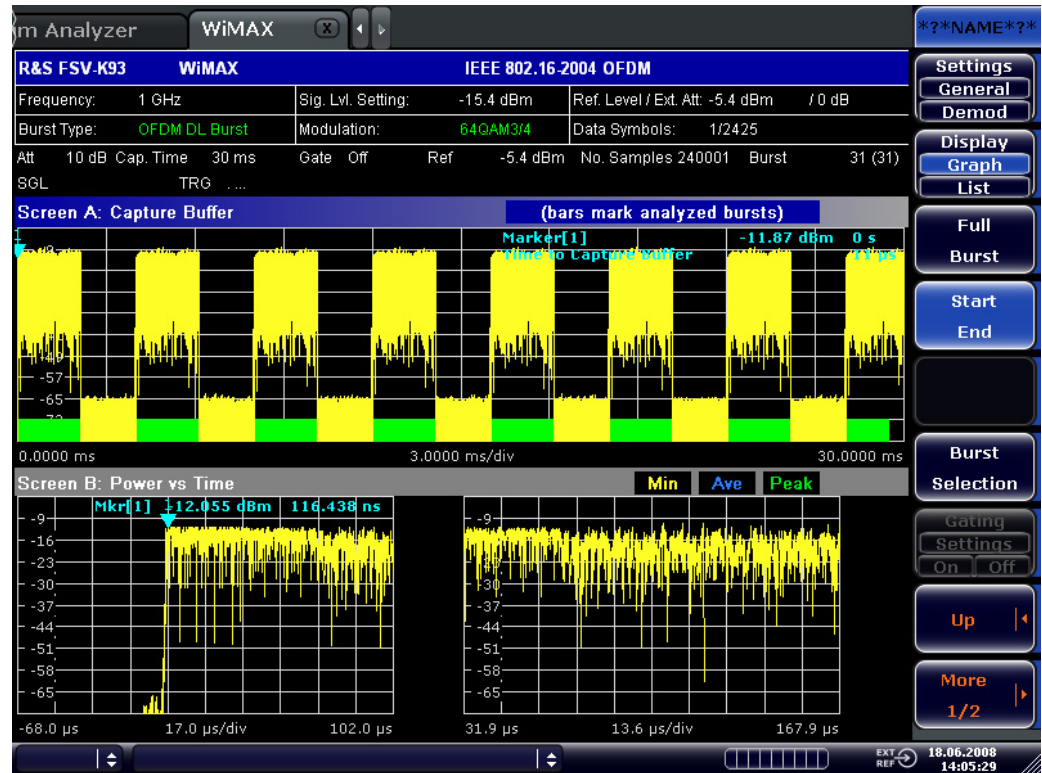


For further details refer to the "[PVT](#)" softkey.

→ Remote: [CONF: BURS: PVT: SEL FULL](#)

Start End (IEEE 802.16-2004 OFDM)

Displays the results in two separate graphs, the left hand side showing the start and the right hand side showing the end of a burst ("Display Graph" selected), or in a list ("Display List" selected).



→ Remote: [CONF:BURS:PVT:SEL_EDGE](#)

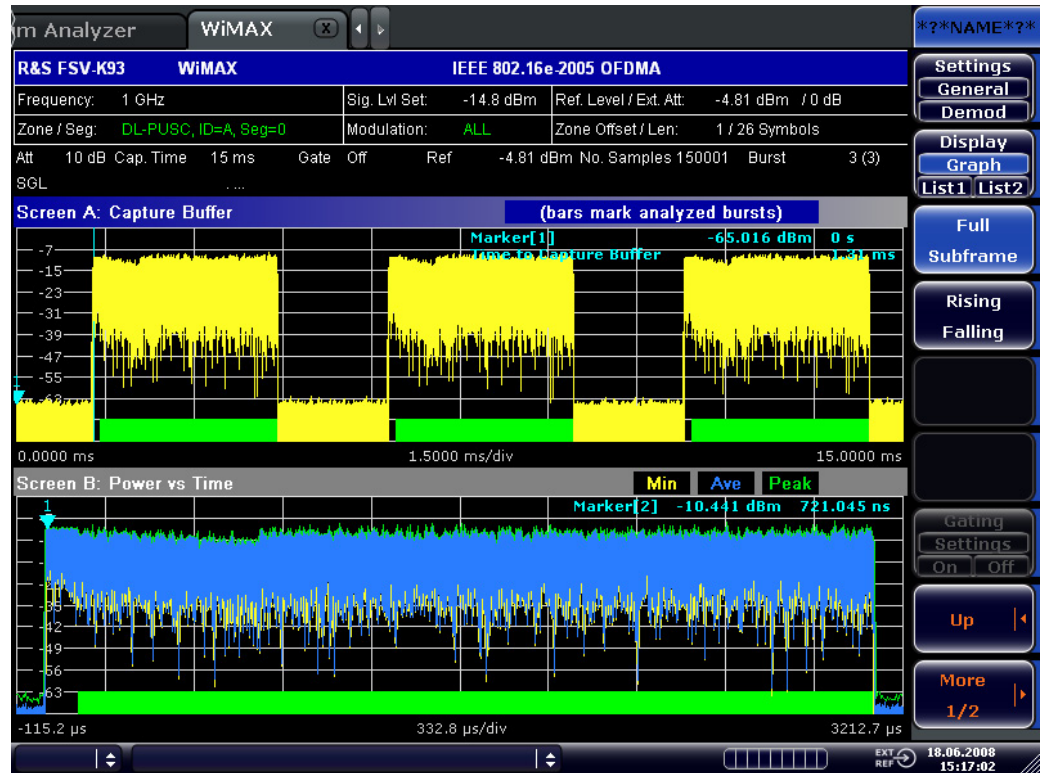
Burst Selection (IEEE 802.16-2004 OFDM)

Opens an edit dialog box to select a burst by entering its number.

→ Remote: [CONF:BURS:PVT:BURS_1](#)

Full Subframe (IEEE 802.16e-2005 OFDMA/WiBro)

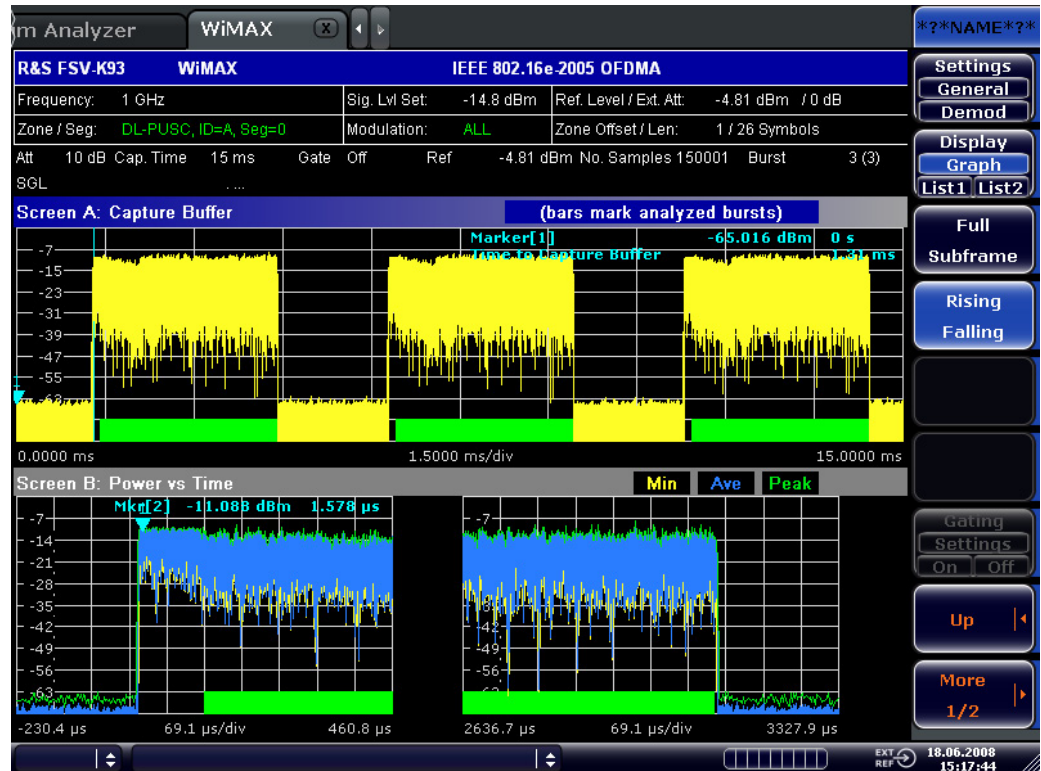
Displays the results in a single graph with the minimum, mean, and maximum power profile of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1"/"2" selected).



→ Remote: [CONF : BURS : PVT : SEL FULL](#)

Rising/Falling (IEEE 802.16e-2005 OFDMA/WiBro)

Displays the results in two separate graphs: the minimum, mean, and maximum power profile of rising (on the left hand) respective falling (on the right hand) edge of the subframe that contains the zone selected to be analyzed ("Display Graph" selected), or in two lists ("Display List 1"/"2" selected).



→ Remote: [CONF:BURS:PVT:SEL_EDGE](#)

Gating Settings On/Off (Spectrum Mask, Spectrum FFT, Spectrum ACPR, CCDF)

Activates or deactivates gating, or opens the "Gate Settings" dialog box to specify range of captured data used in results calculation.

Gate Settings		
	Time	Samples
Delay	129 μs	2579
Length	196 μs	3920
Link Gate and Marker	<input type="checkbox"/>	

- On Uses only the specified range of captured data in results calculation. In the Magnitude Capture Buffer trace, two vertical lines mark the specified range.
- Off Uses all the captured data in results calculation.

In the "Gate Settings" dialog box, the following parameters are set:

"Delay"	Start point of captured data to be used in results calculation, i.e. the delay from the start of the captured data in time or samples. If the delay is specified in time, the number of samples is updated accordingly, and vice versa.
"Length"	Amount of captured data to be used in results calculation. If the length is specified in time, the number of samples is updated accordingly, and vice versa.
"Link Gate and Marker"	If activated, the position of the marker and the gate lines are linked. The marker is positioned half way between gate start and end. The marker position alters if the gate is modified, and the gate lines move with the marker if the marker position is altered.

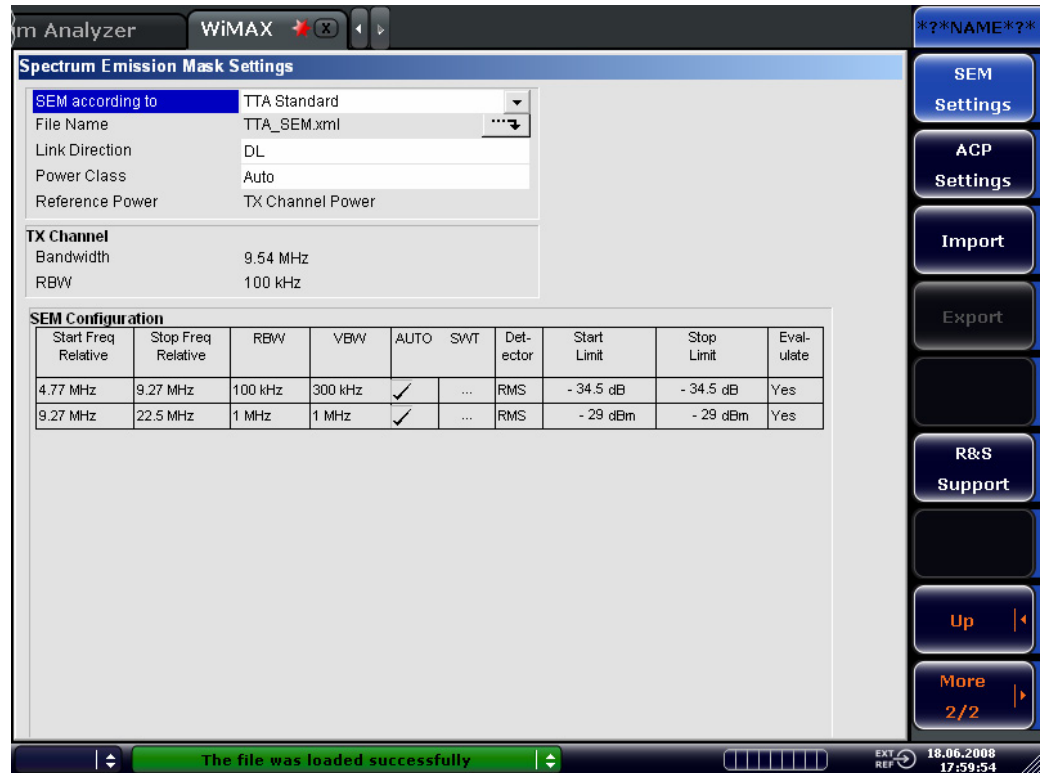
The gate settings are defined for following measurements: Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR.

If a frequency sweep measurement is active (Spectrum Mask and Spectrum ACP), the result display is switched to the Magnitude Capture Buffer display in order to help defining the gate settings correctly.

- Remote: [SWE:EGAT ON](#)
- Remote: [SWE:EGAT:HOLD 125us](#), [SWE:EGAT:HOLD:SAMP 2500](#) (Delay)
- Remote: [SWE:EGAT:LENG 100ms](#), [SWE:EGAT:LENG:SAMP 2000000](#) (Length)
- Remote: [SWE:EGAT:LINK ON](#) (Link Gate and Mark)

SEM Settings (IEEE 802.16e-2005 WiBro)

Opens the "Spectrum Emission Mask Settings" dialog box to configure the Spectrum Emission Mask measurement.



"SEM according to"	Specifies how the Spectrum Emission Mask settings and limits are applied: "TTA Standard" - as specified in the standard. "User" - as specified in the selected XML file
"File Name"	Specifies the XML file name
"Link Direction"	Sets the link direction: "UL" - uplink, "DL" - downlink
"Power Class"	Sets the power class: "Auto" - automatic selection ("INF", "23") "dBm", ("23", "INF") "dBm" - power class values for uplink ("INF", "29") "dBm", ("29", "40") "dBm", ("40", "INF") "dBm" - power class values for downlink

The other parameters are set by default.

The "SEM Configuration" shows the settings and limits applied over specified frequency ranges around the TX channel. The settings displayed are dependent on the selected "Link Direction" and "Power Class".

This softkey is available from firmware version 1.60.

- Remote: [POW:SEM:TTA STANDARD](#) (SEM according to)
- Remote: [POW:SEM:MOD UL](#) (Link Direction)
- Remote: [POW:SEM:CLAS 0](#) (Power Class)

Import

Opens the "Choose iqw file to import" dialog box.

Enter the path and the name of the IQ data file you want to import. Focus the "Select" button and press "ENTER" to load the specified IQ data file. The "Select" button becomes active only, if the entered name matches a file name in the selected directory.

- Remote: [M MEM:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'](#)

Export

Opens the "Choose iqw file to export" dialog box.

Enter the path and the name of the IQ data file you want to export. Press "ENTER" to write the IQ data into the specified file. If the file cannot be created or there is no valid IQ data to export an error message is displayed.

- Remote: [M MEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'](#)

R&S Support

Creates files that help identifying the current problem. The files are stored under C:\R_S\Instr\user\Support. If you contact the Rohde&Schwarz support to get help for a certain problem, send these files to the support in order to identify and solve the problem faster.

- Remote: --

EVM Constell

Opens a submenu to select the error vector magnitude (EVM) or the constellation result displays.

EVM vs Symbol/Carrier

Selects the EVM vs Symbol or EVM vs Carrier result displays.

◆ EVM vs Symbol (IEEE 802.16-2004 OFDM)

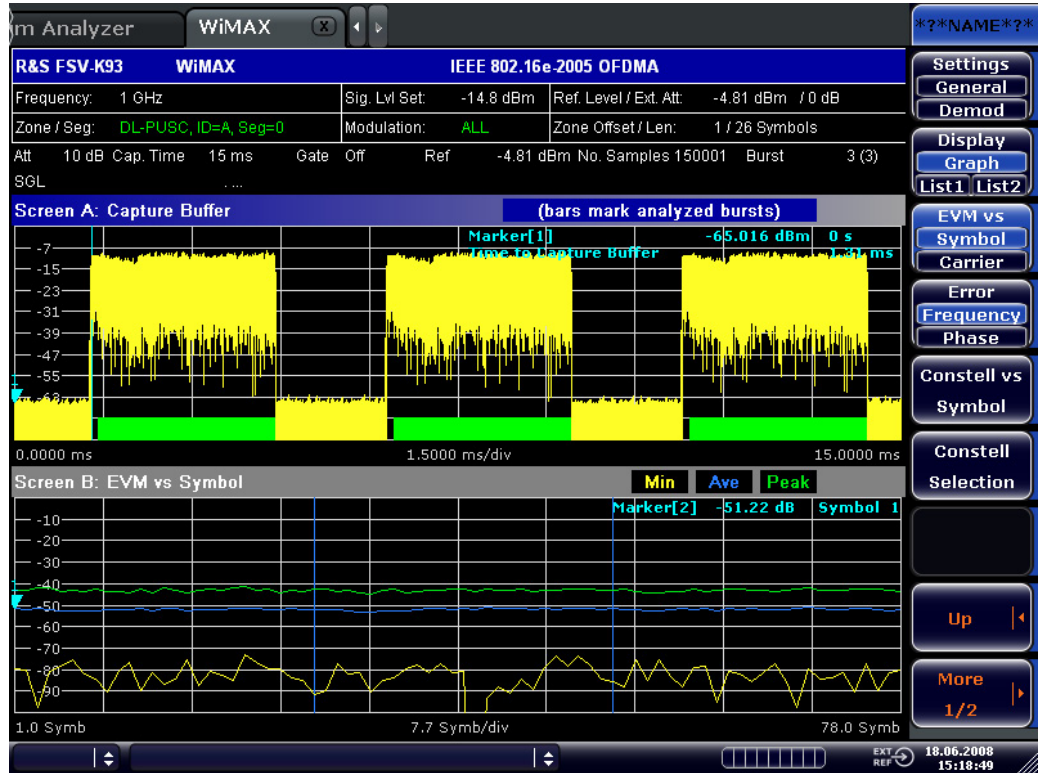
This result display shows the EVM measured over the full range of the measured input data. The results are displayed on a per-symbol basis, with blue vertical lines marking the boundaries of each burst. Note that burst boundary lines are only displayed if the number of analyzed bursts is less than 250. The minimum, average, and maximum traces are displayed.

For the trace labeled with EVM a commonly used EVM definition is applied, which is the square root of the momentary error power normalized by the averaged reference power. For details of this measurements please refer to chapter 2 of the base unit.



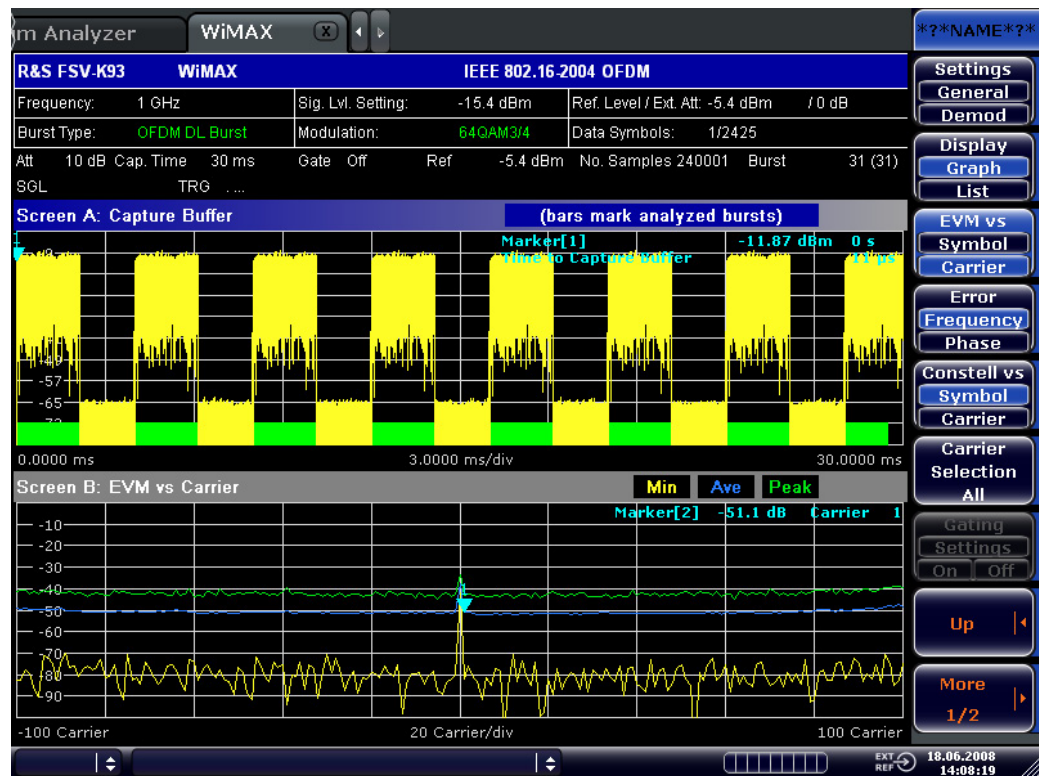
◆ EVM vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)

This result display shows all EVM values versus the symbols of the analyzed zone. If the capture buffer contains more than one analyzed zones, the corresponding result graphs will be appended. The minimum, mean, and maximum statistics is performed over carriers.

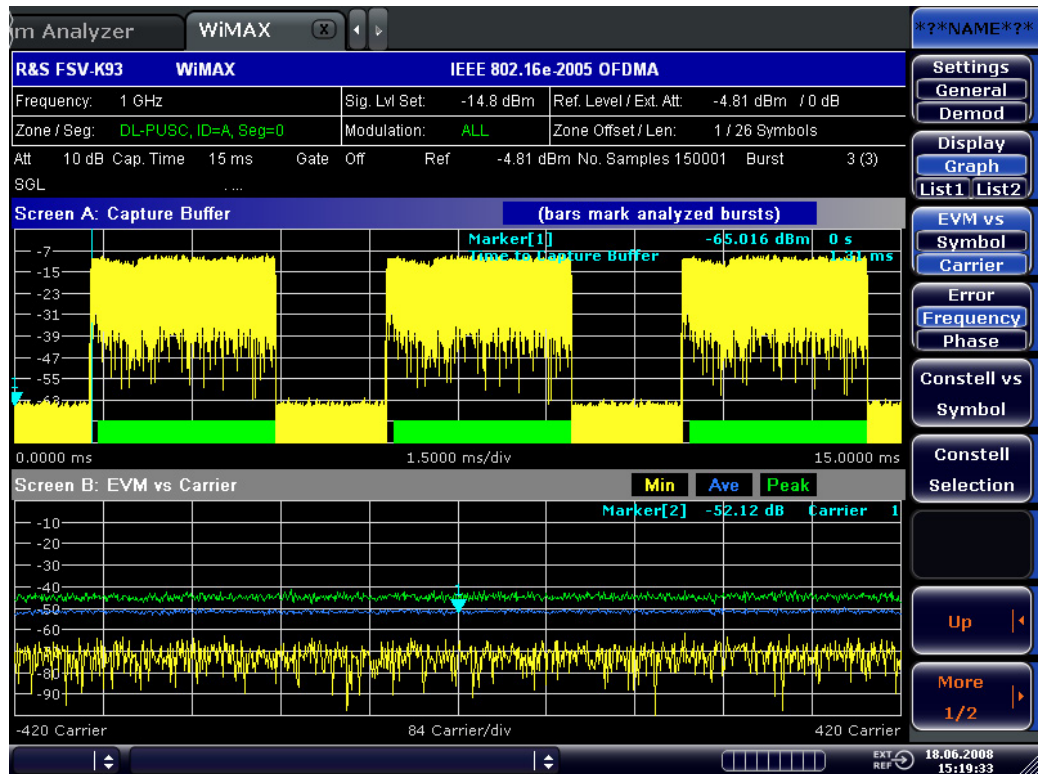


◆ EVM vs Carrier (IEEE 802.16-2004 OFDM)

This result display shows all EVM values recorded on a per-carrier basis over the full set of measured data. The minimum, average and maximum traces are displayed.



- ◆ EVM vs Carrier (IEEE 802.16e-2005 OFDMA/WiBro)
This result display shows all EVM values versus the physical carriers. The minimum, mean, and maximum statistics is performed over the symbols of all analyzed zones in the capture buffer.



- Remote: [CONF:BURS:EVM:ESYM](#) (EVM vs Symbol)
- Remote: [CONF:BURS:EVM:ECAR](#) (EVM vs Carrier)

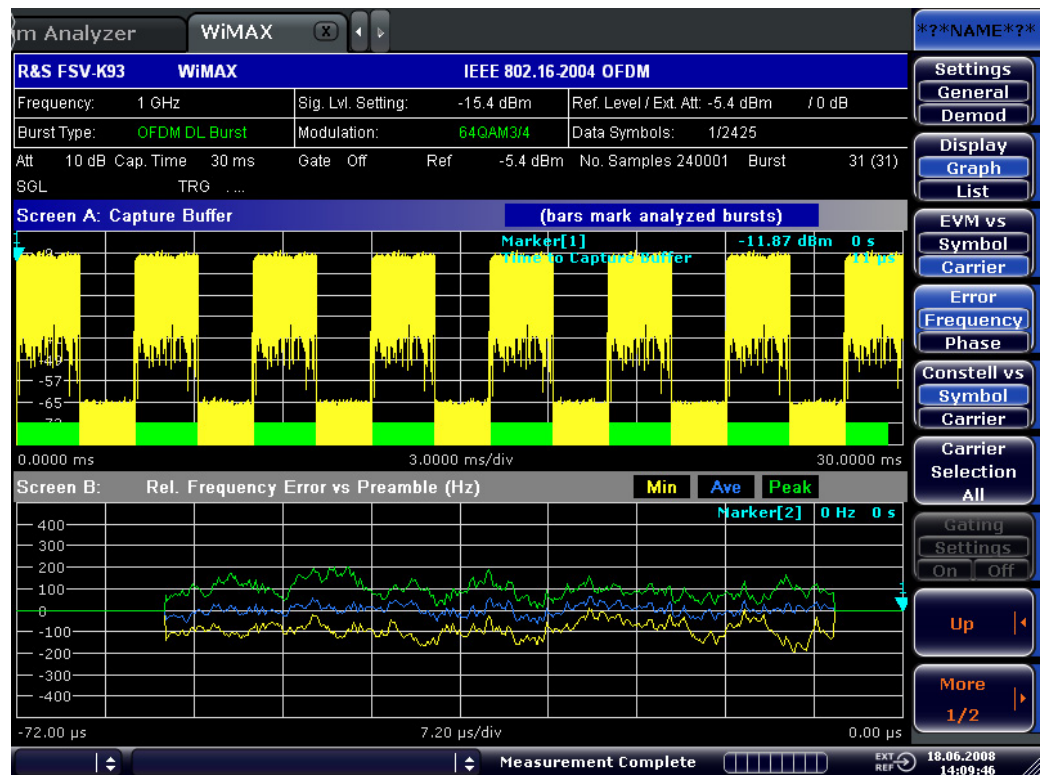
Error Frequency/Phase (IEEE 802.16-2004 OFDM)

Selects the Frequency Error vs Preamble or the Phase Error vs Preamble result displays.

- ◆ Error Frequency/Phase (IEEE 802.16-2004 OFDM)

These result displays show the error values recorded over the preamble part of the burst. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.

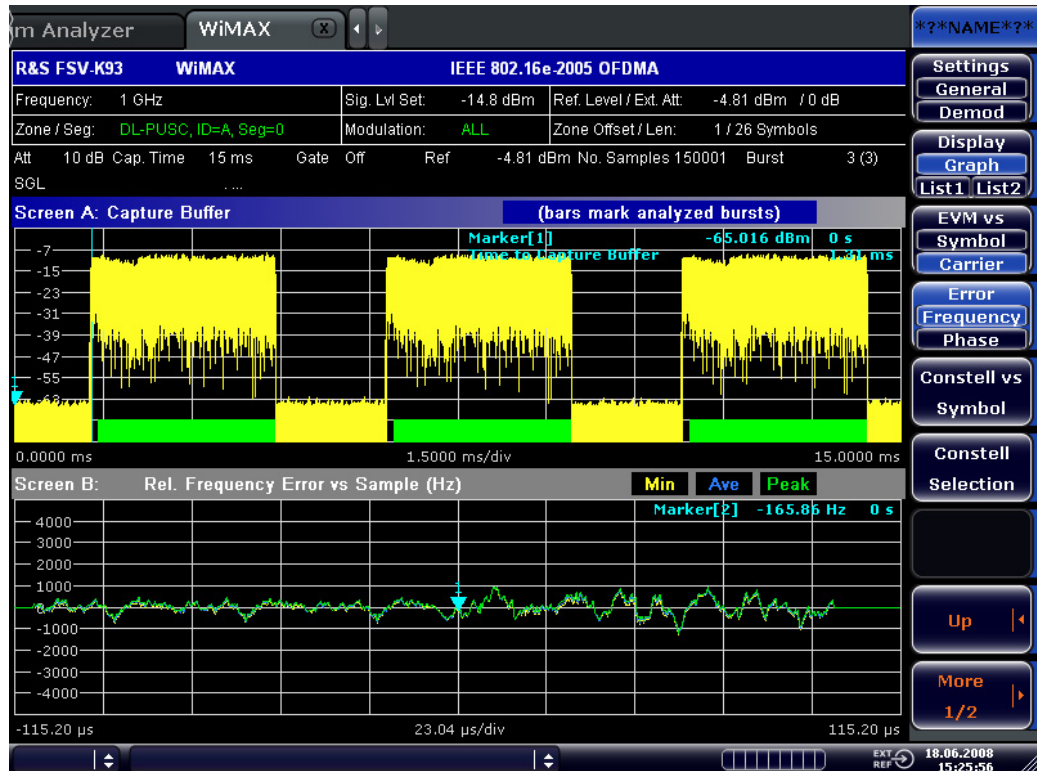
Using the "[Y-Axis/Div](#)" softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.



◆ Error Frequency/Phase (IEEE 802.16e-2005 OFDMA/WiBro)

These result displays show the error values recorded over the first two symbols of the subframe. In OFDMA/WiBro this measurement result is available under the following condition: All subchannels are used by data bursts. A minimum, average and maximum trace are displayed. The results display either relative frequency error or phase error.

Using the "[Y-Axis/Div](#)" softkey, the scaling of the y-axis can be modified to allow the results to be scaled to an optimum level.



- Remote: [CONF : BURS : PRE](#)
- Remote: [CONF : BURS : PRE : SEL_FREQ](#) (Frequency Error vs Preamble)
- Remote: [CONF : BURS : PRE : SEL_PHAS](#) (Phase Error vs Preamble)

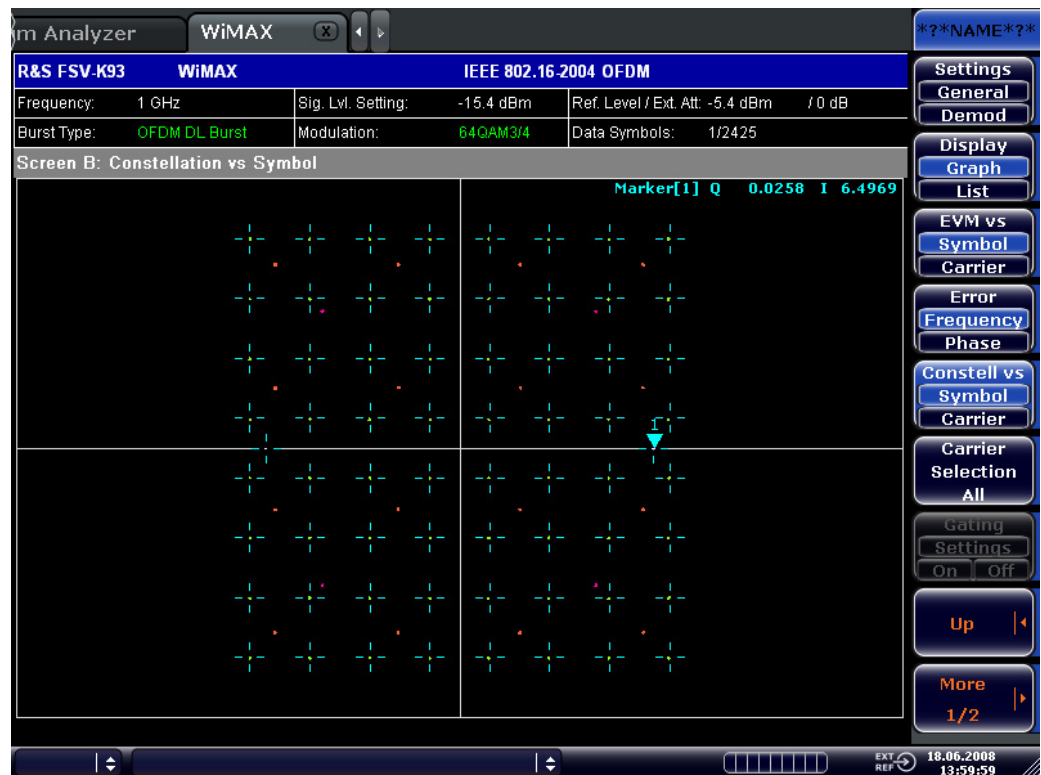
Constell vs Symbol/Carrier

Selects the Constellation vs Symbol or the Constellation vs Carrier result displays.

- ◆ Constellation vs Symbol (IEEE 802.16-2004 OFDM)

This result display shows the in-phase and quadrature phase results over the full range of the measured input data. The ideal points for the selected modulations scheme are displayed for reference purposes.

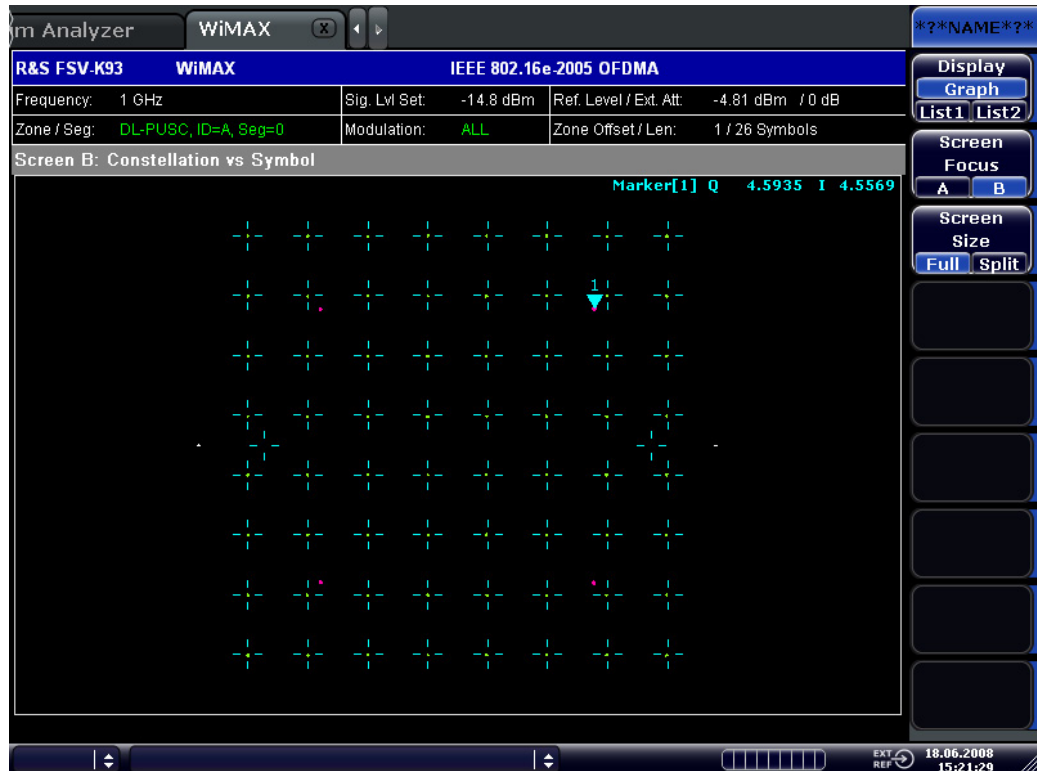
The amount of data displayed in the Constellation result display can be reduced by selecting the carrier or carriers for which data is to be displayed ("[Carrier Selection](#)" softkey).



◆ Constellation vs Symbol (IEEE 802.16e-2005 OFDMA/WiBro)

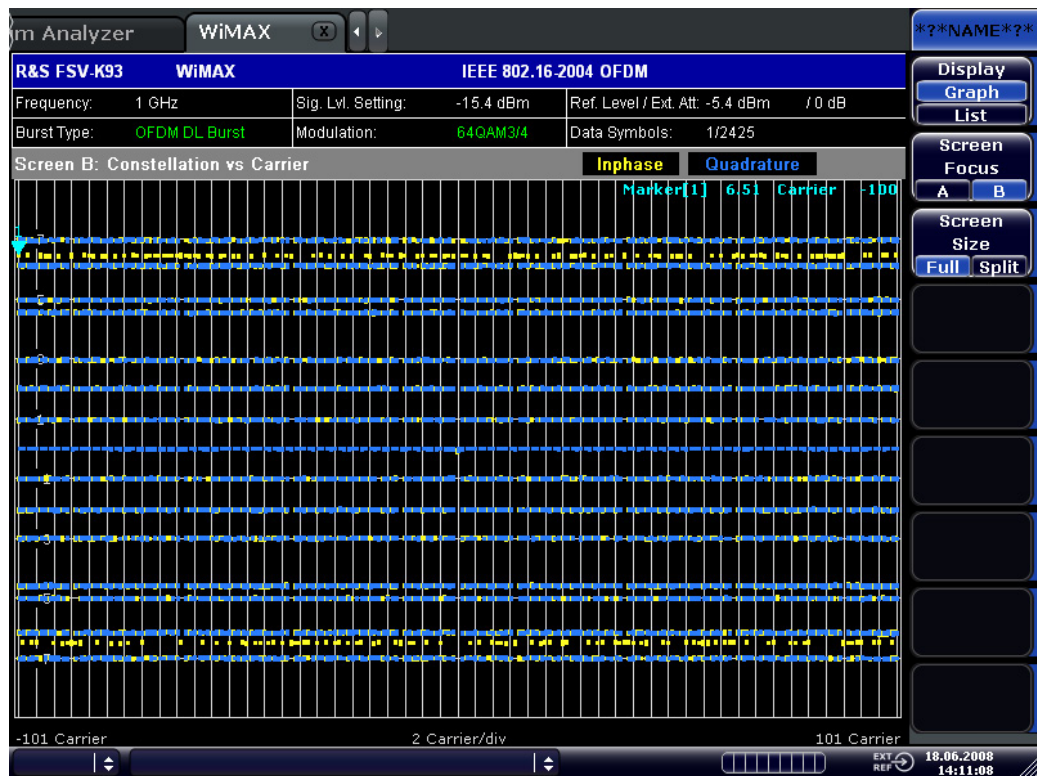
This result display shows the complex constellation diagram of the modulation symbols. The modulation symbols belong to the bursts of the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Bitstream result display.

The amount of data displayed in the Constellation result display can be reduced via the "[Constell Selection](#)" softkey.



◆ Constellation vs Carrier (IEEE 802.16-2004 OFDM)

This result display shows the in-phase and quadrature phase results over the full range of the measured input data plotted on a per-carrier basis. The magnitude of the in-phase and quadrature part is shown on the y-axis, both are displayed as separate traces (I-> trace 1, Q-> trace 2).



→ Remote: [CONF:BURS:CONS:CSYM](#) (Constellation vs Symbol)

→ Remote: [CONF:BURS:CONS:CCAR](#) (Constellation vs Carrier)

Carrier Selection (IEEE 802.16-2004 OFDM)

Opens a dialog box to select the carrier for data display. Either a specific carrier number, pilots only or all carriers can be selected.

→ Remote: [CONF:BURS:CONS:CARR:SEL -26](#)

Constell Selection (IEEE 802.16e-2005 OFDMA/WiBro)

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, burst, symbol, or carrier. If the constellation selection parameters are changed, the result display is updated accordingly.

→ Remote: [CONF:BURS:CONS:SYMB:SEL 1](#) (symbol)

→ Remote: [CONF:BURS:CONS:FORM:SEL QPSK](#) (modulation)

→ Remote: [CONF:BURS:CONS:BURS:SEL 1](#) (burst)

Y-Axis/Div (EVM vs Symbol/Carrier, Error Frequency/Phase)

Opens a dialog box to modify the y-axis settings:

"Auto Scaling"	If activated, the scaling of the y-axis is calculated automatically.
"Per Division"	Specifies the scaling to be used if "Auto Scaling" is deactivated.
"Unit"	Specifies the y-axis unit.

This softkey is only available for the above mentioned measurements if trace data are displayed.

- Remote: [DISP:WIND2:TRAC1:Y:AUTO ON](#) (Auto Scaling)
- Remote: [DISP:WIND2:TRAC1:Y:PDIV 2](#) (Per Division)
- Remote: [UNIT:EVM PCT](#) (Unit - EVM vs Symbol/Carrier)
- Remote: [UNIT:PRE HZ](#) (Unit - Error Frequency/Phase)

Spectrum

Opens a submenu for frequency measurements.

Spectrum Flat./Diff./Group Delay

Sets the Spectrum Flatness result displays in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected).

- ◆ Spectrum Flatness and Spectrum Flatness Group Delay (IEEE 802.16-2004 OFDM)

These result displays show either the Spectrum Flatness or the Group Delay values recorded on a per-carrier basis over the full set of measured data. A minimum, average and maximum trace are displayed for each of the result types. If the Spectrum Flatness result display is selected an upper and lower limit line representing the limits specified for the selected standard are displayed. An overall pass/fail status is displayed for the obtained (average) results against these limit lines.

Figure 64: Spectrum Flatness for IEEE 802.16-2004 OFDM

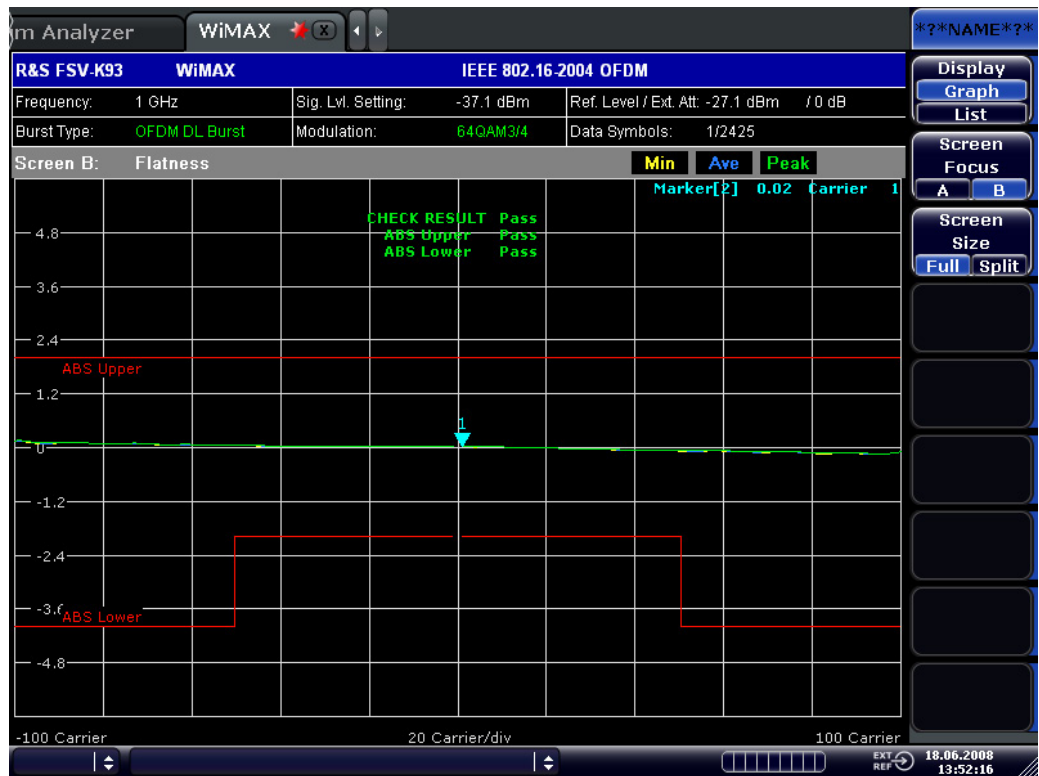
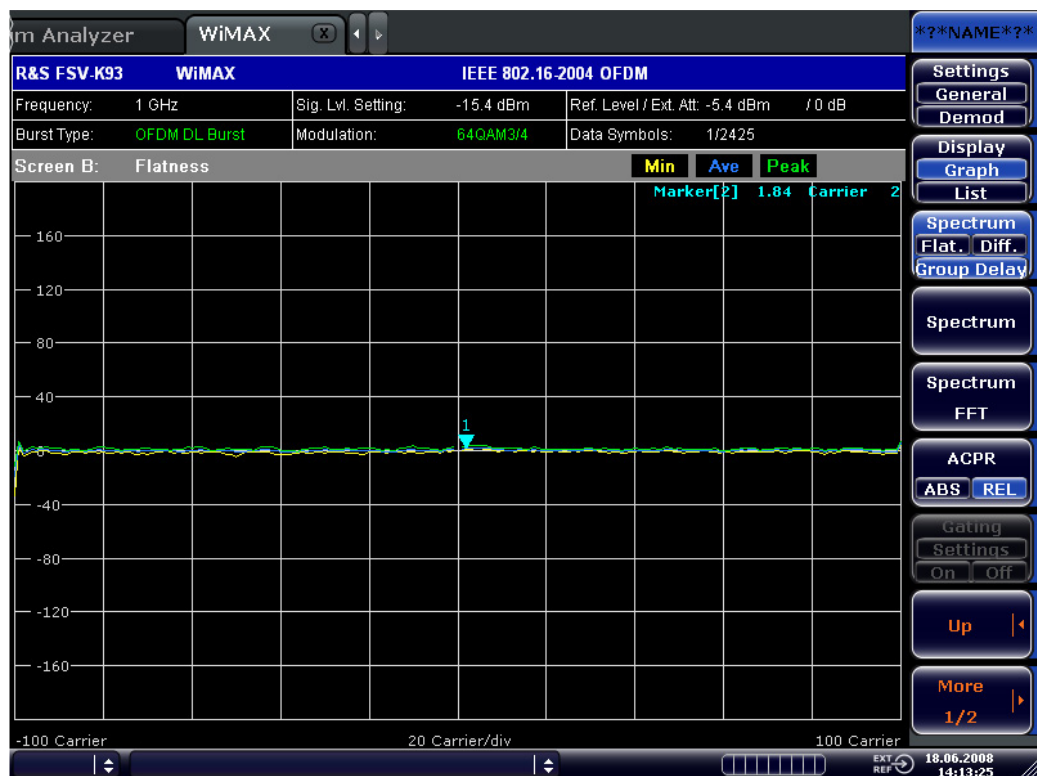


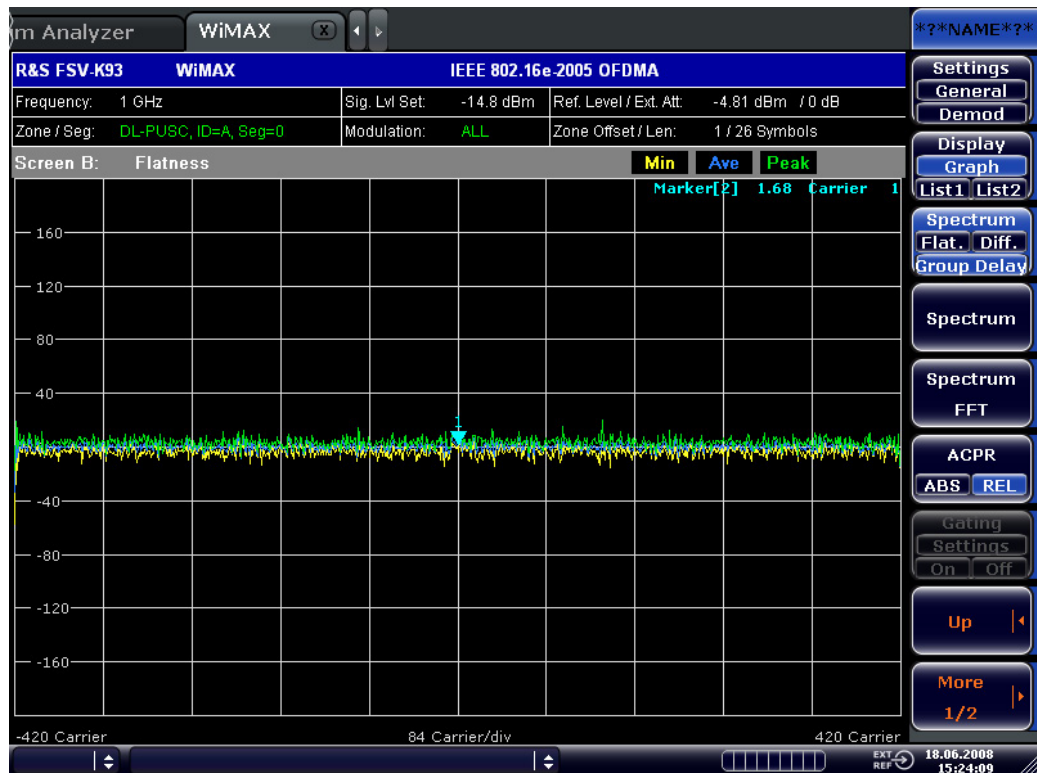
Figure 65: Group Delay for IEEE 802.16-2004 OFDM



◆ Spectrum Flatness and Spectrum Flatness Group Delay (IEEE 802.16e-2005 OFDMA/WiBro)

This result display shows the average energy of the constellations for the physical carriers. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics is performed over the analyzed zones in the capture buffer.

Figure 66: Group Delay for IEEE 802.16e-2005 OFDMA/WiBro

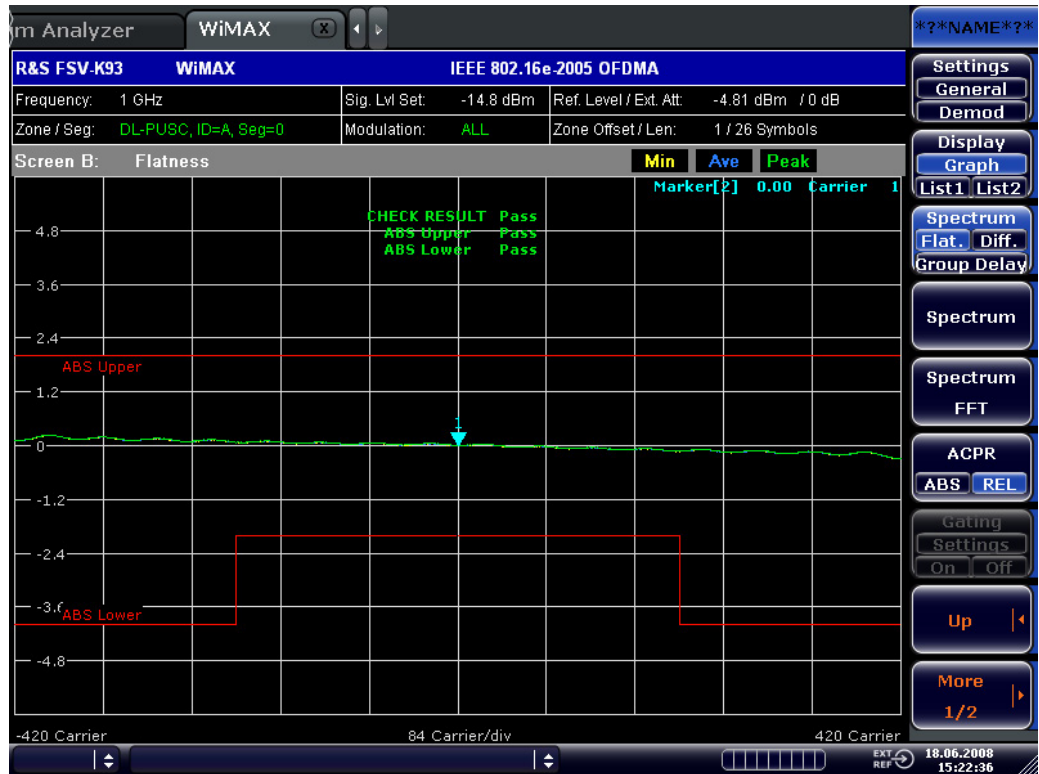


Restrictions on OFDMA/WiBro Group Delay measurements

The measurement requires all useful carriers to be active (for example for a 1024 FFT size, 840 positions are required). This requirement does not depend on the subchannel bitmap, i.e. the bitgroups that are switched on. It solely depends on the FFT size and guard band.

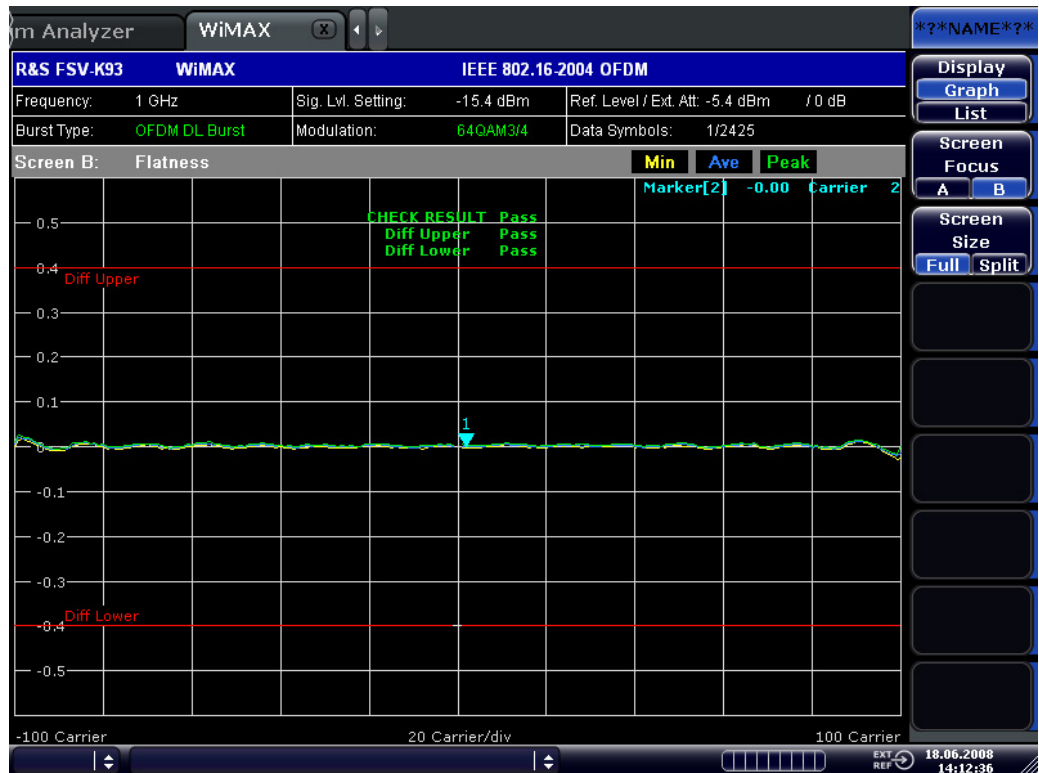
This requirement is affected by the Channel Estimation Range parameters in the Demod Settings:

- If Downlink (DL) = Preamble Only, then the requirement is automatically met.
- If Downlink (DL) = Preamble and Payload / Payload Only, then all bitgroups must be switched on and all channels must be covered by data bursts.

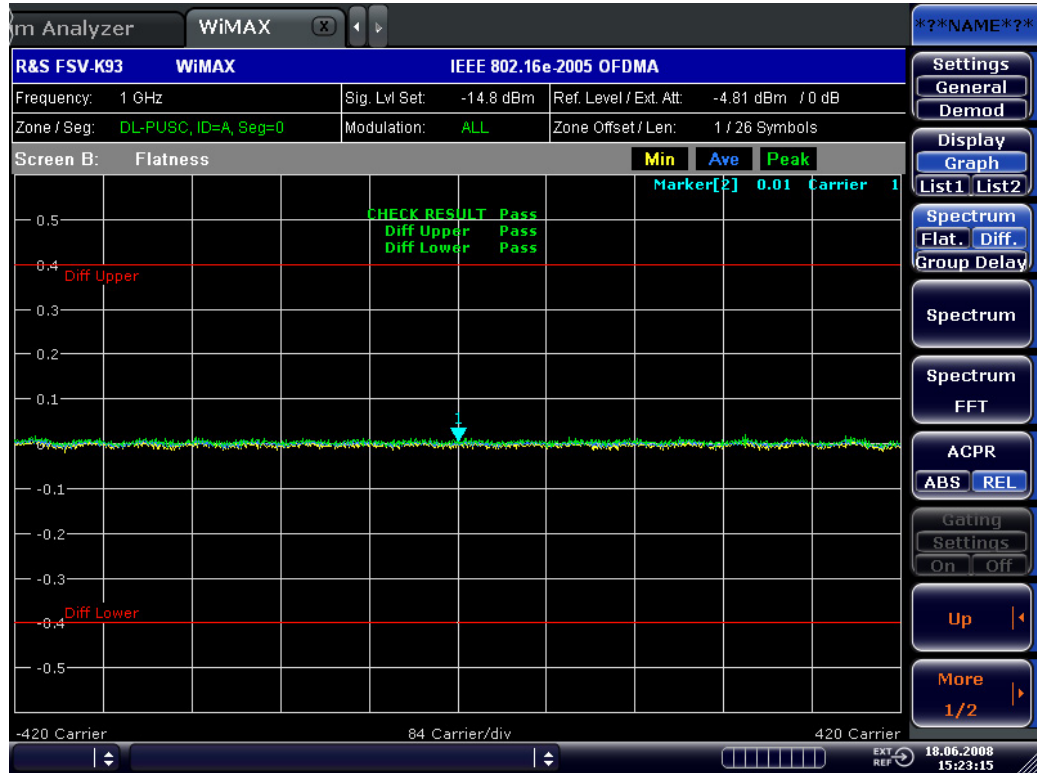


◆ Spectrum Flatness Difference (IEEE 802.16-2004 OFDM)

This result display shows the adjacent carrier power difference of the preamble part of the burst. A minimum, average and maximum trace are displayed.



- ◆ Spectrum Flatness Difference (IEEE 802.16e-2005 OFDMA/WiBro)
This result display shows the absolute difference of adjacent carriers. The limit lines are displayed according to the requirements of the standard. The minimum, mean, and maximum statistics is performed over the analyzed zones in the capture buffer.



- ➔ Remote: [CONF:BURS:SPEC:FLAT](#)
- ➔ Remote: [CONF:BURS:SPEC:FLAT:SEL_FLAT](#) (Spectrum Flatness)
- ➔ Remote: [CONF:BURS:SPEC:FLAT:SEL_GRD](#) (Spectrum Flatness Group Delay)
- ➔ Remote: [CONF:BURS:SPEC:FLAT:SEL_DIFF](#) (Spectrum Flatness Difference)

Spectrum IEEE/ETSI (IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA) /

Spectrum Emission Mask (IEEE 802.16e-2005 WiBro)

Sets the Spectrum (Emission) Mask result display. For the IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA standards, the result is displayed in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected). For the IEEE 802.16e-2005 WiBro standard, graph and table are displayed combined.

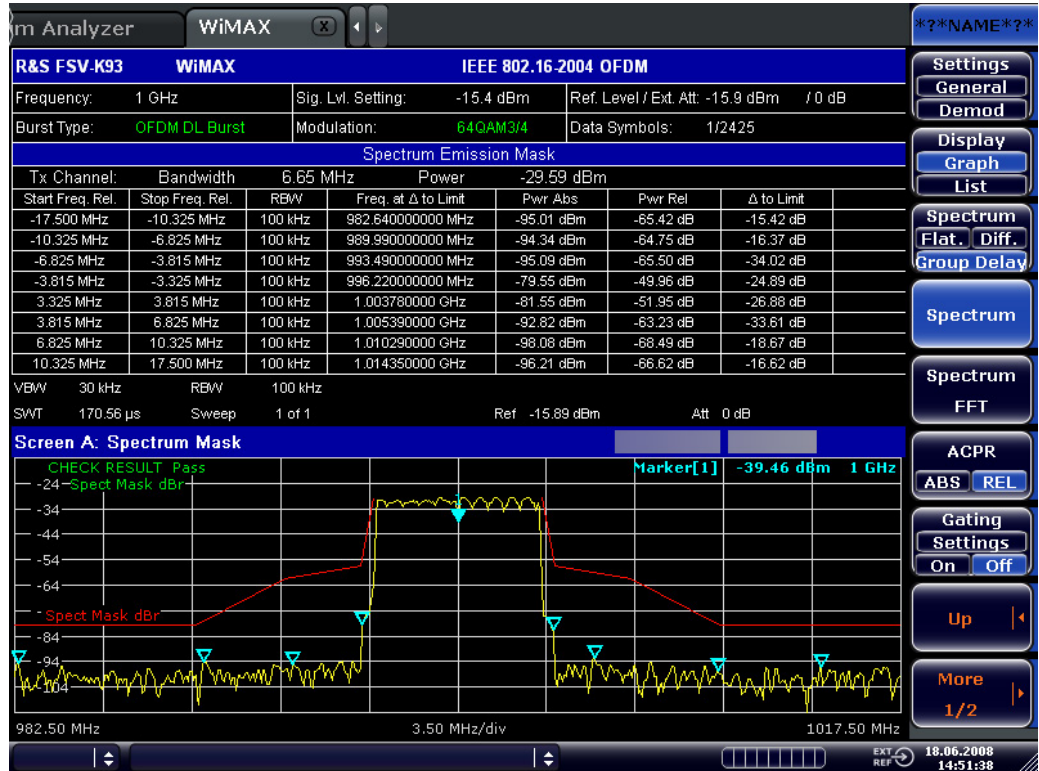
This result display shows power against frequency. A limit line representing the spectrum mask specified for the selected standard is displayed and an overall pass/fail status is displayed for the obtained results against this limit line.

For the IEEE 802.16-2004 OFDM, IEEE 802.16e-2005 OFDMA standards, the span of the results is related to the specified sample rate.

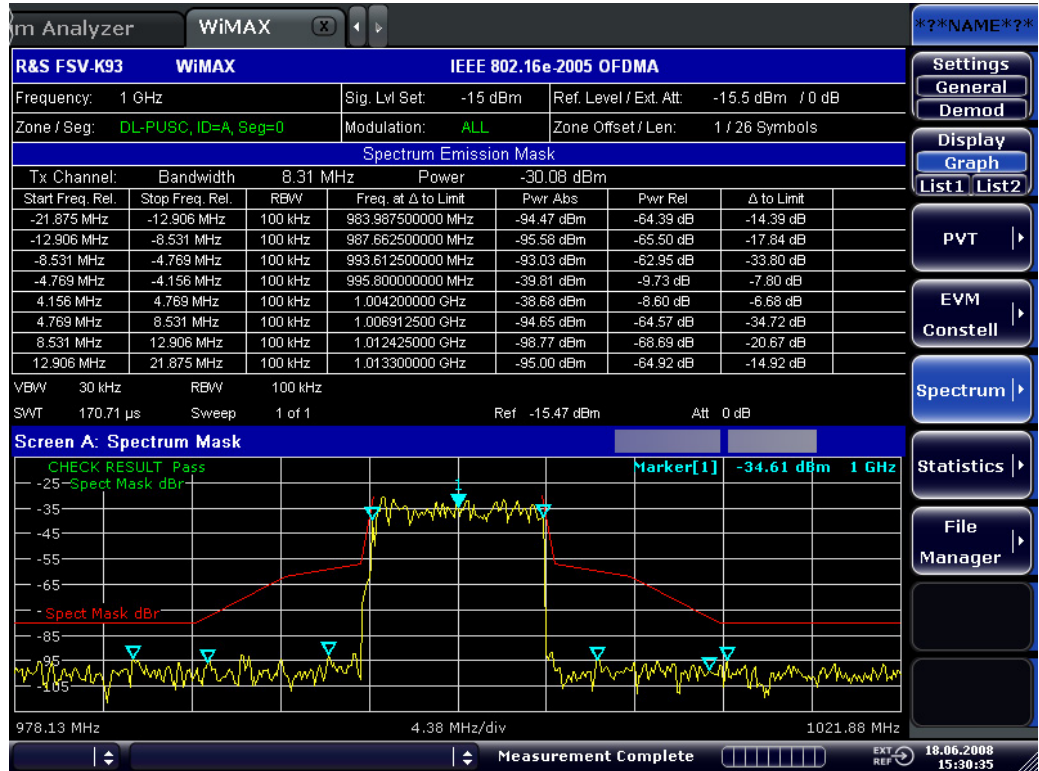
For the IEEE 802.16e-2005 WiBro standard, the table contains the results for each of the individual frequency ranges. On the trace, the highest power value is marked for each of the specified frequency ranges with a marker.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed. For the IEEE 802.16e-2005 WiBro standard, the Spectrum Emission Mask measurement is configured via the "SEM Settings" softkey.

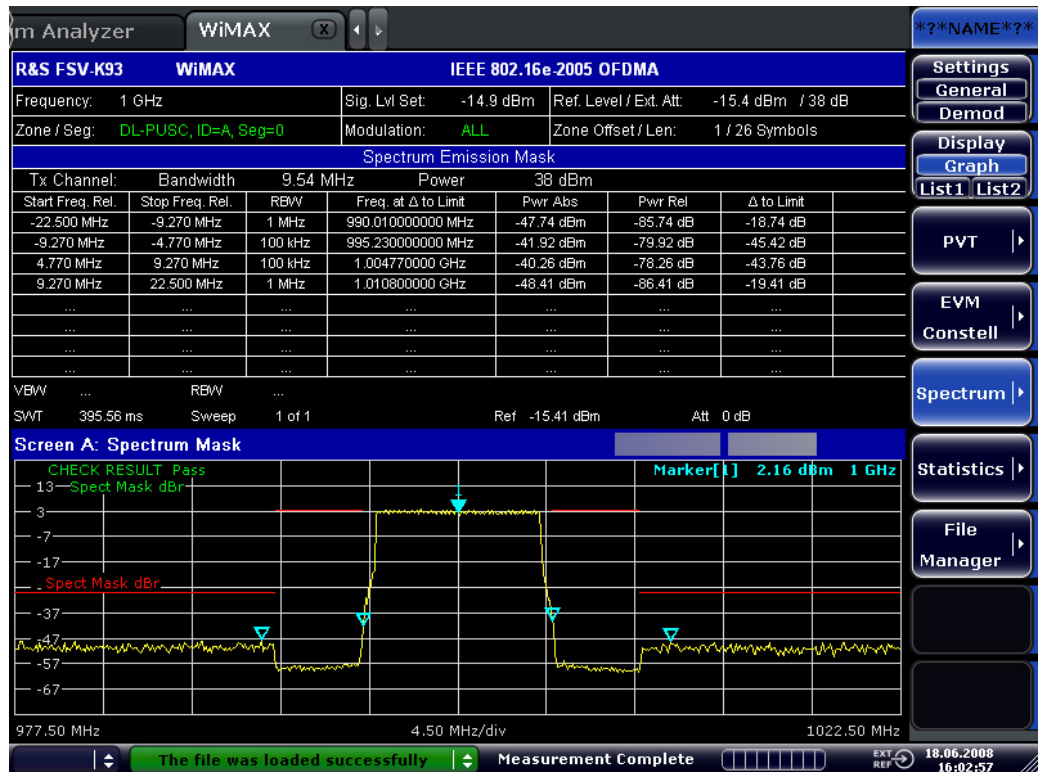
◆ Spectrum IEEE (IEEE 802.16-2004 OFDM)



◆ Spectrum IEEE (IEEE 802.16e-2005 OFDMA)



◆ IEEE 802.16e-2005 WiBro



- Remote: [CONF:BURS:SPEC:MASK](#)
- Remote: [CONF:BURS:SPEC:MASK:SEL IEEE](#)
- Remote: [CONF:BURS:SPEC:MASK:SEL ETSI](#)

SEM Settings

Opens the "SEM Settings" dialog box to configure the Spectrum Emission Mask result display.

Pane	Field	Description
	SEM according to	specifies how the Spectrum Emission Mask settings and limits are applied
	File Name	When User settings are specified, File Name shows the name of the loaded XML file
	Link Direction	Allows the settings and limits for the relevant link direction (Uplink or Downlink) to be displayed
	Power Class	Specifies the power class of the device and therefore the limits to be applied
	Reference Power	Specifies how the reference power is measured
TX Channel	Bandwidth	Specifies the bandwidth of the Tx Channel
	RBW	Specifies the RBW to be used for the Tx Channel
SEM Configuration	Start Freq Relative	Start frequency relative to the carrier
	Stop Freq Relative	Stop frequency relative to the carrier
	RBW	RBW to be used for this range
	VBW	VBW to be used for this range
	AUTO	Specifies whether auto sweep time is used for this range
	SWT	The sweep time for this range if AUTO is switched off
	Detector	The type of detector to use for this range
	Start Limit	Limit to be applied at the start of the range
	Stop Limit	Limit to be applied at the end of the range
	Evaluate	Specifies whether limit check should be done for this range

(SEM according to IEEE 802.16-2004 OFDM/ IEEE 802.16e-2005 OFDMA

→ Remote: [POW:SEM_USER](#)

(SEM according to - IEEE 802.16e-2005 WiBro)

→ Remote: [POW:SEM:TTA_STANDARD](#)

(Link Direction)

→ Remote: [POW:SEM:MOD:UL](#)

(Power Class)

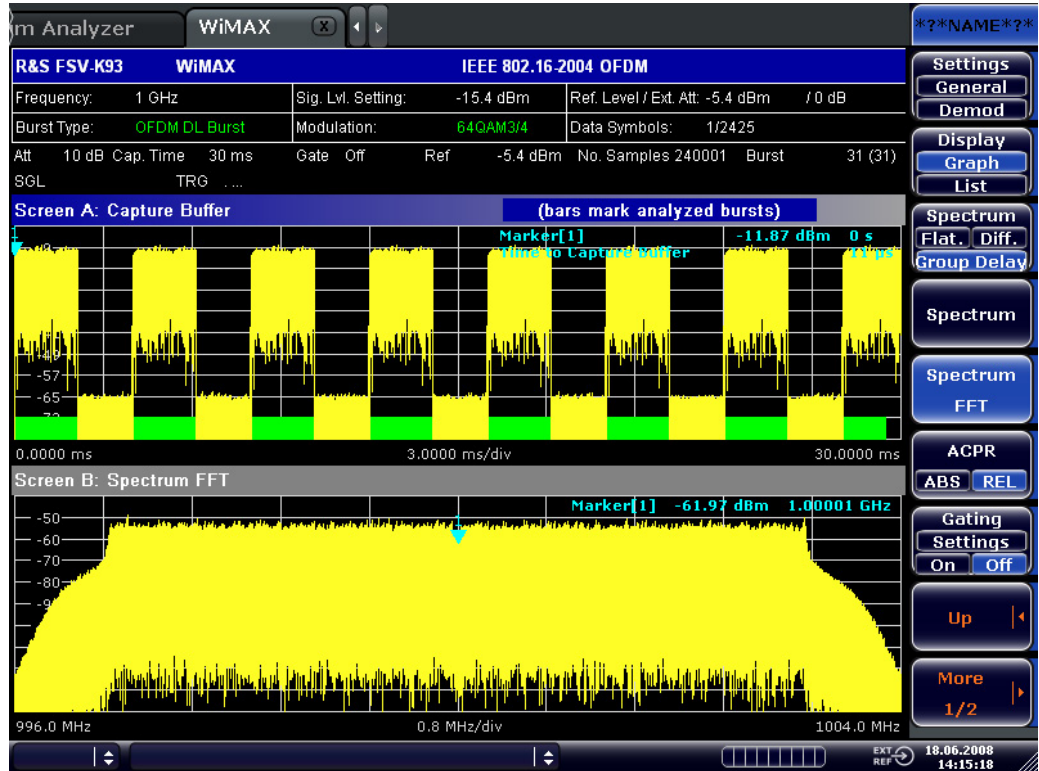
→ Remote: [POW:SEM:CLAS_0](#)

Spectrum FFT

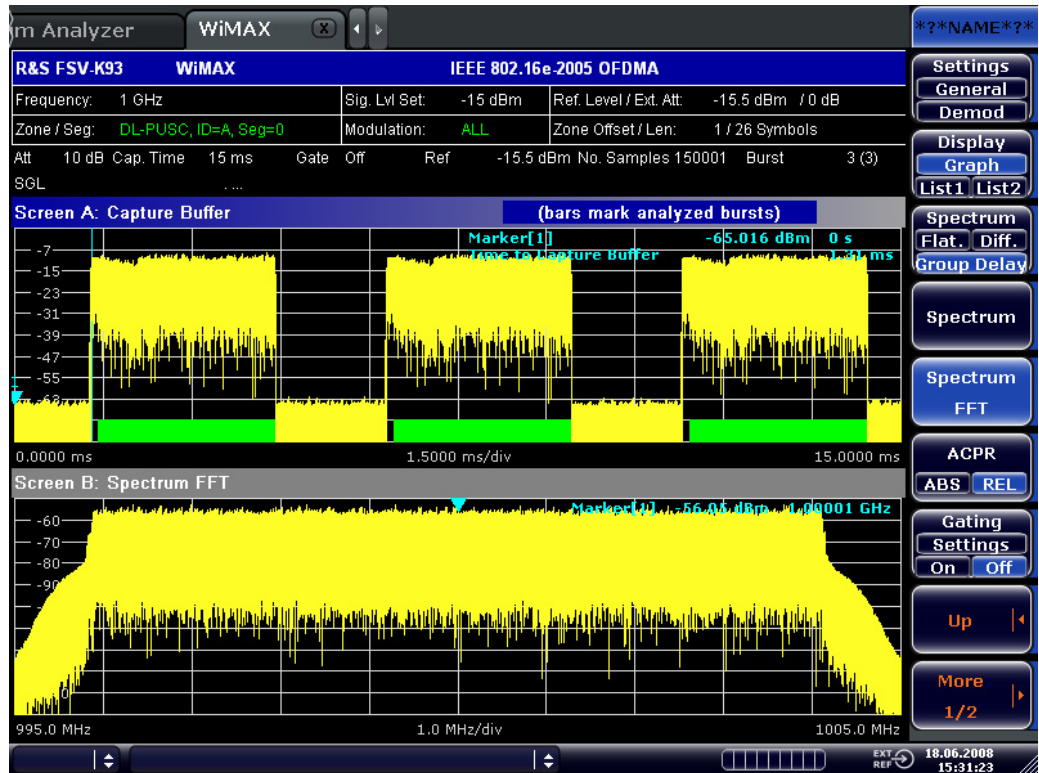
Sets the Spectrum FFT result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected).

This result display shows the Power vs Frequency results obtained from a FFT performed over the range of data in the Magnitude Capture Buffer which lies within the gate lines. If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the "[Refresh](#)" softkey in the sweep menu.

◆ IEEE 802.16-2004 OFDM



◆ IEEE 802.16e-2005 OFDMA/WiBro



→ Remote: [CONF: BURS: SPEC: FFT](#)

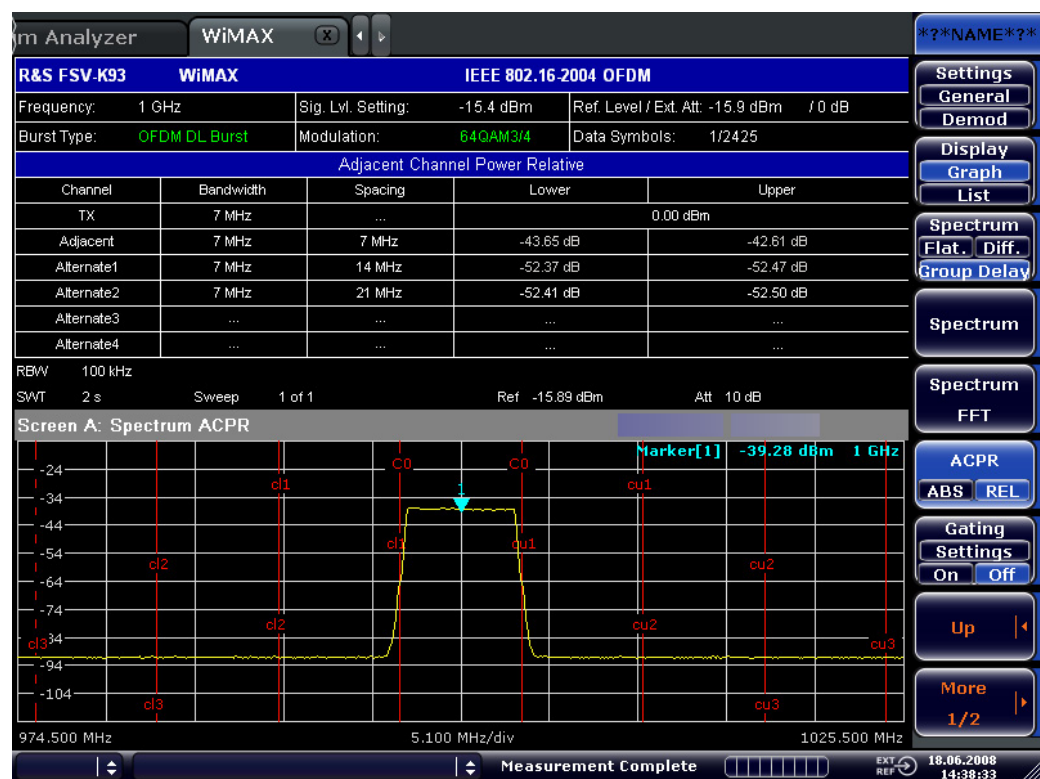
ACPR Abs/Rel

Sets the ACPR (Adjacent Channel Power Relative) result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected).

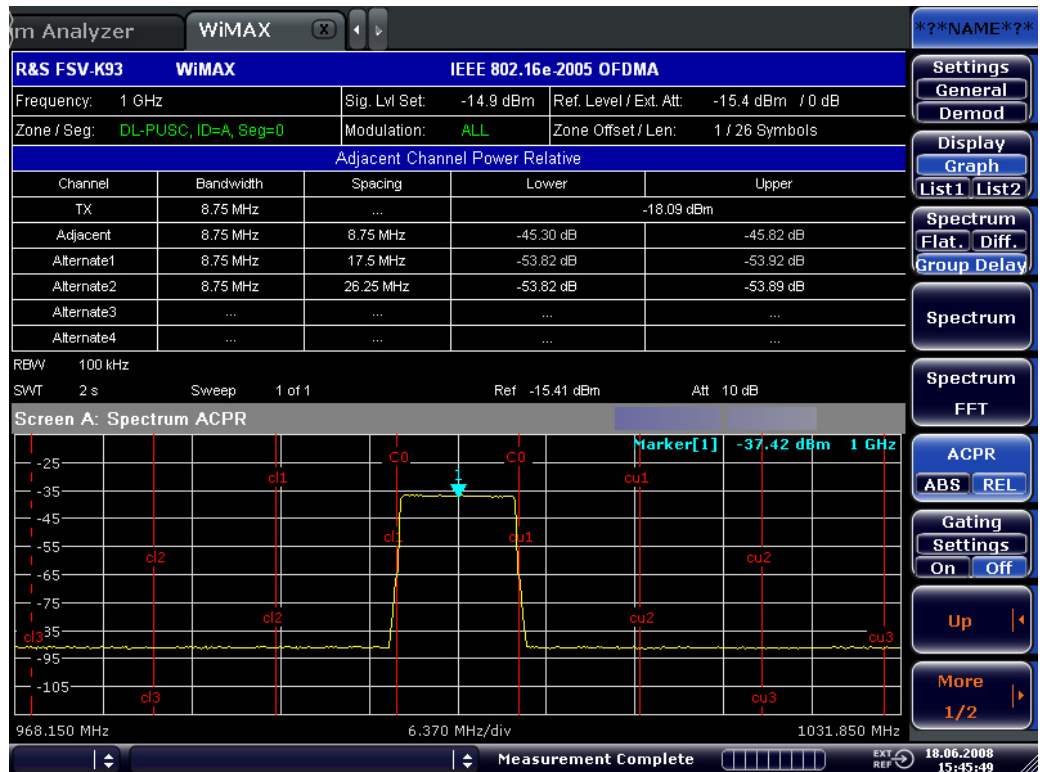
This result display is similar to the Spectrum Mask measurement, and provides information about leakage into adjacent channels. The results show the relative power measured in the three nearest channels either side of the measured channel. This measurement is the same as the adjacent channel power measurement provided by the spectrum analyzer.

The number of sweeps is set in the "General Settings" dialog box, "Sweep Count" field. If the measurement is performed over multiple sweeps both a max hold trace and an average trace are displayed.

◆ IEEE 802.16-2004 OFDM



◆ IEEE 802.16e-2005 OFDMA/WiBro



- Remote: [CONF:BURS:SPEC:ACPR](#)
- Remote: [CONF:BURS:SPEC:ACPR:SEL_ABS](#)
- Remote: [CALC2:MARK:FUNC:POW:RES?](#) (result query)
- Remote: [CALC2:MARK:FUNC:POW:RES:MAXH?](#) (result query)

ACP Settings

Opens the "ACP Settings" dialog box to configure the ACPR result display. By default, the ACP settings are derived from the "General Settings" dialog box, "Channel BW" field.

Pane	Field	Description
Channels	No. of Channels	Specifies the number of channels adjacent to the transmit channel to be measured. If set to 0, only the transmit channel is measured.
TX/ACP Channel BW	TX	Specifies the bandwidth of the transmit channel to be measured by the ACP measurement.
	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the bandwidth of the first to fifth channel before and after the transmit channel to be measured.
ACP Channel Spacing	Adjacent, Alternate 1, Alternate 2, Alternate 3, Alternate 4	Specifies the spacing of the first to fifth channel before and after the transmit channel to be measured.

- Remote: [POW:ACH:ACP 3](#) (No. of Channels)
- Remote: [POW:ACH:BAND 30kHz](#) (TX)
- Remote: [POW:ACH:SPAC 33kHz](#) (Adjacent/TX)
- Remote: [POW:ACH:SPAC:ALT1 100kHz](#) (Alternate 1 to 4/TX)
- Remote: [POW:ACH:BAND:ACH 30kHz](#) (Adjacent)
- Remote: [POW:ACH:BAND:ALT2 30kHz](#) (Alternate 1 to 4)

Statistics

Opens a submenu to display statistics measurement results.

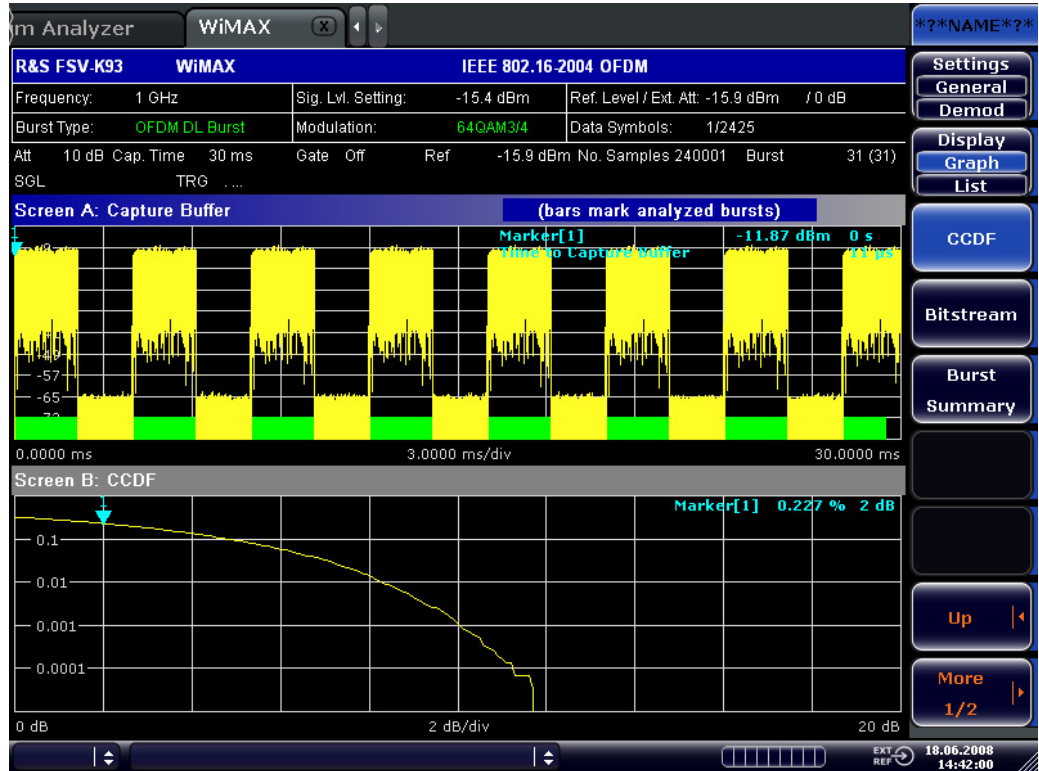
CCDF

Sets the CCDF result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected).

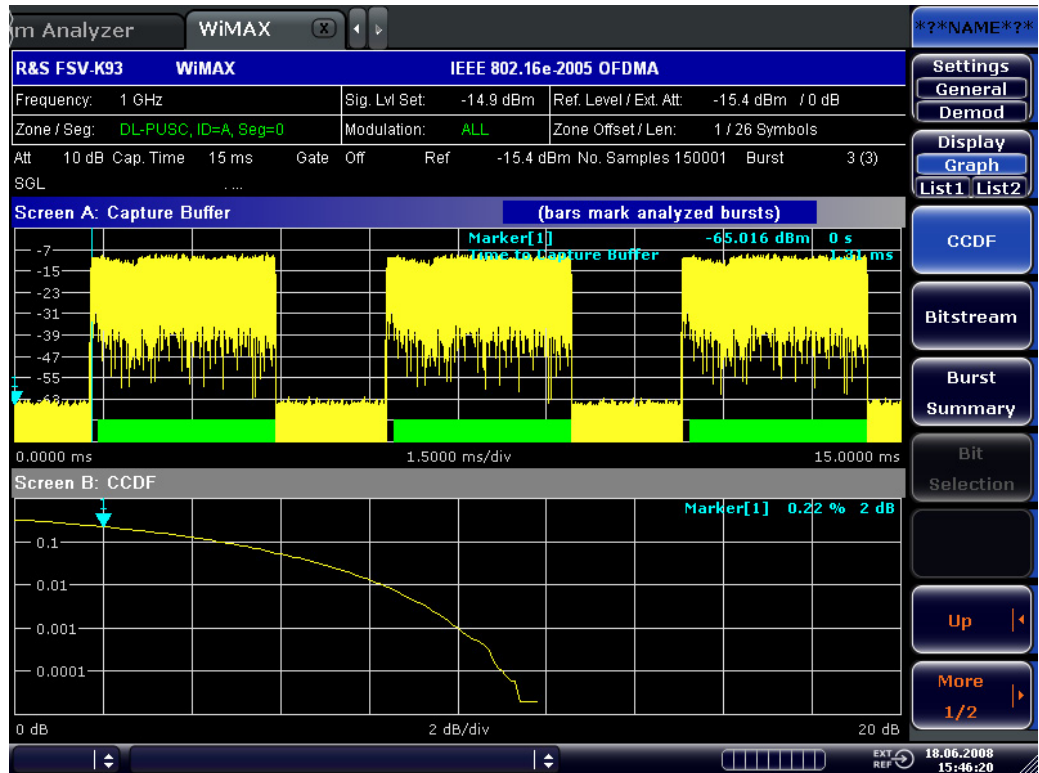
This result display shows the probability of an amplitude within the gating lines exceeding the mean power measured between the gating lines. The x-axis displays power relative to the measured mean power.

If the gate start or gate length are altered then the results can be updated to reflect these changes by pressing the "[Refresh](#)" softkey in the sweep menu.

◆ IEEE 802.16-2004 OFDM



◆ IEEE 802.16e-2005 OFDMA/WiBro



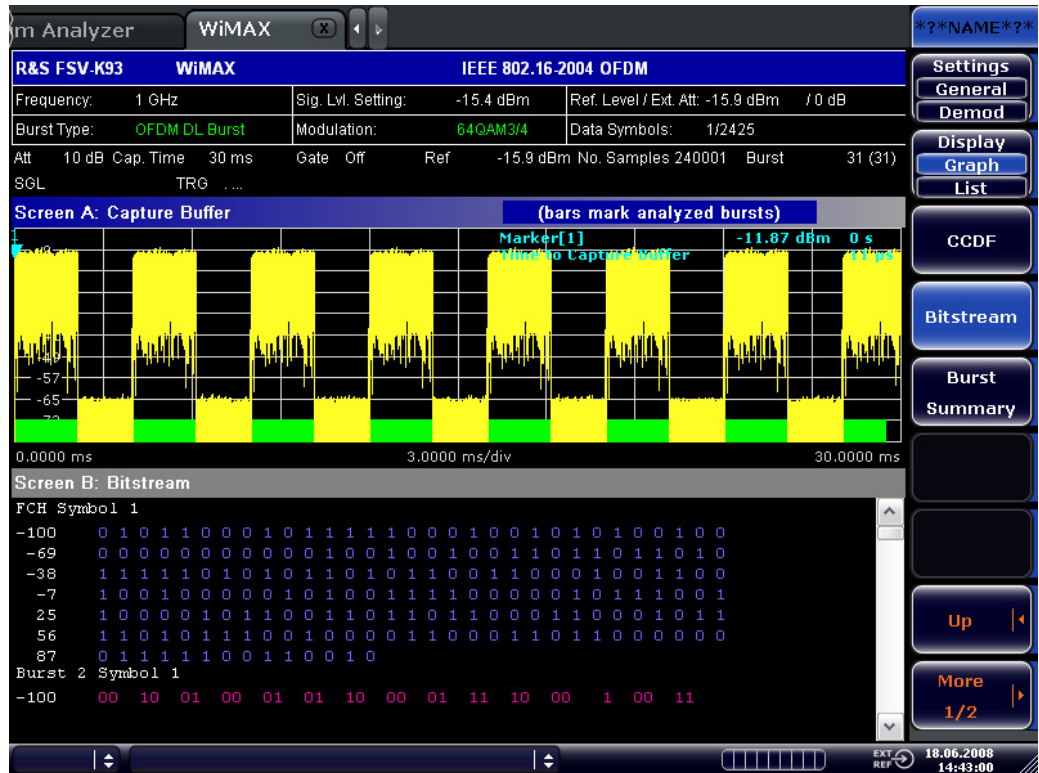
→ Remote: [CONF: BURS: STAT: CCDF](#)

Bitstream

Sets the Bitstream result display in graphical form ("Display Graph" selected), or in tabular form ("Display List 1"/"2" selected).

◆ IEEE 802.16-2004 OFDM

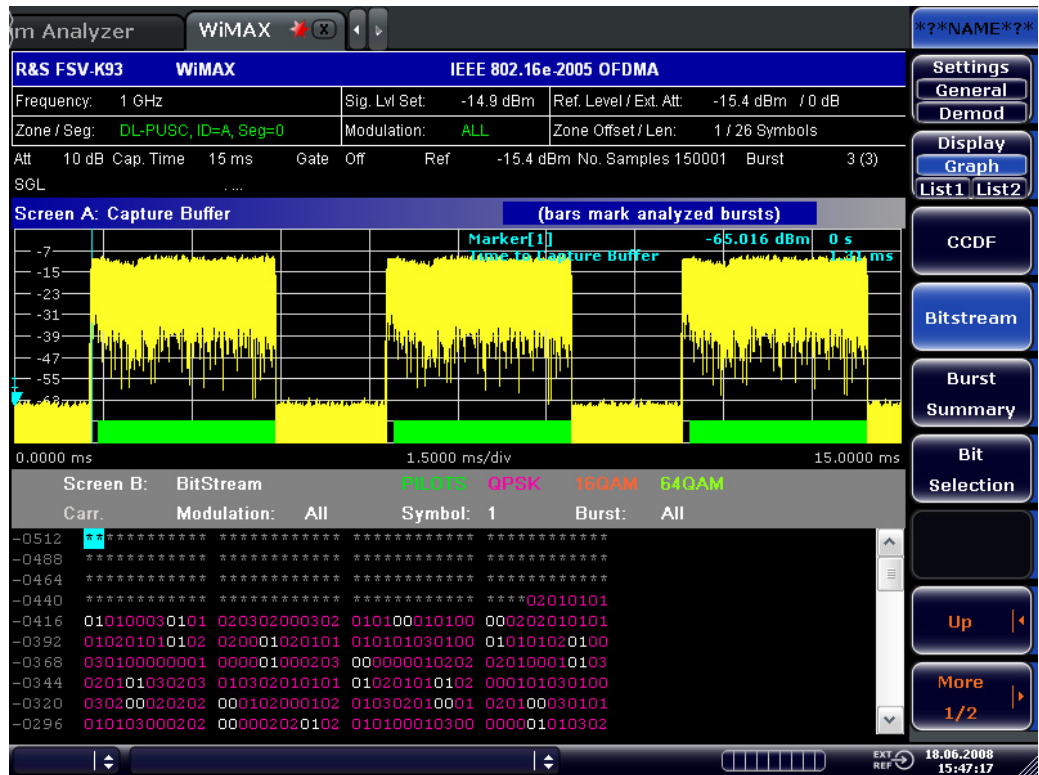
This result display shows the demodulated data stream. These results are grouped by burst and symbol. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.



◆ IEEE 802.16e-2005 OFDMA/WiBro

This result display shows the modulation symbols of the bursts from the analyzed zone. The different modulation formats are displayed in unique colors. The same color assignment is used in the Constellation vs Symbol result display. The modulation symbols define bit sequences. The mapping is defined in the standard. Signals with erroneous pilot sequences (i.e where the detected pilot sequence does not match that according to the standard) are highlighted with a red background.

The amount of data displayed in the Bitstream result display can be reduced via the "Bit Selection" softkey.

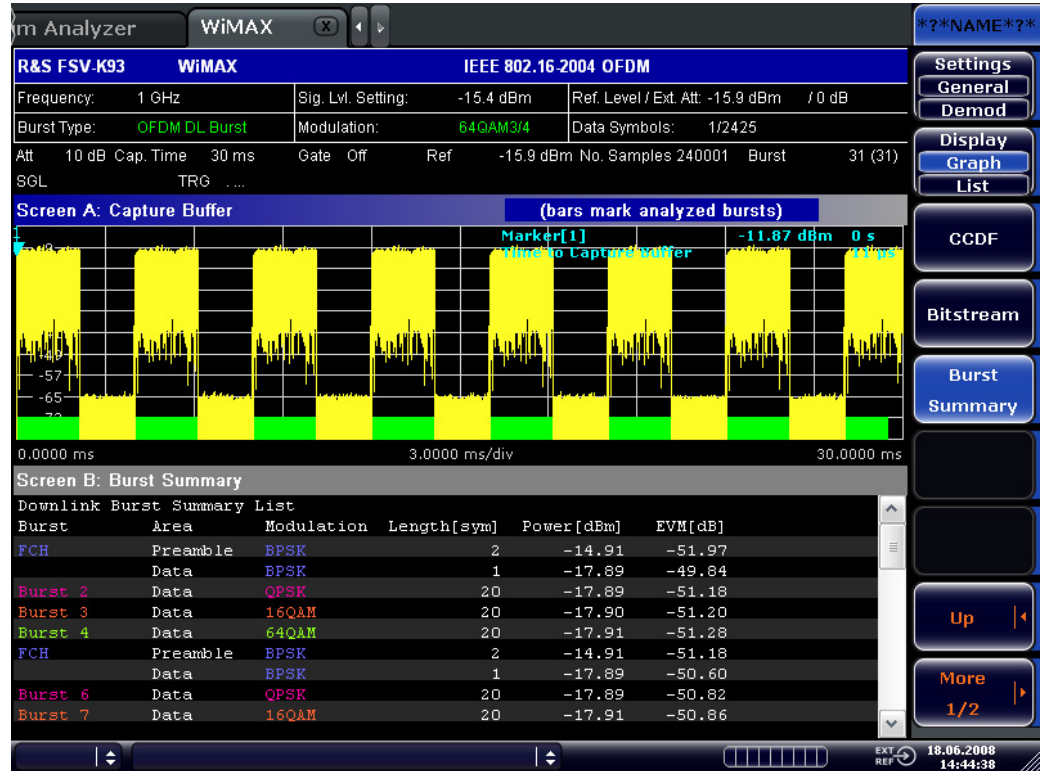


→ Remote: [CONF : BURS : STAT : BSTR](#)

Burst Summary

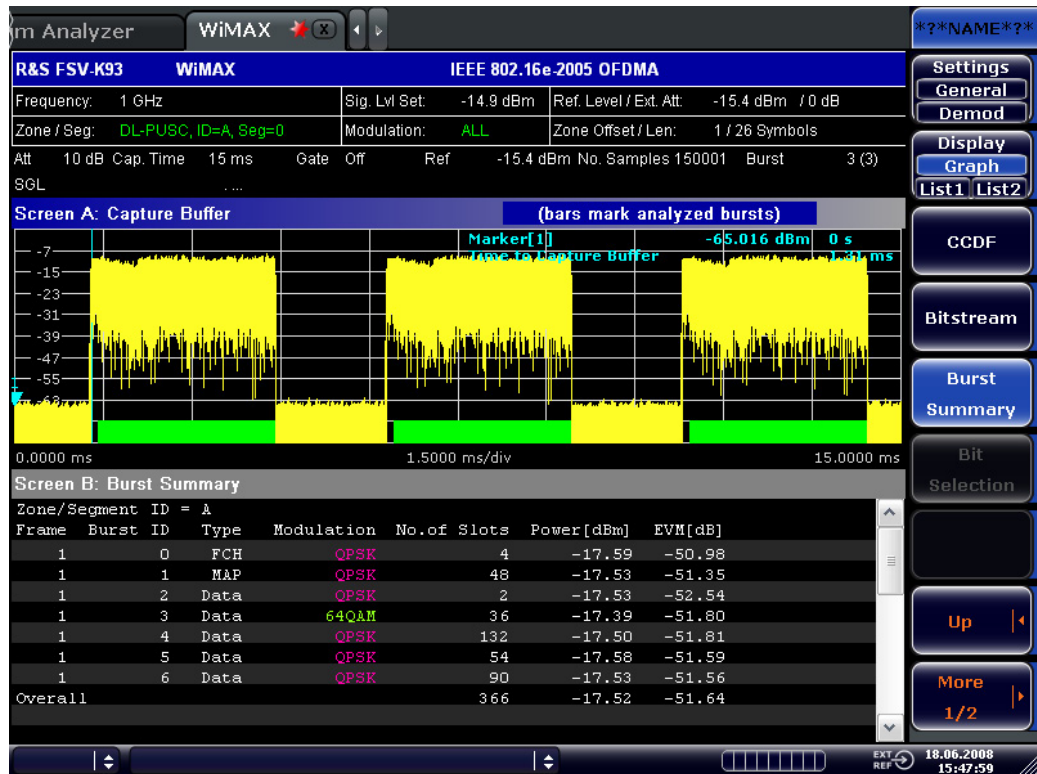
This result display shows the summary data for the analyzed bursts. If no dialog boxes are displayed, the results can be scrolled through using the cursor keys or rotary knob.

◆ IEEE 802.16-2004 OFDM



◆ IEEE 802.16e-2005 OFDMA/WiBro

This result display provides information about the bursts from the analyzed zone, i.e. modulation of the burst, power boosting information, EVM of the burst. Each analyzed zone will produce a set of burst results.



→ Remote: [CONF: BURS: STAT: BSUM](#)

Bit Selection (IEEE 802.16e-2005 OFDMA/WiBro)

Opens a dialog box for filtering the displayed results. The results may be filtered by any combination of modulation, symbol or burst. If the bit selection parameters are changed, the result display is updated accordingly.

This softkey is only available if the Bitstream measurement ("[Bitstream](#)" softkey) is selected.

- Remote: [CONF: BURS: BSTR: SYMB: SEL 1](#) (symbol)
- Remote: [CONF: BURS: BSTR: FORM: SEL QPSK](#) (modulation)
- Remote: [CONF: BURS: BSTR: BURS: SEL 1](#) (burst)

File Manager (IEEE 802.16e-2005 OFDMA/WiBro)

Opens the "File Manager" dialog box. The File Manager provides the possibility to transfer WiMAX settings from an R&S SMU signal generator via LAN. For step-by-step instructions see ["To transfer the current R&S SMU WiMAX settings via LAN"](#) on page 1032. The File Manager also offers some general file management support.

The File Manager writes into the directory C:\R_S\Instr\user\WMAN and its subdirectories or a USB memory stick only.

Under "File Types", filter the displayed files by selecting:

"All" (*.*) All file types are displayed. Use this selection to perform general file management tasks.

"SMU WiMax" Only files with the extension WiMAX are displayed.

Depending on the focus, the following softkeys are provided:

- ◆ "Recall"
- ◆ "New Folder"
- ◆ "Copy"
- ◆ "Paste"
- ◆ "Rename"
- ◆ "Delete File"

For further information refer to section "Instrument Functions - Basic Settings", ["Saving and Recalling Settings Files - FILE Key"](#).

14.4.2 Softkeys of the sweep menu – SWEEP key (Option R&S FSV-K93)

The following table shows all softkeys available in the sweep menu in "WiMAX" mode ("SWEEP" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description..

Command
Run Single/Cont
Auto Level
Refresh

Run Single/Cont

Selects the sweep mode.

- "Single" single sweep mode
- "Cont" continuous sweep mode

A single measurement will complete once the requested number of bursts have been obtained or a single sweep has been completed, depending on the measurement settings. If a measurement is completed in continuous mode, a new measurement will be started.

If a measurement is started while another measurement is in progress, the first measurement will be aborted and the new measurement started immediately.

- Remote: [INIT:CONT OFF](#) (single sweep mode)
- Remote: [INIT:CONT ON](#) (continuous sweep mode)

Auto Level

Starts an automatic level detection measurement. After the automatic level detection has been completed, the trace is displayed in the Magnitude Capture Buffer display. If this softkey is pressed while a measurement is running, the current measurement is aborted and the automatic level detection measurement is started. If the aborted measurement was a continuous measurement, it is resumed after the automatic level detection is completed.

- Remote: [CONF:POW:AUTO ON](#)

Refresh

Updates the current measurement results with respect to the current gate settings. This softkey is only available if the measurement results are effected by the gate settings (Spectrum FFT, CCDF, Spectrum Mask, Spectrum ACPR) and if the gate settings are modified after a measurement result has been obtained.

- Remote: [INIT:REFR](#)

14.4.3 Softkeys of the marker menu - MKR key (Option R&S FSV-K93)

The following table shows all softkeys available in the marker menu in "WLAN" mode ("MKR" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description. Close all settings dialog boxes before opening the marker menu.

Command
Marker 1
Unzoom
Marker Zoom
Marker Off

Marker 1

Opens a dialog box to adjust the marker. The contents of the dialog box depends on the type of graph the marker is adjusted to. After every change, the marker position in the trace and the marker information are updated.

- Remote: [CALC1:MARK1 ON](#)
- Remote: [CALC:MARK:X 2ms](#)
- Remote: [CALC:MARK:Y?](#)
- Remote: [CALC2:MARK:SYMB 2](#)
- Remote: [CALC2:MARK:CARR -7](#)

Unzoom

Cancels the marker zoom.

- Remote: [CALC:MARK:FUNC:ZOOM 1](#)

Marker Zoom (Magnitude Capture Buffer, PVT, Constellation vs Symbol, Constellation vs Carrier)

Opens an edit dialog box to select the magnification factor for the zoom. The maximum magnification depends on the type of result display.

- Remote: [CALC:MARK:FUNC:ZOOM 4](#)

Marker Off

Switches off all makers in the active result display.

- Remote: [CALC2:MARK:AOFF](#)

14.4.4 Softkeys of the marker to menu – MKR-> key (Option R&S FSV-K93)

The following table shows all softkeys available in the marker-> menu in "WiMAX" mode ("MKR"-> key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
MKR -> Trace

MKR -> Trace

Opens an edit dialog box to enter the number of the trace, on which the marker is to be placed. This softkey is available for all result displays with more than one trace.

→ Remote: [CALC2:MARK:TRAC 2](#)

14.4.5 Softkeys of the lines menu – LIN key (Option R&S FSV-K93)

The following table shows all softkeys available in the lines menu in "WiMAX" mode ("LINES" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

This menu is only available if the results are displayed in form of a list (for details see "[Result summary list](#)" and "[Display Graph/List](#)" softkey).

Command
Default Current
Default All

Default Current

Resets all limits for the current modulation scheme to the values specified in the selected standard.

→ Remote: see "[CALCulate:LIMit Subsystem \(WiMAX / WiBro, K93\)](#)"

Default All

Resets all limits for all modulation schemes to the values specified in the selected standard.

→ Remote: see "[CALCulate:LIMit Subsystem \(WiMAX / WiBro, K93\)](#)"

14.4.6 Softkeys of the trace menu – TRAC key (Option R&S FSV-K93)

The following table shows all softkeys available in the trace menu in "WiMAX" mode ("TRACE" key). It is possible that your instrument configuration does not provide all softkeys. If a softkey is only available with a special option, model or (measurement) mode, this information is delivered in the corresponding softkey description.

Command
Display List/Graph
Screen Focus A/B
Screen Size Full/Split

Display List/Graph

For details refer to the "[Display Graph/List](#)" softkey in the WiMAX menu.

Screen Focus A/B

Selects the active screen for IQ measurement results in split and full screen mode. Only the markers of an active screen can be controlled.

→ Remote: [DISP:WIND1:SSEL](#)

Screen Size Full/Split

Changes the display between split and full screen for IQ measurement results. Frequency sweep measurement results are always displayed in full screen.

→ Remote: [DISP:FORM_SING](#)

14.5 Remote Commands of the WiMAX/WiBro Measurements Option (R&S FSV-K93)

This section describes the remote commands for the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93). This option includes the functionality of the WiMAX 802.16 OFDM Measurements option (R&S FSV-K93). Accordingly both options are described together in this section, differentiated by the corresponding standards:

- ◆ WiMAX 802.16 OFDM Measurements (R&S FSV-K93)
 - IEEE 802.16-2004/Cor 1-2005 OFDM physical layer mode
The corresponding remote control mode is OFDM. In chapter "Instrument Functions", the short form IEEE 802.16-2004 OFDM is used to reference this standard.
- ◆ WiMAX IEEE 802.16 OFDM, OFDMA Measurements option (R&S FSV-K93)
 - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 OFDMA physical layer mode
The corresponding remote control mode is OFDMA. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 OFDMA is used to reference this standard.
 - IEEE 802.16-2004/Cor 1-2005, IEEE 802.16e-2005 based WiBro
The corresponding remote control mode is WiBro. In chapter "Instrument Functions", the short form IEEE 802.16e-2005 WiBro is used to reference this standard.

For details on conventions used in this chapter refer to section "[Notation](#)" of the description of the base unit.

For further information on analyzer or basic settings commands, refer to the corresponding subsystem in section "[Remote Control – Description of Analyzer Commands](#)" or section "[Remote Control - Description of Basic Settings Commands](#)".

Subsystems of the WiMAX, WiBro Measurements options (K93)

- ◆ "[ABORt Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1093
- ◆ "[CALCulate:BURSt Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1094
- ◆ "[CALCulate:LIMit Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1095
- ◆ "[CALCulate:MARKer Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1118
- ◆ "[CONFigure Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1128
- ◆ "[DISPlay Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1170
- ◆ "[FETCh Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1176
- ◆ "[FORMat Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1192
- ◆ "[INITiate Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1193
- ◆ "[INPut Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1194
- ◆ "[INSTrument Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1195
- ◆ "[MMEMory Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1196
- ◆ "[SENSE Subsystem \(WiMAX / WiBro, K93\)](#)" on page 1198
- ◆ "[STATus Subsystem \(WiMAX, K93\)](#)" on page 1222
- ◆ "[SYSTEM Subsystem \(WiMAX, K93\)](#)" on page 1226
- ◆ "[TRACe Subsystem \(WiMAX, K93\)](#)" on page 1227
- ◆ "[TRIGger Subsystem \(WiMAX, K93\)](#)" on page 1237
- ◆ "[UNIT Subsystem \(WiMAX, K93\)](#)" on page 1240

14.5.1 ABORt Subsystem (WiMAX / WiBro, K93)

The ABORt subsystem contains the commands for aborting triggered actions.

Commands of the ABORt Subsystem

- ◆ "[ABORt](#)"

ABORt

For details refer to "[ABORt](#)".

14.5.2 CALCulate:BURSt Subsystem (WiMAX / WiBro, K93)

The CALCulate:BURSt subsystem checks the IQ measurement results.

Commands of the CALCulate:BURSt Subsystem

◆ "[CALCulate<1|2>:BURSt\[:IMMediate\]](#)"

CALCulate<1|2>:BURSt[:IMMediate]

This command forces the IQ measurement results to be recalculated according to the current settings.

The numeric suffixes <1|2> sets the measurement window for the calculation.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC1 :BURSt
```

Starts the recalculation of the IQ measurement results.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.3 CALCulate:LIMit Subsystem (WiMAX / WiBro, K93)

The CALCulate:LIMit subsystem contains commands for the limit lines and the corresponding limit checks.

Commands of the CALCulate:LIMit Subsystem

- ◆ "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:ALL](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:ALL:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror\[:AVERage\]](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror\[:AVERage\]:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror:MAXimum](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror:MAXimum:RESult?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:SPECTrum:MASK:CHECK:X?](#)"
- ◆ "[CALCulate<1|2>:LIMit<1...8>:SPECTrum:MASK:CHECK:Y?](#)"

CALCulate<1|2>:LIMit<1...8>:FAIL?

This command queries the limit check result of the limit line indicated in the selected measurement window. To obtain a valid result, a complete sweep must be performed. A synchronization with *OPC, *OPC? or *WAI is therefore recommended.

The numeric suffixes <1|2> sets the measurement window for the calculation. The numeric suffixes <1...8> specify the limit lines as follows:

Suffix	Limit
1 to 2	These indexes are not used
3	ETSI Spectrum Mask limit line
4	IEEE Spectrum Mask limit line
5	Spectrum Flatness (Upper) limit line
6	Spectrum Flatness (Lower) limit line
7	Spectrum Flatness Difference (Upper) limit line
8	Spectrum Flatness Difference (Lower) limit line

**Note**

No limit lines are displayed in screen A. Therefore all commands with the suffix 1 for CALCulate will return 0

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

INIT; *WAI

Starts a new sweep and waits for its end.

CALC2:LIM1:FAIL?

Queries the result of the check for limit line 1 in screen B.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:ALL

This command sets or returns all the limit values.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

The results are input or output as a list of values separated by commas in the following (ASCII) format:

Result input/output in ASCII format	Description
<average EVM all bursts>, <max EVM all bursts>	dB or % depending on selected units (" UNIT:TABLE ")
<average EVM data carriers >, <max EVM data carriers >	dB or % depending on selected units (" UNIT:TABLE ")
<average Frequency Error>, <max Frequency Error>	Down Link Mode: Hz; .Up Link Mode: %
<average Symbol Error>, <max Symbol Error>	Down Link Mode: ppm; Up Link Mode: %
<average SS Timing>, <maximum SS Timing >	only returned in Up Link mode
<average IQ Offset>, <max IQ Offset>	dB or % depending on selected units (" UNIT:TABLE ")

Example

```
CALC:LIM:BURS:ALL?
```

All limit values are returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:ALL:RESult?

This command returns all the limit results.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

The results are output as a list of result strings separated by commas. For the output order see "[CALCulate<1|2>:LIMit<1...8>:BURSt:ALL](#)" command.

Example

```
CALC:LIM:BURS:ALL:RES?
```

All limit values are returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1..8>:BURSt:BERPilot[:AVERAge]

This command sets the average Bit Error Rate for pilot carriers limit.

Parameter

-1000000 to 1000000 %

Example

```
CALC:LIM:BURS:BERP -25.0
```

Average Bit Error Rate for pilot carriers limit is set to -25.0 dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot[:AVERAge]:RESult?

This command returns the Bit Error Rate for pilot carriers limit result.
This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:BERP:RES?
```

Average EVM for all carrier limit result is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum

This command sets the maximum Bit Error Rate Limit.

Parameter

-1000000 to 1000000 %

Example

```
CALC:LIM:BURS:EVM:ALL:MAX?
```

Maximum EVM for all carrier limit is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:BERPilot:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude Limit result. This is a combined figure that represents the pilot, data and the free carrier. This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:EVM:ALL:MAX:RES?
```

Maximum EVM for all carrier limit result is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL[:AVERAge]

This command sets the average Error Vector Magnitude Limit. This is a combined figure that represents the pilot, data and the free carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %

If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:EVM:ALL -25.0
```

Average EVM for all carrier limit is set to -25.0 dB.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL[:AVERAge]:RESult?

This command returns the average Error Vector Magnitude Limit result. This is a combined figure that represents the pilot, data and the free carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:EVM:ALL:RES?
```

Average EVM for all carrier limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL:MAXimum

This command sets the maximum Error Vector Magnitude Limit. This is a combined figure that represents the pilot, data and the free carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %

If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:EVM:ALL:MAX?
```

Maximum EVM for all carrier limit is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:ALL:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude Limit result. This is a combined figure that represents the pilot, data and the free carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:EVM:ALL:MAX:RES?
```

Maximum EVM for all carrier limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA[:AVERAge]

This command sets the average Error Vector Magnitude Limit for the data carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %

If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:EVM:DATA -30.0
```

Average EVM for data carrier limit is set to -30.0 dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA[:AVERAge]:RESult?

This command returns the average Error Vector Magnitude limit result summary for the data carrier in dB.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:EVM:DATA:RES?
```

Average EVM for data carrier limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA:MAXimum

This command sets the maximum Error Vector Magnitude Limit for the data carrier.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %

If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:EVM:DATA:MAX?
```

Maximum EVM for data burst limit is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:EVM:DATA:MAXimum:RESult?

This command returns the maximum Error Vector Magnitude limit result summary for the data carrier in dB.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:EVM:DATA:MAX:RES?
```

Maximum EVM for data carrier limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor[:AVERage]

This command sets the average frequency error limit.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 Hz or %

If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.

**Note**

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example

```
CALC:LIM:BURS:FERR 10000
```

The average frequency error limit is set to 10000 Hz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor[:AVERage]:RESult?

This command returns the average frequency error limit result.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:FERR:RES?
```

Average frequency error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor:MAXimum

This command sets the maximum frequency error limit.
The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 Hz or %

If no unit is specified the unit depends on the current Up/Down Link Mode: Hz in Down Link mode, % in Up Link mode.

**Note**

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example

```
CALC:LIM:BURS:FERR:MAX?
```

Maximum frequency error limit is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:FERRor:MAXimum:RESult?

This command returns the maximum frequency error limit result. The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command). This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:FERR:MAX:RES?
```

Maximum frequency error limit result is returned

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset[:AVERage]

This command sets the average IQ offset error limit. The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %
If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:IQOF -10.0
```

Average IQ offset error limit is set to -10.0 dB.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset[:AVERAge]:RESult?

This command returns the average IQ offset error limit result.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:IQOF:RES?
```

Average IQ offset error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset:MAXimum

This command sets the maximum IQ offset error limit.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

-1000000 to 1000000 dB or %

If no unit is specified the unit specified by the "[UNIT:TABLE](#)" command is used.

Example

```
CALC:LIM:BURS:IQOF:MAX 15.0DB
```

Maximum IQ offset error limit is set to 15.0 dB.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:IQOFset:MAXimum:RESult?

This command returns the maximum IQ offset error limit result.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:IQOF:MAX:RES?
```

Maximum IQ offset error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming[:AVERage]

This command is only supported for reasons of compatibility with the FSP family. It sets the average Subscriber Station Timing limit.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

0PCT

Example

```
CALC:LIM:BURS:SST 0
```

The average SS Timing limit is set to 0%.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming[:AVERage]:RESult?

This command returns the average Subscriber Station Timing limit result. The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command). This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:SST:RES?
```

Average SS Timing limit result is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming:MAXimum

This command is only supported for reasons of compatibility with the FSP family. It sets the maximum Subscriber Station Timing limit. The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

0PCT

Example

```
CALC:LIM:BURS:SST:MAX?
```

Maximum SS Timing limit is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SSTiming:MAXimum:RESult?

This command returns the maximum Subscriber Station Timing limit.
The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines
(see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).
This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:SST:MAX:RES?
```

Maximum SS Timing limit result is returned.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror[:AVERAge]

This command sets the average symbol error limit.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

<numeric_value> in ppm or %: -1000000 to 1000000

If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.

**Note**

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example

```
CALC:LIM:BURS:SYMB 10000
```

The average symbol error limit is set to 10000 Hz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror[:AVERAge]:RESult?

This command returns the average symbol error limit result.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:SYMB:RES?
```

Average symbol error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror:MAXimum

This command sets the maximum symbol error limit.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

Parameter

<numeric_value> in ppm or %: -1000000 to 1000000

If no unit is specified the unit depends on the current Up/Down Link Mode: ppm in Down Link mode, % in Up Link mode.

**Note**

There is no relationship between the Down Link and Up Link values. Setting a Down Link value in Up Link mode does not change the displayed limit value.

Example

```
CALC:LIM:BURS:SYMB:MAX?
```

Maximum symbol error limit is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:BURSt:SYMBolerror:MAXimum:RESult?

This command returns the maximum symbol error limit result.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Return values

0 PASSED
1 FAILED

Example

```
CALC:LIM:BURS:SYMB:MAX:RES?
```

Maximum symbol error limit result is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:SPECtrum:MASK:CHECK:X?

This command returns the x-value at the maximum overstepping of the spectrum mask limits.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Example

```
CALC:LIM:SPEC:MASK:CHECK:X?
```

Returns the frequency at the maximum overstepping.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:LIMit<1...8>:SPECtrum:MASK:CHECK:Y?

This command returns the y-value at the maximum overstepping of the spectrum mask limits.

The numeric suffixes <1|2> sets the measurement window for the calculation and the suffixes <1...8> specify the limit lines (see "[CALCulate<1|2>:LIMit<1...8>:FAIL?](#)" command).

This command is only a query and therefore has no *RST value.

Example

```
CALC:LIM:SPEC:MASK:CHECK:Y?
```

Returns the power at the maximum overstepping.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.4 CALCulate:MARKer Subsystem (WiMAX / WiBro, K93)

The CALCulate:MARKer subsystem checks the marker functions of the instrument.

The following subsystem is included:

["CALCulate:MARKer:FUNCTION Subsystem \(WiMAX / WiBro, K93\)"](#) on page 1125

Commands of the CALCulate:MARKer Subsystem

- ◆ ["CALCulate<1|2>:MARKer<1>\[:STATe\]"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:AOFF"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:B"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:CARRier"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:MAXimum"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:MINimum"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:SYMBol"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:TRACe"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:X"](#)
- ◆ ["CALCulate<1|2>:MARKer<1>:Y"](#)

CALCulate<1|2>:MARKer<1>[:STATe]

This command switches the markers in the specified measurement window on or off.

Parameter

ON | OFF

Example

```
CALC1:MARK1 ON
```

Switches the screen A marker ON.

```
CALC2:MARK1 OFF
```

Switches the screen B marker OFF.

Characteristics

*RST value: ON

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:AOFF

This command switches off all active markers in the specified measurement window. The window is set by the numeric suffix of CALCulate<1|2>.

Example

```
CALC1 : MARK : AOFF
```

Switches off all markers in the screen A window.

```
CALC2 : MARK : AOFF
```

Switches off all markers in the screen B window.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:BURSt

This command positions the selected marker in the specified measurement window to the indicated burst. This command is only available for the Constellation vs Symbol result display.

Parameter

1 to <number of captured bursts in capture buffer>

Example

```
CALC2 : MARK : BURS 2
```

Positions marker 1 in screen B to burst 2.

```
CALC2 : MARK : BURS?
```

Outputs the symbol value of marker 1 in screen B.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:CARRier

This command positions the selected marker to the indicated carrier.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

<numeric_value>

Example

```
CALC:MARK:CARR -7
```

Positions marker 1 to carrier -7.

```
CALC:MARK:CARR?
```

Outputs the carrier value of marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:MAXimum

This command sets the selected marker to the maximum peak value in the current trace. This command is only available for the Spectrum Flatness result display.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC2:MARK:MAX
```

Set marker 1 in screen B to maximum value in trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:MINimum

This command sets the selected marker to the minimum peak value in the current trace. This command is only available for the Spectrum Flatnes result display. This command is an event and therefore has no *RST value and no query.

Example

```
CALC2:MARK:MIN
```

Set marker 1 in screen B to minimum value in trace.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:SYMBol

This command positions the selected marker to the indicated symbol. This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

1 to <number of symbols in selected burst>

Example

```
CALC2:MARK:SYMB 2
```

Positions marker 1 in screen B to symbol 2.

```
CALC2:MARK:SYMB?
```

Outputs the symbol value of marker 1 in screen B.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:TRACe

This command assigns the selected marker to the indicated measurement curve in the selected measurement window.

This command is only available for the following result displays:

- ◆ Constellation versus Carrier
- ◆ EVM vs Symbol
- ◆ EVM vs Carrier
- ◆ Frequency Error vs Preamble
- ◆ Phase Error vs Preamble
- ◆ PVT Rising / Falling
- ◆ Spectrum Flatness
- ◆ Spectrum Flatness Difference
- ◆ Spectrum Mask, if Max Hold trace is displayed
- ◆ Spectrum ACP/ACPR, if Max Hold trace is displayed

Parameter

1 to 3

Example

```
"CALC2:MARK:TRAC 2
```

Assigns marker 1 in screen B to trace 2.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:TTCapture?

This command returns the time to the start of the first frame in the capture buffer.

This command is only a query and therefore has no *RST value.

Example

```
CALC:MARK:TTC?
```

Returns the time to the start of the first frame in the capture buffer.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:X

This command positions the selected marker to the indicated inphase (Constellation vs Symbol), frequency (Spectrum FFT, Spectrum Mask, Spectrum APCR), time (Magnitude Capture Buffer, Auto level, PVT Full Burst, PVT Rising / Falling), power (CCDF), sub-carrier (Constellation vs Carrier, EVM vs Carrier, Spectrum Flatness) or symbol (EVM vs Symbol) in the selected measurement window.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

1 to <maximum range for selected measurement>

Example

```
CALC:MARK:X 2ms
```

Positions marker 1 in screen A to time 2ms.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:Y

This command positions the selected marker to the indicated quadrature (Constellation vs Symbol), magnitude of I or Q (Constellation vs Carrier), EVM (EVM vs Carrier) or abs (Spectrum Flatness) in the selected measurement window.

This command is query only for the following result displays:

- ◆ Auto Level
- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier
- ◆ EVM vs Symbol
- ◆ PVT Full
- ◆ PVT Rising / Falling
- ◆ Magnitude Capture Buffer
- ◆ Spectrum Mask
- ◆ Spectrum FFT
- ◆ CCDF

Example

```
CALC2:MARK:Y -2
```

Positions marker 1 in screen B to -2.

```
CALC:MARK:Y?
```

Outputs the measured value of marker 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

14.5.4.1 CALCulate:MARKer:FUNCtion Subsystem (WiMAX / WiBro, K93)

The measurement window is selected by CALCulate 1 (screen A) or 2 (screen B).

Commands of the CALCulate:MARKer:FUNCtion Subsystem

- ◆ "[CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult\[:CURRent\]?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult:MAXHold?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture:FRAMe](#)"
- ◆ "[CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture\[:TIMe\]?](#)"
- ◆ "[CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM](#)"

CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult[:CURRent]?

This command queries the current result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run, for there to be summary data available.

The numeric suffix <1|2> at CALCulate specifies the measurement window.

This command is only a query and therefore has no *RST value.

Results are output separated by commas. Adjacent channel power values are output in dB. The order is as follows:

- | | |
|---|---|
| ◆ | Power of main channel |
| ◆ | Power of lower adjacent channel |
| ◆ | Power of upper adjacent channel |
| ◆ | Power of lower alternate adjacent channel 1 |
| ◆ | Power of upper alternate adjacent channel 1 |
| ◆ | Power of lower alternate adjacent channel 2 |
| ◆ | Power of upper alternate adjacent channel 2 |
| ◆ | Power of lower alternate adjacent channel 3 |
| ◆ | Power of upper alternate adjacent channel 3 |
| ◆ | Power of lower alternate adjacent channel 4 |
| ◆ | Power of upper alternate adjacent channel 4 |

Example

```
CALC2:MARK:FUNC:POW:RES?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture:FRAMe

This command sets or returns the frame that the Time to Capture Buffer marker is to be set to.

Example

```
CALC2:MARK:FUNC:TTC:FRAM 2
```

Characteristics

*RST value: -1

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:FUNCtion:TTCapture[:TIME]?

This command sets or returns the frame that the Time to Capture Buffer marker is to be set to..

Example

```
CALC2:MARK:FUNC:TTC?
```

Characteristics

*RST value: -1

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult:MAXHold?

This command queries the maximum result values of the adjacent channel power measurement. An ACPR (Adjacent channel power relative) measurement must have previously been run with more than one sweep to provide the summary data. For details on the output refer to

["CALCulate<1|2>:MARKer<1>:FUNCtion:POWer:RESult\[:CURRent\]?"](#)
on page 1125.

This command is a query only and thus has no *RST value.

Example

```
CALC:MARK:FUNC:POW:RES:MAXH?
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CALCulate<1|2>:MARKer<1>:FUNCtion:ZOOM

This command defines the ratio to be zoomed around the marker 1 in the selected measurement window. The default value is 1, where the full trace is shown.

- ◆ Constellation vs Carrier
- ◆ Constellation vs Symbol
- ◆ PVT Full Burst
- ◆ PVT Rising / Falling
- ◆ Magnitude Capture Buffer

Parameter

1 to 1000000

Example

```
CALC:MARK:FUNC:ZOOM 2
```

Zooms 50% in screen A.

```
CALC:MARK:FUNC:ZOOM 4
```

Zooms 25% in screen A.

```
CALC:MARK:FUNC:ZOOM 1
```

Deactivates zooming in screen A.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDMA/WiBro

14.5.5 CONFigure Subsystem (WiMAX / WiBro, K93)

The CONFigure subsystem contains commands for configuring complex measurement tasks. The CONFigure subsystem is closely linked to the functions of the FETCH subsystem, where the measurement results are queried.

Commands of the CONFigure Subsystem

- ◆ ["CONFigure:ADDRess:SMU"](#)
- ◆ ["CONFigure:BURSt:BSTReam:BURSt:SElect"](#)
- ◆ ["CONFigure:BURSt:BSTReam:FORMat:SElect"](#)
- ◆ ["CONFigure:BURSt:BSTReam:SYMBol:SElect"](#)
- ◆ ["CONFigure:BURSt:CONST:BURSt:SElect"](#)
- ◆ ["CONFigure:BURSt:CONST:CARRier:SElect"](#)
- ◆ ["CONFigure:BURSt:CONST:CCARRier\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:CONST:CSYMBol\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:CONST:FORMat:SElect"](#)
- ◆ ["CONFigure:BURSt:CONST:SYMBol:SElect"](#)
- ◆ ["CONFigure:BURSt:EVM:ECARRier\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:EVM:ESYMBol\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:PREamble\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:PREamble:SElect"](#)
- ◆ ["CONFigure:BURSt:PVT\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:PVT:BURSt"](#)
- ◆ ["CONFigure:BURSt:PVT:SElect"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:ACPR\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:ACPR:SElect"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:FFT\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:FLATness\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:FLATness:SElect"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:MASK\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:SPECTrum:MASK:SElect"](#)
- ◆ ["CONFigure:BURSt:STATistics:BSTReam\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:STATistics:BSTReam: SYMBol:SElect"](#)
- ◆ ["CONFigure:BURSt:STATistics:BSTReam:FORMat:SElect"](#)
- ◆ ["CONFigure:BURSt:STATistics:BSTReam:BURSt:SElect"](#)
- ◆ ["CONFigure:BURSt:STATistics:BSUMmary\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:STATistics:CCDF\[:IMMediate\]"](#)
- ◆ ["CONFigure:BURSt:STATistics:PREamble:SElect"](#)
- ◆ ["CONFigure:BURSt:STATistics:PREamble\[:IMMediate\]"](#)
- ◆ ["CONFigure:CHANnel"](#)
- ◆ ["CONFigure:POWER:AUTO"](#)
- ◆ ["CONFigure:POWER:AUTO:SWEp:TIME"](#)

Remote Commands of the WiMAX/WiBro Measurements Option (R&S FSV-K93)

- ◆ "[CONFigure:POWer:EXPEcted:RF](#)"
- ◆ "[CONFigure:STANdard](#)"
- ◆ "[CONFigure:WIMax:AVERaging](#)"
- ◆ "[CONFigure:WIMax:DLSFrame:IDCell](#)"
- ◆ "[CONFigure:WIMax:DLSFrame:PREamble:MODE](#)"
- ◆ "[CONFigure:WIMax:DLSFrame:PREamble:INDEX](#)"
- ◆ "[CONFigure:WIMax:DLSFrame:SEGment<1...3>](#)"
- ◆ "[CONFigure:WIMax:FBAND](#)"
- ◆ "[CONFigure:WIMax:FSBWratio:AUTO](#)"
- ◆ "[CONFigure:WIMax:FSBWratio:BW](#)"
- ◆ "[CONFigure:WIMax:FSBWratio:FS](#)"
- ◆ "[CONFigure:WIMax:IGRatio](#)"
- ◆ "[CONFigure:WIMax:NFFT](#)"
- ◆ "[CONFigure:WIMax:TDDFrame:TTG](#)"
- ◆ "[CONFigure:WIMax:ULSFrame:CRLength](#)"
- ◆ "[CONFigure:WIMax:ULSFrame:FRAME](#)"
- ◆ "[CONFigure:WIMax:ULSFrame:SEGment<1..3>:BITMap<1..18>](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>\[:ANALyze\]:STATe](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTRol\[:DATA\]](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:COUNT?](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELeTe](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:FORMAt](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:OFFSet:AUTO](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:POWer](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:RESet](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SLOT:DURation](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:COUNT](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:OFFSet](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:COUNT](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:OFFSet](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:TYPE](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:CONTRol\[:DATA\]](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:COUNT?](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:DELeTe](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:IDSegment](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:PERMbase](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:RESet](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:SYMB:OFFSet](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:SYMB:COUNT](#)"
- ◆ "[CONFigure:WIMax:ZONE<1...26>:TYPE](#)"

CONF:ADDR:SMU

This remote control command is used to specify the IP address of the SMU to which WiMax settings can be uploaded or downloaded.

Parameter

String representing IP address

Example

```
CONF:ADDR:SMU '192.168.1.68'
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONF:BURSt:BSTReam:BURSt:SElect

This command selects bursts and pilots. It is only available if the Bitstream measurement is selected (see ["CONF:BURSt:STATistics:BSTReamf:IMMediate"](#) command).

Parameter

0 to 9999	burst number
ALL	all bursts
PILOTS	only pilots

Example

```
CONF:BURS:STAT:BSTR
```

Configures the Bitstream measurement type.

```
CONF:BURS:BSTR:BURS:SEL 1
```

Selects burst 1.

```
INIT
```

Starts a Bitstream measurement. The results of the selected burst (1) are calculated.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:BSTReam:FORMat:SElect

This command selects the modulation format. It is only available if the Bitstream measurement is selected (see

["CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]"](#) command).

Parameter

ALL | QPSK | QAM16 | QAM64

Example

```
CONF: BURS: STAT: BSTR
```

Configures the Bitstream measurement type.

```
CONF: BURS: BSTR: FORM: SEL QPSK
```

Selects the QPSK modulation formats.

```
INIT
```

Starts a Bitstream measurement. The results of the selected modulation formats (QPSK) are calculated.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:BSTReam:SYMBol:SElect

This command selects the symbol. It is only available if the Bitstream measurement is selected

(["CONFigure:BURSt:STATistics:BSTReam\[:IMMEDIATE\]"](#)). Parameter

0 to 9999 symbol number

ALL all symbols

Example

```
CONF: BURS: STAT: BSTR
```

Configures the Bitstream measurement type.

```
CONF: BURS: BSTR: SYMB: SEL 1
```

Selects symbol 1.

```
INIT
```

Starts a Bitstream measurement. The results of the selected symbol (1) are calculated.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:CONSt:BURSt:SElect

This command selects bursts and pilots. It is only available if the Constellation vs Symbol measurement is selected (see "[CONFigure:BURSt:CONSt:CSYMBOL:IMMEDIATE](#)" command).

Parameter

0 to 9999	burst number
ALL	all bursts
PILOTS	only pilots

Example

```
CONF: BURS: CONS: CSYM
```

Configures the Constellation vs Symbol measurement type.

```
CONF: BURS: CONS: BURS: SEL 1
```

Selects burst 1.

```
INIT
```

Starts a Constellation vs Symbol measurement. The results of the selected burst (1) are calculated.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:CONSt:CARRier:SElect

This command selects carriers and pilots. It is only available if the Constellation vs Symbol measurement is selected (see "[CONFigure:BURSt:CONSt:CSYMBOL:IMMEDIATE](#)" command).

Parameter

-100 to 100	carrier number
ALL	all carriers
PILOTS	only pilots

Example

```
CONF: BURS: CONS: CSYM
```

Configures the Constellation vs Symbol measurement type.

```
CONF: BURS: CONS: CARR: SEL -26
```

Carrier -26 is selected.

```
INIT
```

Starts a Constellation vs Symbol measurement. The results of the selected carrier (-26) are calculated.

Characteristics

*RST value: ALL

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:CONSt:CCARrier[:IMMEDIATE]

This command configures the Constellation vs Carrier measurement type. This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: CONS: CCAR
```

Configures the Constellation vs Carrier measurement type.

```
INIT
```

Starts a Constellation vs Carrier measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

CONFigure:BURSt:CONSt:CSYMBOL[:IMMEDIATE]

This command configures the Constellation vs Symbol measurement type. This command is an event and therefore has no *RST value and no query.

Example

```
CONF : BURS : CONS : CSYM
```

Configures the Constellation vs Symbol measurement type.

```
INIT
```

Starts a Constellation vs Symbol measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:CONSt:FORMat:SElect

This command selects the modulation format. It is only available if the Constellation vs Symbol measurement is selected (see "[CONFigure:BURSt:CONSt:CSYMBOL\[:IMMEDIATE\]](#)" command).

Parameter

ALL | QPSK | QAM16 | QAM64

Example

```
CONF : BURS : CONS : CSYM
```

Configures the Constellation vs Symbol measurement type.

```
CONF : BURS : CONS : FORM : SEL QPSK
```

Selects the QPSK modulation formats.

```
INIT
```

Starts a Constellation vs Symbol measurement. The results of the selected modulation formats (QPSK) are calculated.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:CONSt:SYMBol:SElect

This command selects the symbol. It is only available if the Constellation vs Symbol measurement is selected (see

["CONFigure:BURSt:CONSt:CSYMBOL:IMMEDIATE\]"](#) command).

Parameter

0 to 9999 symbol number
ALL all symbols

Example

```
CONF: BURS: CONS: CSYM
```

Configures the Constellation vs Symbol measurement type.

```
CONF: BURS: CONS: SYMB: SEL 1
```

Selects symbol 1.

```
INIT
```

Starts a Constellation vs Symbol measurement. The results of the selected symbol (1) are calculated.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:EVM:ECARrier[:IMMEDIATE]

This command configures the EVM vs Carrier measurement type.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: EVM: ECAR
```

Configures the EVM vs Carrier measurement type.

```
INIT
```

Starts a EVM vs Carrier measurement.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:EVM:ESYMBOL[:IMMEDIATE]

This command configures the EVM vs Symbol measurement type.
This command is an event and therefore has no *RST value and no query.

Example

```
CONF : BURS : EVM : ESYM
```

Configures the EVM vs Symbol measurement type.

```
INIT
```

Starts a EVM vs Symbol measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:PREamble[:IMMEDIATE]

This command configures the Phase or Frequency vs Preamble measurement type. The selection between the both measurements is made via the "[CONFigure:BURSt:PREamble:SElect](#)" command.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF : BURS : PRE
```

Configures the Phase or Frequency vs Preamble measurement type.

```
CONF : BURS : PRE : SEL  FREQ
```

The measurement results are interpreted as Frequency Error vs Preamble.

```
INIT
```

Starts a Frequency Error vs Preamble measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:PREamble:SElect

This command configures the interpretation of the preamble measurement results.

Parameter

PHASe | FREQuency

Example

```
CONF: BURS: PRE
```

Configures the Phase or Frequency vs Preamble measurement type.

```
CONF: BURS: PRE: SEL FREQ
```

The measurement results are interpreted as Frequency Error vs Preamble.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:PVT[:IMMEDIATE]

This command configures the Power vs Time (PVT) measurement type. For further settings of the Power vs Time measurement see the "[CONFigure:BURSt:PVT:BURSt](#)" and "[CONFigure:BURSt:PVT:SElect](#)" commands.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: PVT
```

Configures the Power vs Time measurement type.

```
INIT
```

Starts a Power vs Time measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:PVT:BURSt

This command specifies the burst that is used for the Power vs Time measurement results.

Parameter

1 to 10922

Example

```
CONF: BURS: PVT
```

Configures the Power vs Time measurement type.

```
CONF: BURS: PVT: BURS 1
```

Uses burst 1 for the Power vs Time measurement results.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

CONFigure:BURSt:PVT:SElect

This command configures the interpretation of the Power vs Time (PVT) measurement results. The available measurement types depend on the selected standard.

Parameter

FULL	PVT Start and End	OFDM
	PVT R _{ring} / Falling	OFDMA/WiBro
EDGE	PVT Full Burst	OFDM
	PVT Full Subframe	OFDMA/WiBro

Example

```
CONF: BURS: PVT
```

Configures the Power vs Time measurement type.

```
CONF: BURS: PVT: SEL FULL
```

The measurement results are interpreted as full burst.

Characteristics

*RST value: FULL

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:ACPR[:IMMEDIATE]

This command configures the ACPR (adjacent channel power relative) measurement type.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: SPEC: ACPR
```

Configures the ACPR measurement type.

```
INIT
```

Starts an ACPR measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:ACPR:SElect

This command specifies the type of ACP measurement to be performed.

Parameter

ABSolute | RELative

Example

```
CONF: BURS: SPEC: ACPR: SEL ABS
```

Specifies the ACP measurement type absolute.

Characteristics

*RST value: REL

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FFT[:IMMEDIATE]

This command configures the FFT (Fast Fourier Transform) measurement type. This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: SPEC: FFT
```

Configures the FFT measurement type.

```
INIT
```

Starts an FFT measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FLATness[:IMMEDIATE]

This command configures the Spectrum Flatness measurement type. For settings for the Spectrum Flatness measurement see

["CONFigure:BURSt:SPECtrum:FLATness:SElect"](#) command.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: SPEC: FLAT
```

Configures the Spectrum Flatness measurement type.

```
INIT
```

Starts a Spectrum Flatness measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:FLATness:SELEct

This command configures the interpretation of the Spectrum Flatness measurement results.

Parameter

FLATness	spectrum flatness
GRDelay	group delay
DIFFerence	flatness difference

Example

```
CONF: BURS: SPEC: FLAT
```

Configures the Spectrum Flatness measurement type.

```
CONF: BURS: SPEC: FLAT: SEL GRD
```

Configures the group delay for the Spectrum Flatness measurement.

Characteristics

*RST value: FLAT

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:MASK[:IMMediate]

This command configures the Spectrum Mask measurement type. For settings for the Spectrum Mask measurement see

["CONFigure:BURSt:SPECtrum:MASK:SELEct"](#) command.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: SPEC: MASK
```

Configures the Spectrum Mask measurement type.

```
INIT
```

Starts a Spectrum Mask measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:SPECtrum:MASK:SElect

This command configures the interpretation of the Spectrum Mask measurement results..

Parameter

IEEE interpretation according to IEEE standard
ETSI interpretation according to ETSI standard

Example

```
CONF: BURS: SPEC: MASK
```

Configures the Spectrum Mask measurement type.

```
CONF: BURS: SPEC: MASK: SEL ETSI
```

The measurement results are interpreted using the ETSI standard.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:BSTReam[:IMMediate]

This command configures the Bitstream measurement type.
This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: STAT: BSTR
```

Configures the Bitstream measurement type.

```
INIT
```

Starts a Bitstream measurement.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONF:BURSt:STATistics:BSTReam:BURSt:SElect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected burst.

Example

```
CONF:BURS:STAT:BST:BURS:SEL ALL
```

Configures the Bitstream measurement type to measure all bursts

Characteristics

*RST value: ALL

SCPI: device-specific

Mode

OFDMA/WiBro

CONF:BURSt:STATistics:BSTReam:FORMat:SElect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected modulation format.

Example

```
CONF:BURS:STAT:BST:FORM:SEL ALL
```

Configures the Bitstream measurement type to measure all modulation types

Characteristics

*RST value: ALL

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:STATistics:BSTReam: SYMBol:SElect

This remote control command is only available when Bit Stream measurement is selected. When the Bit Stream measurement is initiated, it will calculate the results of the selected symbol.

Example

```
CONF: BURS: STAT: BST: SYMB: SEL 1
```

Configures the Bitstream measurement type to measure symbol 1

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:BURSt:STATistics:BSUMmary[:IMMEDIATE]

This command configures the Burst Summary measurement type. This command is an event and therefore has no *RST value and no query.

Example

```
CONF: BURS: STAT: BSUM
```

Configures the Burst Summary measurement type.

```
INIT
```

Starts a the Burst Summary measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:CCDF[:IMMediate]

This command configures the CCDF (conditional cumulative distribution functions) measurement type.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF : BURS : STAT : CCDF
```

Configures the CCDF measurement type.

```
INIT
```

Starts a CCDF measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:PREAmble[:IMMediate]

This command configures the Phase or Frequency Vs Preamble measurement type.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF : BURS : STAT : PRE
```

Configures the Phase or Frequency Vs Preamble measurement type.

```
INIT
```

Starts a Phase or Frequency Vs Preamble measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:BURSt:STATistics:PREAmble:SELEct

This command configures the Phase or Frequency Vs Preamble measurement type.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF:BURS:STAT:SEL FREQ
```

Configures the Phase or Frequency Vs Preamble measurement type for Frequency Vs Preamble.

```
INIT
```

Starts a Frequency Vs Preamble measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:CHANnel

This command specifies the measurement input channel. This command will automatically cause the internal measurement frequency to be recalculated.

Parameter

0 to 3153

Example

```
CONF:CHAN 9
```

Defines the frequency of channel 9 as measurement range.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM

CONFigure:POWer:AUTO

This command switches on or off the automatic power level detection.

Parameter

ON | OFF | ONCE

Example

```
CONF:POW:AUTO ON
```

At the start of every measurement sweep the input power level is detected automatically.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:POWer:AUTO:SWEep:TIME

This command specifies the sweep time for the automatic power level detection.

Parameter

1ms to 1s

Example

```
CONF:POW:AUTO ON
```

At the start of every measurement sweep the input power level is detected automatically.

```
CONF:POW:AUTO:SWE:TIME 200MS
```

The sweep time is set to 200 ms power level.

Characteristics

*RST value: 100 ms

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:POWer:EXPected:RF

This command specifies the input power level of the source signal that will be supplied at the analyzer RF input.

Parameter

-999.99 dBm to 999.99 dBm

Example

```
CONF:POW:EXP:RF -20
```

Assumes an input signal strength of -20 dBm.

Characteristics

*RST value: -30 dBm

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:STANdard

This command specifies the Wireless LAN standard to be measured.

Parameter

0	IEEE 802.16-2004	OFDM
1	IEEE 802.16e-2005	OFDMA
2	IEEE 802.16e-2005	WiBro

Example

```
CONF:STAN 0
```

The measurements will be performed according to IEEE 802.16-2004.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:AVERaging

This command specifies the RSSI, CINR averaging parameter.

Parameter

0.000001 to 0.999999

Example

```
CONF:WIM:AVER 0.1
```

Sets the value to 0.1

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:DLSFrame:IDCell

This command specifies the downlink IDCell number. The downlink IDCell number is used as DL_PermBase parameter for the permutation equations to partly set the sub carrier randomizer initialization vector.

Parameter

0 to 31

Example

```
CONF:WIM:DLSF:IDC 0
```

Sets the downlink IDCell number to 0.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:DLSFrame:PREamble:MODE

This command specifies how the preamble index is calculated.

Parameter

- AUTO The preamble index is automatically calculated according to the parameters set by the "[CONFigure:WIMax:DLSFrame:IDCell](#)" and "[CONFigure:WIMax:DLSFrame:SEGMENT<1...3>](#)" commands.
- USER The preamble index can be specified manually, i.e. the preamble pattern is chosen by the "[CONFigure:WIMax:DLSFrame:PREamble:INDEX](#)" command according to the standard.

Example

```
CONF:WIM:DLSF:PRE:MOD AUTO
```

Activates the automatic calculation of the preamble index.

Characteristics

*RST value: USER

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:DLSFrame:PREamble:INDEX

This command specifies the preamble pattern (according to the standard) to be used.

Parameter

integer from 0 to 113

Example

```
CONF:WIM:DLSF:PRE:MOD USER
```

Deactivates the automatic calculation of the preamble index.

```
CONF:WIM:DLSF:PIND 31
```

Specifies the preamble pattern.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:DLSFrame:SEGMENT<1...3>

This command specifies the allowable logical subchannel usage of the transmission spectrum for one of the three downlink PUSC segments. Note that the indexes specified on the instrument are 0, whereas based under remote control they are 1 based. This means, the first segment on the instrument is labeled segment 0 and would be accessed with the command CONF:WIM:DLSF:SEGM1.

Parameter

0 to 63

Example

```
CONF:WIM:DLSF:SEGM1 63
```

Specifies the logical subchannel usage of the transmission spectrum for the first downlink PUSC segment to 63.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:FBANd

This command configures the Phase or Frequency vs Preamble measurement type.

Parameter

The suffix 1 can be omitted in the input (see list below) and is omitted in the output (see example).

Selection	Value	Range in GHz	Description
UNSPecified	UNSPecified		
ETSI or ETSI1	ETSI	3.410-4.200	Licensed Band
ETSI2	ETSI	10.000-10.680	Licensed Band
MMDS or MMDS1	MMDS	2.150-2.162	Licensed Band
MMDS2	MMDS	2.500-2.690	Licensed Band
WCS or WCS1	WCS	2.305-2.320	Licensed Band
WCS2	WCS	2.345-2.360	Licensed Band
CEPT or CEPT1	CEPT	5.470-5.725	License Exempt Band
CEPT2	CEPT	5.725-5.875	License Exempt Band
UNII or UNII1	U-NII	5.250-5.350	License Exempt Band
UNII2	U-NII	5.725-5.825	License Exempt Band

Example

```
CONF:WIM:FBAN ETSI
```

Configures the frequency band to be ETSI 3.41GHz - 4.2GHz.

```
CONF:WIM:FBAN?
```

After frequency band is set to ETSI this will return "ETSI" as the current frequency band.

```
CONF:WIM:FBAN ETSI1
```

Configures the frequency band to be ETSI 3.41GHz - 4.2GHz.

```
CONF:WIM:FBAN?
```

After frequency band is set to ETSI1 this will return "ETSI" as the current frequency band.

```
CONF:WIM:FBAN ETSI2
```

Configures the frequency band to be ETSI 10.0GHz - 10.68GHz.

```
CONF:WIM:FBAN?
```

After frequency band is set to ETSI2 this will return "ETSI2" as the current frequency band.

```
INIT
```

Starts a Phase or Frequency vs Preamble measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:AUTO

This remote control command only switches the Fs/BS ratio to automatic (as per standard) or to user defined values. User mode is only available when the Frequency Band is set to UNSPECIFIED.

Parameter

ON | OFF

Example

```
CONF:WIM:FSBW:AUTO ON
```

Sets FS/BW ratio to auto.

Characteristics

*RST value: on

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:BW

This remote control command sets the Channel Bandwidth (BW) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (Fs). Ratio = Fs/BW.

.

Example

```
CONF:WIM:FSBW:BW 1.5
```

Sets the Channel Bandwidth ratio to 1.5.

Characteristics

*RST value: 7

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:FSBWratio:FS

This remote control command sets the Sample Rate (Fs) part of the ratio used to calculate the relationship between the Channel Bandwidth (BW) and the Sample Rate (FS). Ratio = Fs/BW.

Example

```
CONF:WIM:FSBW:FS 2
```

Sets the Channel Bandwidth ratio to 1.5.

Characteristics

*RST value: 8

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:IGRatio

This command specifies the number of guard samples.

Parameter

valid range:

$$\frac{T_g}{T_b} \in \{1/32, 1/16, 1/8, 1/4\}$$

The ration can be set to one of four values - 4, 8, 16 or 32. The table below shows the relationship between these values and the number of guard samples.

Value	Guard samples (Tg/Tb)
4	1/4
8	1/8
16	1/16
32	1/32

Example

```
CONF:WIM:IGR 16
```

Sets the number of guard samples to 1/16.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:LMODe

This command specifies only to analyze the Down Link or Up Link bursts during a measurement.

Parameter

UL | DL

Example

```
CONF:WIM:LMODe UL
```

Only the Up Link bursts are analyzed.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

CONFigure:WIMax:NFFT

This command specifies the current FFT size.

Parameter

FFT128 FFT size of 128 carriers
FFT512 FFT size of 512 carriers
FFT1024 FFT size of 1024 carriers
FFT2048 FFT size of 2048 carriers

Example

```
CONF:WIM:NFFT FFT2048
```

Sets the FFT size to 2048 carriers.

Characteristics

*RST value: FFT1024

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:TDDFrame:TTG

This command specifies the TDD frame TX Transition Gap (TTG).

Parameter

0 to 2 seconds

Example

```
CONF:WIM:TDDF:TTG 10us
```

Specifies the TDD frame TX Transition Gap as 10 μ s.

Characteristics

*RST value: 5us

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ULSFrame:CRLength

This remote control command is used to specify the Control Region length for the uplink frame.CRLength (K93)

Parameter

0 to 30

Example

```
CONF:WIM:ULSF:CRL 0
```

Set the uplink control region length to 0.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ULSFrame:FRAMe

This command selects the frame number of the uplink frame in which the UL map that specifies the uplink burst was transmitted.

Parameter

0 to 10

Example

```
CONF:WIM:ULSF:FRAM 0
```

Selects frame number 0.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ULSFrame:SEGMENT<1..3>:BITMap<1..18>

This remote control command is used to specify the allowable logical sub channel bitmap usage of the transmission spectrum for one of the three uplink segments. (K93)

Example

```
CONF:WIM:ULSF:SEGM1:BITM1?
```

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>[:ANALyze]:STATe

This command sets a zone for analysis. This will come into effect when the next measurement is executed.

Parameter

ON | OFF

Example

```
CONF:WIM:ZONE1:ANAL ON
```

Sets zone 1 for analysis.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:CONTrol[:DATA]

This command associates a burst definition with a specific zone. A zone may have up to 32 bursts defined within it.

New bursts can only be appended to the end of the existing burst list. For example if 4 bursts are already defined, then the suffix required to enter a new burst is 5.

Parameter

<Modulation>,<Subchannels>,<Symbols>,<Slot Duration>,<Subchannel Offset>,<Symbol Offset>,<Burst Power>,<Burst Type>

with:

<Modulation>	QPSK_1_2 QPSK_3_4 QAM16_1_2 QAM16_3_4 QAM64_1_2 QAM64_2_3 QAM64_3_4	modulation scheme
<Subchannels>	<numeric_value>	number of subchannels used by the burst
<Symbols>	<numeric_value>	number of symbols used by the burst
<Slot Duration>	<numeric_value>	slot duration (only applies to uplink and ignored by downlink bursts)
<Subchannel Offset>	<numeric_value>	subchannel offset of the burst
<Symbol Offset>	<numeric_value>	symbol offset of the burst
<Burst Power>	<numeric_value>	Defines the boosting power of the burst.
<Burst Type>	FCH DLMAP ULMAP DATA	burst type

For further details refer to ["Burst List"](#).

Example

```
CONF:WIM:ZONE1:BURS1:CONT QAM16_1_2,1D2,5,10,20,0,0,0, DATA
```

Defines a 16 QAM 1/2 burst using 5 subchannels and 10 symbols.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:COUNt?

This command returns the current count of user defined bursts within the specified zone.

This command is only a query and therefore has no *RST value.

Example

```
CONF:WIM:ZONE1:BURS1:COUN?
```

Returns the user defined bursts within zone 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:DELete

This command deletes a specific burst from within the specified zone.

Example

```
CONF:WIM:ZONE1:BURS1:DEL
```

Deletes burst 1 from zone 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:FORMat

This command specifies the burst modulation format for the specified zone.

Parameter

QPSK1D2	QPSK code rate 1/2
QPSK3D4	QPSK code rate 3/4
QAM16_1D2	16 QAM code rate 1/2
QAM16_3D4	16 QAM code rate 3/4
QAM64_1D2	64 QAM code rate 1/2
QAM64_2D3	64 QAM code rate 2/3
QAM64_3D4	64 QAM code rate 3/4

Example

```
CONF:WIM:ZONE1:BURS1:FORM QAM64_3D4
```

Sets the burst modulation format to QAM64_3D4.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:OFFSet:AUTO

This command allows, for the specified zone and burst, the logical subchannel and symbol offsets to be automatically calculated so that they are contiguous. The command only applies to uplink bursts.

Parameter

ON | OFF

Example

```
CONF:WIM:ZONE1:BURS1:OFFS:AUTO ON
```

Activates the automatic calculation of the logical subchannel and symbol offsets.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:POWer

This command specifies, for the specified zone and burst, the boosting power associated with the burst.

Parameter

-80 to 10

Example

```
CONF:WIM:ZONE1:BURS1:POW 0
```

Sets the boosting power associated with the burst to 0.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:RESet

This remote control command removes all burst data associated with a specific zone. The burst index is ignored.

Example

```
CONF:WIM:ZONE1:BURS1:RESet
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SLOT:DURation

This command defines, for the specified zone and burst, the duration of an uplink burst in slots in seconds. The command has no effect on downlink bursts.

Parameter

1 to 3000

Example

```
CONF:WIM:ZONE1:BURS1:SLOT:DUR 10
```

Sets the duration of uplink burst 1 to 10.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:COUNT

This command defines, for the specified zone and burst, the number of logical subchannels used by the burst.

Parameter

1 to 60

Example

```
CONF:WIM:ZONE1:BURS1:SUBC:COUN 5
```

Sets the number of logical subchannels used by burst 1 to 5.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SUBChannel:OFFSet

This command defines, for the specified zone and burst, the logical subchannels offset for the burst. This, together with the symbol offset, can be used to specify the frequency bandwidth in use by specific bursts.

Parameter

0 to 60

Example

```
CONF:WIM:ZONE1:BURS1:SUBC:OFFS 5
```

Sets the subchannels offset for burst 1 to 5.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:COUNt

This command defines, for the specified zone and burst, the number of symbols used by the burst.

Parameter

1 to 1000

Example

```
CONF:WIM:ZONE1:BURS1:SYMB:COUN 5
```

Sets the number of symbols used by burst 1 to 5.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:SYMBol:OFFSet

This command defines, for the specified zone and burst, the symbol offset for the burst. This, together with the logical subchannel offset, can be used to specify the frequency bandwidth in use by specific bursts.

Parameter

0 to 1000

Example

```
CONF:WIM:ZONE1:BURS1:SYMB:OFFS 5
```

Sets the symbol offset for burst 1 to 5.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:BURSt<1...32>:TYPE

For the specified zone and burst, this command specifies the type of burst from the protocol layer perspective, i.e. if the burst contains signaling information or if it is just a data burst.

Parameter

FCH	frame control header
DLMAP	downlink map
ULMAP	uplink map
DATA	data burst

Example

```
CONF:WIM:ZONE1:BURS1:TYPE DATA
```

Burst 1 is a data burst.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:CONTRol[:DATA]

This command adds a new zone. Up to 26 user zones can be defined. New zones can only be appended to the end of the existing defined zones. For example, if 4 zones are already defined, then the suffix required to enter a new zone is 5.

Parameter

<Analyze>,<Type>,<Segment>,<Length>,<Offset>,<Permbase>,<PRBS_ID>

with:

<Analyze>	ON OFF	Specifies whether the zone is too be marked for analysis.
<Type>	DLFUSC DLPUSC ULPUSC	zone type: downlink FUSC (Fully Used Subchannelization) zone, downlink PUSC (Partial Used Subchannelization) zone, or uplink PUSC zone
<Segment>	0 1 2	downlink PUSC zone segment
<Length>	<numeric_value>	zone symbol length
<Offset>	<numeric_value>	zone symbol offset
<Permbase>	<numeric_value>	permbase to be used for channel decoding
<PRBS_ID>	<numeric_value>	PRBS to be used for channel decoding

For further details refer to ["Zone"/"Segment List"](#).

Example

```
CONF:WIM:ZONE1:CONT ON,DLFUSC,0,10,0,0,0
```

Adds a DL_PUSC zone with a length of 10 symbols.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:COUNt?

This command returns the current count of the specified zone.

This command is only a query and therefore has no *RST value.

Example

```
CONF:WIM:ZONE1:COUN?
```

Returns the count of zone 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:DELeTe

This command deletes a specific zone. If the specified zone is within a larger list of zones, then all following zones will be shuffled down to take up the space occupied by the deleted zone.

This command is an event and therefore has no *RST value and no query.

Example

```
CONF:WIM:ZONE1:DEL
```

Deletes zone 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:IDSegment

This command specifies the segment number associated with the zone. This is only valid for PUSC zones and will have no effect on other zone types.

Parameter

0 | 1 | 2

Example

```
CONF:WIM:ZONE1:IDS 0
```

Sets the segment number for zone 1 to 0.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:PERMbase

This command specifies the perm base which is used in the permutation equations for the specified zone.

Parameter

0 to 31

Example

```
CONF:WIM:ZONE1:PERM 0
```

For zone 1, perm base 0 is used in the permutation equations.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:PRBS

This command specifies a known PRBS (pseudo random binary sequence) modulated data sequence that is in use by the DUT of the specified zone.

Parameter

0, 1, 2, 3

Example

```
CONF:WIM:ZONE1:PRBS 0
```

Sets the PRBS to 0.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:RESet

This remote control command removes all zone and burst data. The zone index is ignored.

Example

```
CONF:WIM:ZONE1:RESet
```

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:SYMB:OFFSet

This command specifies the symbol offset associated with the specified zone. This is used to analyze signals which contain multiple zones and allows any zone in a subframe to be set up for analysis.

Parameter

1 to 1000

Example

```
CONF:WIM:ZONE1:SYMB:OFFS 0
```

Sets the symbol offset for zone 1 to 0.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:SYMB:COUNT

This command specifies the number of symbols defined to the specified zone.

Parameter

1 to 1000

Example

```
CONF:WIM:ZONE1:SYMB:COUNT 10
```

Sets the number of symbols for zone 1 to 10.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

CONFigure:WIMax:ZONE<1...26>:TYPE

This command specifies the zone type of the specified zone.

Parameter

DLFUSC downlink FUSC zone

DLPUSC downlink PUSC zone

ULPUSC uplink PUSC zone

Example

```
CONF:WIM:ZONE1:TYPE DLPUSC
```

Specifies zone 1 as downlink PUSC zone.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

14.5.6 DISPlay Subsystem (WiMAX / WiBro, K93)

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. In contrast to the basic device, the WiMAX IEEE 802.16 OFDM, OFDMA Measurements option supports the split screen modus.

Commands of the DISPlay Subsystem

- ◆ ["DISPlay:FORMat"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:SElect"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:SSElect"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TABLe"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TABLe:LIST"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TABLe:UNIT"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe1:Y\[:SCALe\]:AUTO"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe1:Y\[:SCALe\]:PDIVision"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:RLEVel\[:RF\]"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:RLEVel?"](#)
- ◆ ["DISPlay\[:WINDow<1|2>\]:TRACe<1...3>:Y\[:SCALe\]:RLEVel:OFFSet"](#)

DISPlay:FORMat

This command sets the screen display type to full or split screen.

Parameter

SPLit | SINGle

Example

```
DISP:FORM SING
```

Sets the display to full screen.

Characteristics

*RST value: SPLit

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:SElect

This command selects whether screen A or screen B is active (see also "[DISPlay\[:WINDow<1|2>\]:SSElect](#)")

Example

```
DISP:WIND1 SEL  
Sets screen A active.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

DISPlay[:WINDow<1|2>]:SSElect

This command selects whether screen A or screen B is active. The numeric suffix <1|2> defines the active window.

Example

```
DISP:WIND1:SSEL  
Sets screen A active.
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TABLe

This command shows or hides the results table.
The numeric suffix <1|2> defines the active window.

Parameter

ON | OFF

Example

```
DISP:TABL OFF
```

Hides the results table.

Characteristics

*RST value: OFF
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TABLe:LIST

This command displays the requested page for the results table. The number of available pages depends on the selected standard (e.g. OFDM has 1 page, OFDMA has 2 pages).
The numeric suffix <1|2> defines the active window.

Parameter

1 to 2

Example

```
DISP:TABL:LIST 1
```

Selects page 1 of the table of results.

Characteristics

*RST value: 1
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TABLe:UNIT

This command specifies the unit for the parameters listed in the results table.
The numeric suffix <1|2> defines the active window.

Parameter

DB results returned in dB
PCT results returned in percent

Example

```
DISP:TABL:UNIT DB
```

Results are returned in dB.

Characteristics

*RST value: DB
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TRACe1:Y[:SCALE]:AUTO

This command switches on or off automatic scaling of the y-axis for trace 1. If switched on, the y-axis is scaled to best fit the measurement results automatically.
The numeric suffix <1|2> defines the active window.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

ON | OFF

Example

```
DISP:WIND2:TRAC1:Y:AUTO ON
```

Switches on automatic scaling of the y-axis for the active trace.

Characteristics

*RST value: ON
SCPI: conform

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TRACe1:Y[:SCALe]:PDIVision

This command sets the size of each y scale division for trace 1. It has no affect if automatic scaling of the y-axis is enabled.

The numeric suffix <1|2> defines the active window.

This command is query only for the following result displays:

- ◆ Constellation vs Symbol
- ◆ Constellation vs Carrier

Parameter

1E-6 to 10E12

Example

```
DISP:WIND2:TRAC1:Y:AUTO OFF
```

Switches off automatic scaling of the y-axis for the active trace.

```
DISP:WIND2:TRAC1:Y:PDIV 2
```

Sets the y scale division to size 2.

Characteristics

*RST value: 3

SCPI: conform

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RLEVel[:RF]

This command specifies the reference level applied to an RF measurements.

The numeric suffixes of WINDow<1|2> and TRACe<1 to 3> are irrelevant.

Parameter

<numeric_value> in dBm, range specified in data sheet

Example

```
DISP:TRAC:Y:RLEV 10
```

Reference level of the analyzer is 10 dB

```
DISP:TRAC:Y:RLEV:RF -10
```

Reference level of the analyzer is -10 dB

Characteristics

*RST value: 0 dB

SCPI: conform

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALE]:RLEVel?

This command queries the current internal instrument reference level used when performing measurements.

The numeric suffixes of WINDow<1|2> and TRACe<1 to 3> are irrelevant.

This command is only a query and therefore has no *RST value.

Example

```
DISP:TRAC:Y:RLEV?
```

Returns the current reference level in use.

Characteristics

*RST value: -

SCPI: conform

Mode

OFDM, OFDMA/WiBro

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALE]:RLEVel:OFFSet

This command specifies the external attenuation/gain applied to measurements.

The value corresponds to the reference level offset in spectrum analyzer mode..

The numeric suffixes of WINDow<1|2> and TRACe<1 to 3> are irrelevant.

Parameter

-200 to 200 dB

Example

```
DISP:TRAC:Y:RLEV:OFFS 10
```

External attenuation (level offset) of the analyzer is 10 dB

```
DISP:TRAC:Y:RLEV:OFFS -10
```

External attenuation of the analyzer is -10 dB. i.e. a gain of 10 dB

Characteristics

*RST value: 0 dB

SCPI: conform

Mode

OFDM, OFDMA/WiBro

14.5.7 FETCh Subsystem (WiMAX / WiBro, K93)

The FETCh subsystem contains commands for reading out results of complex measurement tasks. This subsystem is closely linked to the CONFigure and SENSE subsystems.

Commands of the FETCh Subsystem

- ◆ ["FETCh:BURSt:ALL?"](#)
- ◆ ["FETCh:BURSt:CINR?"](#)
- ◆ ["FETCh:BURSt:CINR:AVERage?"](#)
- ◆ ["FETCh:BURSt:CINR:MAXimum?"](#)
- ◆ ["FETCh:BURSt:CINR:MINimum?"](#)
- ◆ ["FETCh:BURSt:COUNt?"](#)
- ◆ ["FETCh:BURSt:CRESt:AVERage?"](#)
- ◆ ["FETCh:BURSt:CRESt:MAXimum?"](#)
- ◆ ["FETCh:BURSt:CRESt:MINimum?"](#)
- ◆ ["FETCh:BURSt:EVM:ALL:AVERage?"](#)
- ◆ ["FETCh:BURSt:EVM:ALL:MAXimum?"](#)
- ◆ ["FETCh:BURSt:EVM:ALL:MINimum?"](#)
- ◆ ["FETCh:BURSt:EVM:DATA:AVERage?"](#)
- ◆ ["FETCh:BURSt:EVM:DATA:MAXimum?"](#)
- ◆ ["FETCh:BURSt:EVM:DATA:MINimum?"](#)
- ◆ ["FETCh:BURSt:EVM:PILOt:AVERage?"](#)
- ◆ ["FETCh:BURSt:EVM:PILOt:MAXimum?"](#)
- ◆ ["FETCh:BURSt:EVM:PILOt:MINimum?"](#)
- ◆ ["FETCh:BURSt:FERRor:AVERage?"](#)
- ◆ ["FETCh:BURSt:FERRor:MAXimum?"](#)
- ◆ ["FETCh:BURSt:FERRor:MINimum?"](#)
- ◆ ["FETCh:BURSt:GIMBalance:AVERage?"](#)
- ◆ ["FETCh:BURSt:GIMBalance:MAXimum?"](#)
- ◆ ["FETCh:BURSt:GIMBalance:MINimum?"](#)
- ◆ ["FETCh:BURSt:IQOffset:AVERage?"](#)
- ◆ ["FETCh:BURSt:IQOffset:MAXimum?"](#)
- ◆ ["FETCh:BURSt:IQOffset:MINimum?"](#)
- ◆ ["FETCh:BURSt:QUADoffset:AVERage?"](#)
- ◆ ["FETCh:BURSt:QUADoffset:MAXimum?"](#)
- ◆ ["FETCh:BURSt:QUADoffset:MINimum?"](#)
- ◆ ["FETCh:BURSt:RMS:ALL:AVERage?"](#)
- ◆ ["FETCh:BURSt:RMS:ALL:MAXimum?"](#)
- ◆ ["FETCh:BURSt:RMS:ALL:MINimum?"](#)
- ◆ ["FETCh:BURSt:RMS:AVERage?"](#)
- ◆ ["FETCh:BURSt:RMS:DATA:AVERage?"](#)
- ◆ ["FETCh:BURSt:RMS:DATA:MAXimum?"](#)

- ◆ ["FETCh:BURSt:RMS:DATA:MINimum?"](#)
- ◆ ["FETCh:BURSt:RMS:DLPreamble:AVERage?"](#)
- ◆ ["FETCh:BURSt:RMS:DLPreamble:MAXimum?"](#)
- ◆ ["FETCh:BURSt:RMS:DLPreamble:MINimum?"](#)
- ◆ ["FETCh:BURSt:RMS:MAXimum?"](#)
- ◆ ["FETCh:BURSt:RMS:MINimum?"](#)
- ◆ ["FETCh:BURSt:RMS:PILot:AVERage?"](#)
- ◆ ["FETCh:BURSt:RMS:PILot:MAXimum?"](#)
- ◆ ["FETCh:BURSt:RMS:PILot:MINimum?"](#)
- ◆ ["FETCh:BURSt:RSSI?"](#)
- ◆ ["FETCh:BURSt:RSSi:AVERage?"](#)
- ◆ ["FETCh:BURSt:RSSi:MAXimum?"](#)
- ◆ ["FETCh:BURSt:RSSi:MINimum?"](#)
- ◆ ["FETCh:BURSt:SYMBOLerror:AVERage?"](#)
- ◆ ["FETCh:BURSt:SYMBOLerror:MAXimum?"](#)
- ◆ ["FETCh:BURSt:SYMBOLerror:MINimum?"](#)
- ◆ ["FETCh:BURSt:USERror:AVERage?"](#)
- ◆ ["FETCh:BURSt:USERror:MAXimum?"](#)
- ◆ ["FETCh:BURSt:USERror:MINimum?"](#)
- ◆ ["FETCh:BURSt:TDOMain:PREamble?"](#)
- ◆ ["FETCh:BURSt:TDOMain:SUBFrame?"](#)
- ◆ ["FETCh:BURSt:TDOMain:ZONE?"](#)
- ◆ ["FETCh:SYMBOL:COUNT?"](#)
- ◆ ["FETCh:ZONE:COUNT?"](#)

Further information

- ◆ ["ASCII formats for returned values"](#)

14.5.7.1 ASCII formats for returned values

The results are output as a list of result strings separated by commas.

OFDM results

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>
 <min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>
 <min EVM pilots>,<average EVM pilots>,<max EVM pilots>
 <min IQ offset>,<average IQ offset>,<maximum IQ offset>
 <min gain imbalance>,<average gain imbalance>,<max gain imbalance>
 <min quadrature offset>,<average quadrature offset>,<max quadrature offset>
 <min frequency error>,<average frequency error>,<max frequency error>
 <min symbol error>,<average symbol error>,<max symbol error>
 <min burst power>,<average burst power>,<max burst power>
 <min crest factor>,<average crest factor>,<max crest factor>
 <min SS timing>,<average SS timing>,<max SS timing>
 <min RSSI>,<average RSSI>,<max RSSI>

<min RSSI Standard Deviation>,<average RSSI Standard Deviation>,<max RSSI Standard Deviation>

<min CINR>,<average CINR>,<max CINR>

<min CINR Standard Deviation>,<average CINR Standard Deviation>,<max CINR Standard Deviation>

OFMDA Uplink results

<min BER pilots>,<average BER pilots>,<max BER pilots>

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>

<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>

<min EVM pilots>,<average EVM pilots>,<max EVM pilots>

<min IQ offset>,<average IQ offset>,<maximum IQ offset>

<min gain imbalance>,<average gain imbalance>,<max gain imbalance>

<min quadrature offset>,<average quadrature offset>,<max quadrature offset>

<min frequency error>,<average frequency error>,<max frequency error>

<min symbol error>,<average symbol error>,<max symbol error>

<min power all>,<average power all>,<max power all>

<min power data>,<average power data>,<max power data>

<min power pilots>,<average power pilots>,<max power pilots>

<min crest factor>,<average crest factor>,<max crest factor>

OFDMA Downlink results

<min BER pilots>,<average BER pilots>,<max BER pilots>

<min EVM all bursts>,<average EVM all bursts>,<max EVM all bursts>

<min EVM data carriers>,<average EVM data carriers>,<max EVM data carriers>

<min EVM pilots>,<average EVM pilots>,<max EVM pilots>

<min IQ offset>,<average IQ offset>,<maximum IQ offset>

<min gain imbalance>,<average gain imbalance>,<max gain imbalance>

<min quadrature offset>,<average quadrature offset>,<max quadrature offset>

<min frequency error>,<average frequency error>,<max frequency error>

<min symbol error>,<average symbol error>,<max symbol error>

<min power DL preamble>,<average power DL preamble>,<max power DL preamble>

<min power all>,<average power all>,<max power all>

<min power data>,<average power data>,<max power data>

<min power pilots>,<average power pilots>,<max power pilots>

<min crest factor>,<average crest factor>,<max crest factor>

<min RSSI>,<average RSSI>,<max RSSI>,<RSSI Standard Deviation>

<min CINR>,<average CINR>,<max CINR>,<CINR Standard Deviation>

FETCH:BURSt:ALL?

This command returns all the results. The results are output as a list of result strings separated by commas in ASCII format. For details on the format refer to "[ASCII formats for returned values](#)" on page 1177. The units for the EVM results are specified with the `UNIT:EVM` command.

Example

```
FETCH:BURSt:ALL?
```

All calculated results are returned

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCH:BURSt:CINR?

This command returns all the CINR results separated by commas. For details on the format refer to "[ASCII formats for returned values](#)" on page 1177.

This command is only a query and therefore has no *RST value.

Example

```
FETCH:BURSt:CINR?
```

The calculated CINR results from the most recent measurement are returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:CINR:AVERage? / FETCh:BURSt:CINR:MINimum? / FETCh:BURSt:CINR:MAXimum?

This command returns the determined CINR (carrier to interference and noise ratio) standard deviation value (average, minimum or maximum value). The result is returned in ASCII format.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RSS:MAX?
```

The calculated maximum CINR value is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

FETCh:BURSt:COUNt?

This command returns the number of bursts analyzed in the last sweep.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:COUN?
```

The number of analyzed bursts in the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

**FETCh:BURSt:CRESt:AVERAge? / FETCh:BURSt:CRESt:MAXimum? /
FETCh:BURSt:CRESt:MINimum?**

This command returns the determined crest factor (average, minimum or maximum value) in dBm. The crest factor is the ratio of peak power to average power.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:CRESt:MAX?
```

The calculated maximum crest factor from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

**FETCh:BURSt:EVM:ALL:AVERAge? / FETCh:BURSt:EVM:ALL:MAXimum? /
FETCh:BURSt:EVM:ALL:MINimum?**

This command returns the Error Vector Magnitude (EVM) measurement results summary (average, minimum or maximum value) in dB. The results summary is a combined figure that represents the pilot, data and the free carrier.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:EVM:ALL:MIN?
```

The minimum Error Vector Magnitude value is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:DATA:AVERAge? / FETCh:BURSt:EVM:DATA:MAXimum? / FETCh:BURSt:EVM:DATA:MINimum?

This command returns the Error Vector Management measurement results summary (average, minimum or maximum value) for the data carrier in dB. This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: EVM: DATA: MAX?
```

The maximum EVM recorded for the data carrier is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:EVM:PILot:AVERAge? / FETCh:BURSt:EVM:PILot:MAXimum? / FETCh:BURSt:EVM:PILot:MINimum?

This command returns the Error Vector Management measurement results summary for the EVM pilot carrier in dB. This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: EVM: PIL: MAX?
```

The maximum EVM recorded for the EVM pilot carrier is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

**FETCh:BURSt:FERRor:AVERage? / FETCh:BURSt:FERRor:MAXimum? /
FETCh:BURSt:FERRor:MINimum?**

This command returns the measured average, minimum or maximum frequency errors in Hz.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: FERR: MAX?
```

The maximum frequency error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

**FETCh:BURSt:GIMBalance:AVERage? / FETCh:BURSt:GIMBalance:MAXimum? /
FETCh:BURSt:GIMBalance:MINimum?**

This command returns the measured average, minimum or maximum IQ imbalance errors in dB.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: GIMB: MAX?
```

The maximum IQ Imbalance error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:IQOffset:AVERage? / FETCh:BURSt:IQOffset:MAXimum? / FETCh:BURSt:IQOffset:MINimum?

This command returns the measured average, minimum or maximum IQ offset errors in dB.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: IQOF: MAX?
```

The maximum IQ Offset error from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:QUADOffset:AVERage? / FETCh:BURSt:QUADOffset:MAXimum? / FETCh:BURSt:QUADOffset:MINimum?

This command returns the accuracy in terms of the phase error of symbols within a burst.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: QUAD: MAX?
```

The maximum angle error recorded for a symbol during the measurement.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:RMS:ALL:AVERAge? / FETCh:BURSt:RMS:ALL:MAXimum? / FETCh:BURSt:RMS:ALL:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for all carriers measured during the measurement.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RMS:ALL:MAX?
```

The maximum RMS burst power for all carriers recorded during the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

FETCh:BURSt:RMS:AVERAge? / FETCh:BURSt:RMS:MAXimum? / FETCh:BURSt:RMS:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm measured during the measurement.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RMS:MAX?
```

The maximum burst power recorded for the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

FETCh:BURSt:RMS:DATA:AVERAge? / FETCh:BURSt:RMS:DATA:MAXimum? / FETCh:BURSt:RMS:DATA:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for data carriers measured during the measurement.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: RMS: DATA: MAX?
```

The maximum RMS burst power for data carriers from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

FETCh:BURSt:RMS:DLPreamble:AVERAge? / FETCh:BURSt:RMS:DLPreamble:MAXimum? / FETCh:BURSt:RMS:DLPreamble:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for the downlink preamble measured during the measurement.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: RMS: DLPR: MAX?
```

The maximum RMS burst power for the downlink preamble from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

FETCh:BURSt:RMS:PILot:AVERAge? / FETCh:BURSt:RMS:PILot:MAXimum? / FETCh:BURSt:RMS:PILot:MINimum?

This command returns the average, minimum or maximum RMS burst power in dBm for pilot carriers measured during the measurement.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RMS:PIL:MAX?
```

The maximum RMS burst power for pilot carriers from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM

FETCh:BURSt:RSSI?

This command returns all the received signal strength indicator (RSSI) results separated by commas. For details on the format refer to "[ASCII formats for returned values](#)" on page 1177.

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RSSI?
```

The calculated RSSI results from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:RSSi:AVERAge? / FETCh:BURSt:RSSi:MAXimum? / FETCh:BURSt:RSSi:MINimum?

This command returns the average, minimum or maximum RSSI (received signal strength indicator) standard deviation value. This is an estimate of the total received power of the frame preamble of the segment of the connected BS. For details on the format refer to "[ASCII formats for returned values](#)" on page 1177. This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:RSS:MAX?
```

The maximum RSSI deviation value from the most recent measurement is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt:SYMBolerror:AVERAge? / FETCh:BURSt:SYMBolerror:MAXimum? / FETCh:BURSt:SYMBolerror:MINimum?

This command returns the percentage of symbols that were outside permissible demodulation range within a burst..

This command is only a query and therefore has no *RST value.

Example

```
FETC:BURS:SYMB:MAX?
```

The maximum number of symbols that were out of range per burst is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:BURSt: USERror:AVERage? / FETCh:BURSt: USERror:MAXimum? / FETCh:BURSt: USERror:MINimum?

This command returns Unmodulate Subcarrier Error for the analysed zone..
This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: USER: MAX?
```

The maximum unmodulated subcarrier error is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

FETCh:BURSt:TDOMain:PREamble?

This command returns the minimum, average and maximum preamble time domain values. The result is returned in (ASCII) format.
This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: TDOM: PRE?
```

Returns the minimum, average and maximum preamble time domain values.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

FETCh:BURSt:TDOMain:SUBFrame?

This command returns the minimum, average and maximum subframe time domain values. The result is returned in (ASCII) format.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: TDOM: SUBF?
```

Returns the minimum, average and maximum subframe time domain values.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

FETCh:BURSt:TDOMain:ZONE?

This command returns the minimum, average and maximum zone time domain values. The result is returned in (ASCII) format.

This command is only a query and therefore has no *RST value.

Example

```
FETC: BURS: TDOM: ZONE?
```

Returns the minimum, average and maximum zone time domain values.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

FETCh:SYMBol:COUNt?

This command returns the number of symbol in each analyzed burst found in the last measurement sweep. The results are output as a list of result strings separated by commas in the following (ASCII) format:

<Symbols in 1st burst>,< Symbols in 2nd burst >,..., < Symbols in last burst >

This command is only a query and therefore has no *RST value.

Example

```
FETC:SYMB:COUN?
```

The calculated symbols in the analyzed bursts for the most recent measurement are returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

FETCh:ZONE:COUNt?

This command returns the current number of zones found during measurement analysis.

This command is only a query and therefore has no *RST value.

Example

```
FETC:ZONE:COUN?
```

The current number of zones found during analysis is returned.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

14.5.8 FORMat Subsystem (WiMAX / WiBro, K93)

The FORMat subsystem specifies the data format of the data transmitted from and to the instrument.

Commands of the FORMat Subsystem

- ◆ "[FORMat\[:DATA\]](#)"

FORMat[:DATA]

Parameter

ASCii | REAL | UINT [,8 | 32]

For details refer to section "[Remote Control - Description of Basic Settings Commands](#)" in the base unit description.

14.5.9 INITiate Subsystem (WiMAX / WiBro, K93)

The INITiate subsystem configures the instrument prior to a measurement being carried out. It is basically used to tell the instrument which measurement is to be performed and takes any necessary step to set up the instrument for the measurement.

Commands of the INITiate Subsystem

- ◆ "[INITiate:IMMediate](#)"
- ◆ "[INITiate:CONTinuous](#)"
- ◆ "[INITiate:REFResh](#)"

INITiate[:IMMediate]

For details refer to "[INITiate<1|2>\[:IMMediate\]](#)".

INITiate:CONTinuous

For details refer to "[INITiate<1|2>:CONTinuous](#)".

INITiate:REFResh

This command updates the current IQ measurement results to reflect the current measurement settings. Note that no new IQ data is captured, i.e. the measurement settings apply to the IQ data being currently in the capture buffer. The command applies exclusively to IQ measurements. It requires available IQ data.

Example

```
INIT:REFR
```

Updates the IQ measurement results according to the current settings.

Characteristics

*RST value: -

SCPI: conform

Mode

OFDM, OFDMA/WiBro

14.5.10 INPut Subsystem (WiMAX / WiBro, K93)

The INPut subsystem controls the input characteristics of the RF inputs of the instrument.

Commands of the INPut Subsystem

- ◆ ["INPut:ATTenuation"](#)
- ◆ ["INPut:SElect"](#)

INPut:ATTenuation

For details refer to ["INPut<1|2>:ATTenuation"](#).

INPut:SElect

This command specifies the RF input as currently selected signal input.

Parameter

RF

Example

```
INPut:SEL RF  
Selects RF input.
```

Characteristics

*RST value: RF
SCPI: conform

Mode

OFDM, OFDMA/WiBro

14.5.11 INSTRUMENT Subsystem (WiMAX / WiBro, K93)

The INSTRUMENT subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

Commands of the INSTRUMENT Subsystem

- ◆ "[INSTRUMENT:SElect](#)"
- ◆ "[INSTRUMENT:NSElect](#)"

INSTRUMENT[:SElect]

Parameter

WiMAX (WiMAX 802.16 OFDM Measurements option and WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

For further details refer to section "[Remote Control - Description of Basic Settings Commands](#)" of the base unit description.

INSTRUMENT:NSElect

Parameter

23 (WiMAX 802.16 OFDM Measurements option, R&S FSV-K93)

6 (WiMAX IEEE 802.16 OFDM, OFDMA Measurements option, R&S FSV-K93)

For further details refer to section "[Remote Control - Description of Basic Settings Commands](#)" of the base unit description.

14.5.12 MMEMemory Subsystem (WiMAX / WiBro, K93)

The MMEMemory (mass memory) subsystem provides commands to store and load IQ data.

Commands of the MMEMemory Subsystem

- ◆ "[MMEMemory:LOAD:FRAME:STATe](#)"
- ◆ "[MMEMemory:LOAD:IQ:STATe](#)"
- ◆ "[MMEMemory:STORE:IQ:STATe](#)"

MMEMemory:LOAD:FRAME:STATe

This command loads a zone frame setup from the specified *.xml file. This file is created by a R&S SMU signal generator in accordance to the IEEE 80216e-2005 standard.

Parameter

1,<file_name>

Example

```
MME:STOR:FRAM:STAT 1, 'C:\R_S\Instr\user\data.xml'
```

Loads the zone frame setup from the specified file.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDMA/WiBro

MMEMemory:LOAD:IQ:STATe

This command loads the IQ data from the specified *.iqw file.

Parameter

1,<file_name>

Example

```
MME:LOAD:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'
```

Loads IQ data from the specified file.

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

MMEMory:STORe:IQ:STATe

This command stores the IQ data to the specified *.iqw file.

Parameter

1,<file_name>

Example

```
MMEM:STOR:IQ:STAT 1, 'C:\R_S\Instr\user\data.iqw'
```

Stores IQ data to the specified file.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.13 SENSE Subsystem (WiMAX / WiBro, K93)

The SENSE command is used to set and get the values of parameters in the remote instrument. The get variant of the SENSE command differs from set in that it takes no parameter values (unless otherwise stated) but is followed by the character '?' and will return the parameter's value in the same format as it is set.

Commands of the SENSE Subsystem

- ◆ "[\[SENSe:\]BANDwidth:CHANnel](#)"
- ◆ "[\[SENSe:\]BURSt:COUNt](#)"
- ◆ "[\[SENSe:\]BURSt:COUNt:STATe](#)"
- ◆ "[\[SENSe:\]DEMod:CESTimation](#)"
- ◆ "[\[SENSe:\]DEMod:FILTer:CATalog?](#)"
- ◆ "[\[SENSe:\]DEMod:FILTer:MODulation](#)"
- ◆ "[\[SENSe:\]DEMod:FORMat\[:BCONtent\]:AUTO](#)"
- ◆ "[\[SENSe:\]DEMod:FORMat:BANalyze](#)"
- ◆ "[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:EQUal](#)"
- ◆ "[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:MAX](#)"
- ◆ "[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBOLs:MIN](#)"
- ◆ "[\[SENSe:\]FFFT:OFFSet](#)"
- ◆ "[\[SENSe:\]FREQuency:CENTer](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:ACPairs](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:BANDwidth|BWIDth\[:CHANnel\]](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:BANDwidth|BWIDth:ACHannel](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:BANDwidth|BWIDth:ALTErnate<1|4>](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:MODE](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:SPACing\[:ACHannel\]](#)"
- ◆ "[\[SENSe:\]POWER:ACHannel:SPACing:ALTErnate<1|4>](#)"
- ◆ "[\[SENSe:\]POWER:NCORrection](#)"
- ◆ "[\[SENSe:\]POWER:SEM](#)"
- ◆ "[\[SENSe:\]POWER:SEM:CLASs](#)"
- ◆ "[\[SENSe:\]POWER:SEM:MODE](#)"
- ◆ "[\[SENSe:\]POWER:SEM:TTA](#)"
- ◆ "[\[SENSe:\]SUBChannel](#)"
- ◆ "[\[SENSe:\]SUBChannel:STATe](#)"
- ◆ "[\[SENSe:\]SUBChannel:ULPHysmod](#)"
- ◆ "[\[SENSe:\]SWAPiq](#)"
- ◆ "[\[SENSe:\]SWEep:ACPR:TIME](#)"
- ◆ "[\[SENSe:\]SWEep:ACPR:TIME:AUTO](#)"
- ◆ "[\[SENSe:\]SWEep:COUNt](#)"
- ◆ "[\[SENSe:\]SWEep:EGATE](#)"
- ◆ "[\[SENSe:\]SWEep:EGATE:HOLDoff\[:TIME\]](#)"
- ◆ "[\[SENSe:\]SWEep:EGATE:HOLDoff:SAMPLE](#)"

Remote Commands of the WiMAX/WiBro Measurements Option (R&S FSV-K93)

- ◆ "[SENSE:]SWEep:EGATe:LENGth[:TIME]"
- ◆ "[SENSE:]SWEep:EGATe:LENGth:SAMPle"
- ◆ "[SENSE:]SWEep:EGATe:LINK"
- ◆ "[SENSE:]SWEep:TIME"
- ◆ "[SENSE:]TRACking:LEVel"
- ◆ "[SENSE:]TRACking:PHASe"
- ◆ "[SENSE:]TRACking:PILot"
- ◆ "[SENSE:]TRACking:TIME"

Further information

- ◆ "[Analysis modulation format](#)"

14.5.13.1 Analysis modulation format

Parameter	Standard	Description
'BPSK'	Alias for BI-Phase shift keying at higher data rate for selected standard	
'BPSK3'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 3 Mbps
'BPSK6'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 6 Mbps
'BPSK9'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	BI-Phase shift keying at 9 Mbps
'BPSK45'	IEEE 802.11j (10 MHz)	BI-Phase shift keying at 4.5 Mbps
'BPSK65'	IEEE 802.11n	BI-Phase shift keying at 6.5 Mbps
'BPSK72'	IEEE 802.11n	BI-Phase shift keying at 7.2 Mbps
'CCK11'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 11 Mbps
'CCK55'	IEEE 802.11b & g (Single Carrier)	Complementary Code Keying at 5.5 Mbps
'DBPSK'	IEEE 802.11b & g (Single Carrier)	Differential BI-Phase shift keying
'DQPSK'	IEEE 802.11b & g (Single Carrier)	Differential Quadrature phase shift keying
'PBCC11'	IEEE 802.11b & g (Single Carrier)	PBCC at 11 Mbps
'PBCC22'	IEEE 802.11g (Single Carrier)	PBCC at 11 Mbps
'PBCC55'	IEEE 802.11b & g (Single Carrier)	PBCC at 5.5 Mbps
'QAM16'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM64'	Alias for Quadrature Amplitude Modulation at higher data rate for selected standard	
'QAM1612'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 12 Mbps
'QAM1618'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 18 Mbps
'QAM1624'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 24 Mbps
'QAM1626'	IEEE 802.11n	Quadrature Amplitude Modulation at 26 Mbps
'QAM1636'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 36 Mbps
'QAM1639'	IEEE 802.11n	Quadrature Amplitude Modulation at 39 Mbps
'QAM6424'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 24 Mbps
'QAM6427'	IEEE 802.11j (10 MHz)	Quadrature Amplitude Modulation at 27 Mbps
'QAM6448'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 48 Mbps
'QAM6452'	IEEE 802.11n	Quadrature Amplitude Modulation at 52 Mbps
'QAM6454'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature Amplitude Modulation at 54 Mbps
'QAM6465'	IEEE 802.11n	Quadrature Amplitude Modulation at 65 Mbps
'QAM16289'	IEEE 802.11n	Quadrature Amplitude Modulation at 28.9 Mbps
'QAM16433'	IEEE 802.11n	Quadrature Amplitude Modulation at 43.3 Mbps
'QAM64578'	IEEE 802.11n	Quadrature Amplitude Modulation at 57.8 Mbps
'QAM64585'	IEEE 802.11n	Quadrature Amplitude Modulation at 58.5 Mbps
'QAM64722'	IEEE 802.11n	Quadrature Amplitude Modulation at 72.2 Mbps
'QPSK'	Alias for Quadrature phase shift keying at higher data rate for selected standard	
'QPSK6'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 6 Mbps
'QPSK9'	IEEE 802.11j (10 MHz)	Quadrature phase shift keying at 9 Mbps

Remote Commands of the WiMAX/WiBro Measurements Option (R&S FSV-K93)

'QPSK12'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 12 Mbps
'QPSK13'	IEEE 802.11n	Quadrature phase shift keying at 13 Mbps
'QPSK18'	IEEE 802.11a, g (OFDM), j (20 MHz) & Turbo	Quadrature phase shift keying at 18 Mbps
'QPSK144'	IEEE 802.11n	Quadrature phase shift keying at 14.4 Mbps
'QPSK195'	IEEE 802.11n	Quadrature phase shift keying at 19.5 Mbps
'QPSK217'	IEEE 802.11n	Quadrature phase shift keying at 21.7 Mbps

[SENSe:]BANDwidth:CHANnel

This command specifies the channel bandwidth for the signal to be measured. The channel is selected via the "[CONFigure:CHANnel](#)" command.

Parameter

1.25 MHz to 28 MHz

Example

```
CONF:CHAN 9
```

Defines the frequency of channel 9 as measurement range.

```
BAND:CHAN 7MHZ
```

Sets a channel bandwidth value of 7 MHz.

Characteristics

*RST value: 1.75 MHz

SCPI: conform

Mode

OFDM

[SENSe:]BURSt:COUNT

This command defines the number of bursts that will be analyzed by the measurement.

Parameter

1 to 10922

Example

```
BURSt:COUNT 16
```

Sets the number of bursts to 16.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSE:]BURSt:COUNT:STATe

When this command is set to on, the burst count parameter will be used by the measurement, otherwise the burst count parameter will be ignored.

Parameter

ON | OFF

Example

```
BURS: COUN: STAT ON
```

Sets the burst count state to ON

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]DEMod:CEStimation

This command defines how channel estimation is performed.

IEEE 802.16-2004 OFDM: The improved channel estimation is used for IQ measurements. The effect of this is most noticeable for the EVM measurement results, where the results will be improved if this feature is enabled. However, this functionality is not supported by the IEEE 802.16-2004 standard and must be disabled if the results are to be strictly measured against the standard.

IEEE 802.16e-2005 OFDMA/WiBro: The channel estimation is performed for downlink signals.

Parameter

Standard	Parameter	Description
IEEE 802.16-2004 OFDM	ON	Improved channel estimation is performed.
	OFF	Improved channel estimation is not performed.
IEEE 802.16e-2005 OFDMA	PAYLONLY	Channel estimation is performed in the payload only.
	PREAMONLY	Channel estimation is performed in the preamble only.
	PREAMPAYL	Channel estimation is performed in both the preamble and the payload.

Example

DEM:CEST ON

Specifies that the IQ measurement results will use improved channel estimation.

Characteristics

*RST value:

IEEE 802.16-2004 OFDM OFF

IEEE 802.16e-2005 OFDMA PREAMPAYL

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]DEMod:FILTer:CATalog?

This command reads the names of all available filters. The file names are output without file extension. Syntax of output format: filter_1,filter_2, ... ,filter_n.

This command is a query only and thus has no *RST value.

Example

DEM:FILT:CAT?

Reads all filter names

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]DEMod:FILTer:MODulation

This command selects the TX and RX filters. The names of the filters correspond to the file names; a query of all available filters is possible by means of the "[\[SENSe:\]DEMod:FILTer:CATalog?](#)" command.

Parameter

<string>,<string>

DEF_TX: default transmit filter, DEF_RX: default receive filter

Example

```
DEM:FILT:MOD 'DEF_TX', 'DEF_RX'
```

DEF_TX is selected for the TX filter and DEF_RX for the RX filter

Characteristics

*RST value: AUTO,AUTO

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]DEMod:FORMat[:BContent]:AUTO

This command specifies how the signal should be demodulated.

Parameter

NONE Demodulation off (Brute force mode), the specified modulation is used for all bursts.

FIRST Retrieves the first valid payload modulation and analyzes all bursts with same modulation.

USER Analyzes all bursts carrying the modulation specified.

ALL Retrieves all bursts individual payload modulation and analyzes accordingly.

Example

```
DEM:FORM:AUTO FIRS
```

Specifies that the first symbol field should be decoded.

Characteristics

*RST value: ALL

SCPI: device-specific

Mode

OFDM

[SENSe:]DEMod:FORMat:BANalyze

The remote control command sets the analysis modulation format that will be assumed for the measurement.

If the standard is IEEE 802.16e-2005 OFDMA or WiBro, this command is query only and returns the highest detected modulation format from the last measurement sweep.

Parameter

BPSK1/2	BI-Phase shift keying (OFDM only)
QPSK1/2	Quadrature phase shift keying
QPSK3/4	Quadrature phase shift keying
16QAM1/2	Quadrature Amplitude Modulation
16QAM3/4	Quadrature Amplitude Modulation
64QAM2/3	Quadrature Amplitude Modulation
64QAM3/4	Quadrature Amplitude Modulation

Example

```
DEM:FORM:BAN '16QAM1/2'
```

Only bursts that are of the QAM16 modulation format are analyzed.

Characteristics

*RST value: 16QAM1/2

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQUal

If this command is activated only bursts of equal length will take part in the PVT analysis. The number of symbols that a burst must have in order to take part in the PVT analysis are specified by the

"[\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MIN](#)" command.

Parameter

ON | OFF

Example

```
DEM:FORM:BAN:SYMB:EQU ON
```

Only bursts of equal length will take part in the PVT analysis.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MAX

This command specifies the maximum number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

This value will not have any immediate effect if the

["\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:EQUal\]"](#) command has been set to ON. In this case, no range of symbols is allowed and only bursts with exactly the number of symbols specified by the

["\[SENSe:\]DEMod:FORMat:BANalyze:SYMBols:MIN\]"](#) command shall take place in measurement analysis.

Parameter

1 to 2425

Example

```
DEMod:FORMat:BANalyze:SYMB:MAX 1300
```

Only bursts which contain a maximum symbol count of 1300 are analyzed.

Characteristics

*RST value: 64

SCPI: device-specific

Mode

OFDM

[SENSe:]DEMod:FORMat:BANalyze:SYMBols:MIN

This command specifies the number of data symbols required for bursts to qualify for measurement analysis. Only bursts with the specified number of symbols will be used in the measurement analysis. The number of data symbols is defined as the uncoded bits including service and tail bits.

If the "[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQual" command has been set to ON, this command specifies the exact number of symbols required for a burst to take part in measurement analysis. If the "[SENSe:]DEMod:FORMat:BANalyze:SYMBols:EQual" command is set to OFF, this command specifies the minimum number of symbols required for a burst to take part in measurement analysis.

Parameter

1 to 2425

Example

```
DEM:FORM:BAN:SYMB:MIN 16
```

Only bursts which contain a symbol count of 16 are analyzed.

Characteristics

*RST value: 1

SCPI: device-specific

Mode

OFDM

[SENSe:]FFT:OFFSet

This command specifies the FFT start offset relative to the GP centre.

Parameter

-100 to 100

Example

```
FFT:OFF 0
```

Sets the FFT start offset to 0.

Characteristics

*RST value: 0

SCPI: conform

Mode

OFDMA/WiBro

[SENSe:]FREQuency:CENTer

This command defines the center frequency of the analyzer or the measuring frequency for IQ measurements.

Characteristics

*RST value: 5 GHz

For further details refer to "[\[SENSe:\]FREQuency:CENTer](#)" in the description of the base unit.

[SENSe:]POWer:ACHannel:ACPairs

This command sets the number of adjacent channels pairs (upper and lower channel pairs).

Parameter

0 to 3

0 stands for pure channel power measurement

Example

```
POW:ACH:ACP 3
```

Sets the number of adjacent channels to 3, i.e. the adjacent channel and alternate adjacent channels 1 and 2 are switched on.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth[:CHANnel]

This command sets the channel bandwidth of the system. The bandwidths of adjacent channels are not influenced by this modification.

Parameter

0 Hz to 100 GHz

Example

```
POW:ACH:BAND 30kHz
```

Sets the bandwidth of the TX channel to 30 kHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ACHannel

This command defines the channel bandwidth of the adjacent channel of the system.

Parameter

0 Hz to 100 GHz

Example

```
POW:ACH:BAND:ACH 30kHz
```

Sets the bandwidth of the adjacent channel to 30 kHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth:ALTernate<1|4>

This command defines the channel bandwidth of the first to fourth alternate adjacent channel of the system.

Parameter

0 Hz to 100 GHz

Example

```
POW:ACH:BAND:ALT2 30kHz
```

Sets the bandwidth of the second alternate adjacent channel to 30 kHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:MODE

This command sets the ACP measurement mode to either absolute or relative.

Parameter

ABS Absolute measurement

REL Relative measurement

Example

```
POW:ACH:MODE ABS
```

Sets the ACP measurement to absolute mode.

Characteristics

*RST value: REL

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:SPACing[:ACHannel]

This command defines the channel spacing of the adjacent channel to the TX channel.

Parameter

0 Hz to 100 GHz

Example

```
POW:ACH:SPAC 33kHz
```

Sets the spacing between the carrier signal and the adjacent channel to 33 kHz

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:ACHannel:SPACing:ALTErnate<1|4>

This command defines the channel spacing of the first to fourth alternate adjacent channel to the TX channel..

Parameter

0 Hz to 100 GHz

Example

```
POW:ACH:SPAC:ALT1 100kHz
```

Sets the spacing between TX channel and first alternate adjacent channel to 100 kHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:NCORrection

This command activates or deactivates the noise correction for future spectrum ACP measurements.

Parameter

ON | OFF

Example

```
POW:NCOR ON
```

Activates the noise correction.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM

This command sets the behaviour of the Spectrum Emission Mask (SEM) analysis to use a specific configuration:

Parameter

User	Analysis according to a user-defined configuration
Standard	Analysis according to the TTA standard (WiBro only)
IEEE	Analysis according to the ETSI standard (OFDM/OFDMA only)
ETSI	Analysis according to the IEEE standard (OFDM/OFDMA only)

Example

```
POW:SEM USER
```

Sets the SEM configuration according to a user defined configuration.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:CLASs

This command sets the Spectrum Emission Mask (SEM) power class.

Parameter

- 0 automatic selection
- 1 (-INF, 23) dBm for uplink, (-INF, 29) dBm for downlink
- 2 (23, INF) dBm for uplink, (29, 40) dBm for downlink
- 3 (40, INF) dBm for downlink

Example

```
POW:SEM:CLAS 0
```

Sets the SEM power class to automatic.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:MODE

This command sets the Spectrum Emission Mask (SEM) analysis to be UL or DL (uplink or downlink). This command only available for WiBro standard.

Parameter

DL | UL

Example

```
POW:SEM:MOD UL
```

Sets the Spectrum Emission Mask analysis to be UL.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]POWer:SEM:TTA

This command sets the Spectrum Emission Mask (SEM) analysis according to TTA standard or a user defined mask.

This command is available from firmware version 1.60.

Parameter

USER | STANDARD

Example

```
POW:SEM:TTA STANDARD
```

Sets the SEM analysis according to TTA standard.

Characteristics

*RST value: STANDARD

SCPI: device-specific

Mode

WiBro

[SENSe:]SUBChannel

This command sets the subchannel to be used in the measurement. It is only available in Up Link mode.

Parameter

1 to 31

Example

```
SUBC 12
```

Sets the subchannel to 12.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

[SENSe:]SUBChannel:STATe

This command enables or disables the use of subchannels in the measurement analysis. It is only available in Up Link mode.

Parameter

ON | OFF

Example

```
SUBC:STAT ON
```

Specifies that the measurement will be analyzed using the specified SUBChannel.

Characteristics

*RST value: OFF

SCPI: conform

Mode

OFDMA/WiBro

[SENSe:]SUBChannel:ULPHysmod

This command sets the Up Link Physical Modifier to be used in the measurement. It is only available in Up Link mode.

Parameter

0 to 255

Example

```
SUBC:ULPH 1
```

Sets the UL Physical Modifier to 1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

[SENSe:]SWAPiq

This command defines whether or not the recorded IQ pairs should be swapped (I<->Q) before being processed.

Parameter

ON | OFF

Example

```
SWAP ON
```

Specifies that IQ values should be swapped.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:ACPR:TIME

This command specifies the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements.

Parameter

10 ms to 16000 s

Example

```
SWE:ACPR:TIME:AUTO OFF
```

Deactivates the automatic calculation of the sweep time.

```
SWE:ACPR:TIME 100S
```

Sets the sweep time to 100 s.

Characteristics

*RST value: 2s

SCPI: conform

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:ACPR:TIME:AUTO

This command activates or deactivates the automatic calculation of the sweep time for the Spectrum Mask and Spectrum ACP/ACPR measurements.

Parameter

ON | OFF

Example

```
SWE:ACPR:TIME:AUTO OFF
```

Deactivates the automatic calculation of the sweep time.

Characteristics

*RST value: ON

SCPI: conform

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:COUNT

This command specifies the number of sweeps for Spectrum Mask and Spectrum ACPR measurements.

Parameter

1 to 32767

Example

```
SWE:COUNT 64
```

Sets the number of sweeps to 64.

Characteristics

*RST value: 1

SCPI: conform

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe

For details refer to "[\[SENSe:\]SWEep:EGATe](#)" in the description of the base unit.

[SENSe:]SWEep:EGATe:HOLDoff[:TIME]

This command defines the gate delay in the capture buffer in time units.

Parameter

0 to 262.14 ms

Example

```
SWE:EGAT:HOLD 125us
```

Sets a delay of 125 µs in the capture buffer.

Characteristics

*RST value: 0 s

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:HOLDoff:SAMPle

This command defines the gate delay in the capture buffer as a number of samples.

Parameter

0 to 50E6

Example

```
SWE:EGAT:HOLD:SAMP 2500
```

Sets a delay of 2500 samples in the capture buffer.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LENGth[:TIME]

This command defines the gate time in the capture buffer in time units.

Parameter

0 to 262.14 ms

Example

```
SWE:EGAT:LENG 100ms
```

Sets a gate length of 100 milliseconds between sweeps.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LENGth:SAMPle

This command defines the gate time in the capture buffer as a number of samples.

Parameter

0 to 50E6

Example

```
SWE:EGAT:LENG:SAMP 2000000
```

Enforces a gate length of 2000000 samples in the capture buffer.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:EGATe:LINK

This command links together the movement of the gating lines and the capture buffer marker.

Parameter

ON | OFF

Example

```
SWE:EGAT:LINK ON
```

Keeps the capture buffer marker on the centre of the gating lines if the gating line delay and length are changed.

Characteristics

*RST value: 0

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

[SENSe:]SWEep:TIME

Parameter

24 µs to 15.5 ms

Characteristics

*RST value: 24 µs

For further details refer to "[\[SENSe:\]SWEep:TIME](#)" in the description of the base unit. .

[SENSe:]TRACking:LEVel

This command defines whether or not the measurement results should be compensated for level.

Parameter

ON | OFF

Example

```
TRAC:LEV ON
```

Specifies that the measurement results should be compensated for level.

Characteristics

*RST value: OFF

SCPI: conform

Mode

OFDM

[SENSe:]TRACking:PHASe

This command defines whether or not the measurement results should be compensated for phase.

Parameter

ON | OFF

Example

```
TRAC:PHAS ON
```

Specifies that the measurement results should be compensated for phase.

Characteristics

*RST value: ON

SCPI: conform

Mode

OFDM, OFDMA/WiBro

[SENSe:]TRACking:PILot

This command defines whether the measurement results should have predefined pilot tracking or whether the tracking should be determined when the measurement is run.

Parameter

PRED Predefined pilot tracking is used.
DET Pilot tracking is determined when the measurement is run.

Example

```
TRAC:PILOT DET
```

Pilot tracking is determined when the measurement is run.

Characteristics

*RST value: PRED
SCPI: conform

Mode

OFDMA/WiBro

[SENSe:]TRACking:TIME

This command defines whether or not the measurement results should be compensated for time.

Parameter

ON | OFF

Example

```
TRAC:TIME ON
```

Specifies that the measurement results should be compensated for time.

Characteristics

*RST value: OFF
SCPI: conform

Mode

OFDM, OFDMA/WiBro

14.5.14 STATus Subsystem (WiMAX, K93)

The STATus subsystem contains the commands for the status reporting system (for details refer to "[Remote Control - Basics](#)"). For the STATus:QUEStionable:LIMit register, the measurement window is selected by LIMit 1 (screen A) or 2 (screen B). *RST does not influence the status registers.

Commands of the STATus Subsystem

- ◆ "[STATus:QUEStionable:LIMit<1|2> \[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:CONDition?](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:ENABle](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:PTRansition](#)"
- ◆ "[STATus:QUEStionable:LIMit<1|2>:NTRansition](#)"
- ◆ "[STATus:QUEStionable:POWEr\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:POWEr:CONDition?](#)"
- ◆ "[STATus:QUEStionable:POWEr:ENABle](#)"
- ◆ "[STATus:QUEStionable:POWEr:PTRansition](#)"
- ◆ "[STATus:QUEStionable:POWEr:NTRansition](#)"
- ◆ "[STATus:QUEStionable:SYNC\[:EVENT\]?](#)"
- ◆ "[STATus:QUEStionable:SYNC:CONDition?](#)"
- ◆ "[STATus:QUEStionable:SYNC:ENABle](#)"
- ◆ "[STATus:QUEStionable:SYNC:PTRansition](#)"
- ◆ "[STATus:QUEStionable:SYNC:NTRansition](#)"

STATus:QUEStionable:LIMit<1|2> [:EVENT]?

For details refer to "[STATus:QUEStionable:LIMit<1|2> \[:EVENT\]?](#)".

STATus:QUEStionable:LIMit<1|2>:CONDition?

For details refer to "[STATus:QUEStionable:LIMit<1|2>:CONDition?](#)".

STATus:QUEStionable:LIMit<1|2>:ENABle

For details refer to "[STATus:QUEStionable:LIMit<1|2>:ENABle](#)".

STATus:QUEStionable:LIMit<1|2>:PTRansition

For details refer to "[STATus:QUEStionable:LIMit<1|2>:PTRansition](#)".

STATus:QUEStionable:LIMit<1|2>:NTRansition

For details refer to "[STATus:QUEStionable:LIMit<1|2>:NTRansition](#)".

STATus:QUEStionable:POWer[:EVENT]?

For details refer to "[STATus:QUEStionable:POWer\[:EVENT\]?](#)".

STATus:QUEStionable:POWer:CONDition?

For details refer to "[STATus:QUEStionable:POWer:CONDition?](#)".

STATus:QUEStionable:POWer:ENABLE

For details refer to "[STATus:QUEStionable:POWer:ENABLE](#)".

STATus:QUEStionable:POWer:PTRansition

For details refer to "[STATus:QUEStionable:POWer:PTRansition](#)".

STATus:QUEStionable:POWer:NTRansition

For details refer to "[STATus:QUEStionable:POWer:NTRansition](#)".

STATus:QUEStionable:SYNC[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the EVENT section.

Example

```
STAT:QUES:SYNC?
```

Characteristics

*RST value: -
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the CONDition section.

Example

```
STAT:QUES:SYNC:COND?
```

Characteristics

*RST value: -

SCPI: conform

Mode

OFDM, OFDMA/WiBro

STATus:QUEStionable:SYNC:ENABLE

This command sets the bits of the ENABLE section of the STATus:QUEStionable:SYNC register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit.

Parameter

0 to 65535

Example

```
STAT:QUES:SYNC:ENAB 65535
```

All events bits will be represented in the SYNC summary bit.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

STATus:QUEStionable:SYNC:PTRansition

This command determines what bits in the STATus:QUEStionable:SYNC Condition register will set the corresponding bit in the STATus:QUEStionable:SYNC Event register when that bit has a positive transition (0 to 1). The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Parameter

0 to 65535

Example

```
STAT:QUES:SYNC:PTR 65535
```

All condition bits will be summarized in the Event register when a positive transition occurs.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

STATus:QUEStionable:SYNC:NTRansition

This command determines what bits in the STATus:QUEStionable:SYNC Condition will set the corresponding bit in the STATus:QUEStionable:SYNC Event register when that bit has a negative transition (1 to 0). The variable <number> is the sum of the decimal values of the bits that are to be enabled.

Parameter

0 to 65535

Example

```
STAT:QUES:SYNC:NTR 65535
```

All condition bits will be summarized in the Event register when a positive transition occurs.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.15 SYSTEM Subsystem (WiMAX, K93)

This subsystem contains a series of commands for general functions.

Commands of the SYSTEM Subsystem

- ◆ "[SYSTem:COMMunicate:TCPIP:ADDRESS](#)"

SYSTem:COMMunicate:TCPIP:ADDRESS

This command sets the lookup TCP/IP address of an external R&S SMU signal generator connected via TCP/IP. This enables the instrument to download the frame zone setup directly.

Parameter

<string>

Example

```
SYST:COMM:TCP:ADDR 192.168.1.1
```

Sets the lookup TCP/IP address of the SMU to 192.168.1.1.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDMA/WiBro

14.5.16 TRACe Subsystem (WiMAX, K93)

The TRACe subsystem controls access to the instrument's internal trace memory.

Commands of the TRACe Subsystem

- ◆ ["TRACe\[:DATA\]"](#)
- ◆ ["TRACe:IQ:DATA:MEMory?"](#)
- ◆ ["TRACe:IQ:SRATe"](#)

Further information:

- ◆ ["Constellation vs Symbol"](#)
- ◆ ["Constellation vs Carrier"](#)
- ◆ ["Power vs Time - Full Burst and Start / End Data"](#)
- ◆ ["Power vs Time - Full Subframe and Rising/Falling Subframe"](#)
- ◆ ["Spectrum Flatness/Group Delay/Flatness Difference"](#)
- ◆ ["Spectrum FFT"](#)
- ◆ ["Statistics Bitstream data"](#)
- ◆ ["Statistics Burst Summary data"](#)
- ◆ ["Statistics CCDF - Complementary cumulative distribution function"](#)
- ◆ ["EVM vs Carrier"](#)
- ◆ ["EVM vs Symbol"](#)
- ◆ ["Frequency Sweep Measurements"](#)
- ◆ ["Spectrum Mask"](#)
- ◆ ["Spectrum ACPR"](#)

14.5.16.1 Constellation vs Symbol

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of selected carriers, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

- ◆ If **All Carriers** is selected, it will return 52 per of I and Q data per symbol.
- ◆ If **Pilots Only** is selected, it will return 4 per of I and Q per symbol in the following order:
Carrier -21, Carrier -7, Carrier 7, Carrier 21.
- ◆ If a single carrier is selected, it will return 1 per of I and Q data per symbol.

For the IEEE 802.16e-2005 OFDMA standard, the following rule applies: For all symbols, the results are returned in repeating groups of the FFT size. For example, if the FFT size was 1024 and 12 symbols were found, then 12288 I/Q pairs worth of data would be returned. Carriers that do not exist or are filtered out by the current filter settings are denoted by the keyword **NAN**.

14.5.16.2 Constellation vs Carrier

This measurement represents I and Q data. Data will be returned as a repeating array of interleaved I and Q data in groups of 53 channels including the channel 0, until all the data is exhausted.

Each I and Q point will be returned in floating point format. TRACE1 is used for this measurement results.

14.5.16.3 Power vs Time - Full Burst and Start / End Data

This description applies to measurement results from the IEEE 802.16-2004 OFDM standard.

Both measurement results are once again simply slightly different views of the same results data.

All fully complete bursts within the capture time are analyzed. This data is returned in dBm values on a per sample basis. Each sample will in some way relate to an analysis of each corresponding sample within each processed burst.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1 full burst, burst data values

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1 start, burst data values

TRACE2 end, burst data values

The number of samples returned during full burst analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the rising and falling graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples.

The samples will be returned in floating point format as a single sequence of comma delimited values.

14.5.16.4 Power vs Time - Full Subframe and Rising/Falling Subframe

This description applies to measurement results from the IEEE 802.16e-2005 standard.

Both measurement results are once again simply slightly different views of the same results data.

Remote Commands of the WiMAX/WiBro Measurements Option (R&S FSV-K93)

All fully complete frames within the capture time are analyzed into three master frames. The three master frames relate to the minimum, maximum and average values across all complete frames. This data is returned in dBm values on a per sample basis. Each sample will in some way relate to an analysis of each corresponding sample within each processed frame.

The type of PVT data returned will be determined by the TRACE number passed as an argument to the SCPI command, in addition to the graphic type that is selected.

If the graphic type selected is full burst, then the return data is as follows.

TRACE1 full subframe, minimum frame data values
 TRACE2 full subframe, mean frame data values
 TRACE3 full subframe, maximum frame data values

If the graphic type selected is rising/falling, then the return data is as follows.

TRACE1 rising edge, minimum frame data values
 TRACE2 rising edge, mean frame data values
 TRACE3 rising edge, maximum frame data values
 TRACE4 falling edge, minimum frame data values
 TRACE5 falling edge, mean frame data values
 TRACE6 falling edge, maximum frame data values

The number of samples returned during full frame analysis will depend on the modulation type and will typically be 5000.

The number of samples returned when the start/end graphic type is selected will be less than what is returned for full burst and will be approximately 400 samples. The samples will be returned in floating point format as a single sequence of comma delimited values.

14.5.16.5 Spectrum Flatness/Group Delay/Flatness Difference

There are three separate traces that are available with this measurements. Trace data for a particular trace will only be returnable by querying the appropriate trace.

The graph data returned is as follows:

- ◆ Spectrum Flatness
absolute power value (ABS)
- ◆ Group Delay
relative group delay
- ◆ Spectrum Difference
adjacent carrier power difference in the preamble part of the burst

All traces are all plotted on a per carrier basis. All carriers are drawn in addition to the unused 0 carrier.

The number of carriers depends on the measured standard:

- ◆ For the IEEE 802.16-2004 OFDM standard the number of carriers is 200.
- ◆ For the IEEE 802.16e-2005 OFDMA standard the number of carriers depends on the FFT size.

Carriers that are not used are denoted by the keyword **NAN**.

For example, the return data will be a repeating group of 201 carriers for the IEEE 802.16-2004 OFDM standard.

TRACE1	Minimum absolute power value (ABS) or Minimum group delay values
TRACE2	Mean absolute power value (ABS) or Mean group delay values or
TRACE3	Maximum absolute power value (ABS) or Maximum group delay values or

Absolute power results are returned in dB or dB difference and group delay results are returned in ns.

14.5.16.6 Spectrum FFT

All FFT points will be returned if the data for this measurement is requested. This will be an exhaustive call, due to the fact that there are nearly always more FFT points than IQ samples. The number of FFT points is the number presented by a power of 2 that is higher than the total number of samples.

E.g. if there were 20000 samples, then 32768 FFT points would be returned. Data will be returned in floating point format in dBm. TRACE1 is used for this measurement results.

14.5.16.7 Statistics Bitstream data

Data will be returned depending on the selected standard from which the measurement was executed:

- ◆ For the IEEE 802.16-2004 OFDM standard, data is returned in repeating groups of 200 data channels where each symbol value will be represented by an integer value within one byte. Channel 0 is unused and will therefore not have any data associated with it, with no return data being provided.
- ◆ For the IEEE 802.16e-2005 OFDMA standard, the data is returned in groups of the selected FFT size, where each symbol value will be represented by an integer value within one byte. The FFT size is either 128, 512, 1024, or 2048 sub carriers. Unused carriers, including the zero carrier, are also returned. They are denoted by the string value **NAN**.

The number of repeating groups that are returned will be equal to the number of measured symbols.

64QAM has the highest data rate and it contains symbol values up to 63, making one byte sufficient in size to represent all symbol data values, regardless of the modulation type in use.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

14.5.16.8 Statistics Burst Summary data

The return data depends on the current standard and measurement results.
For the IEEE 802.16-2004 OFDM standard, the data will be returned in repeating groups of 6 comma separated values as follows:

- ◆ 1st value - burst number
If this value is 0 then it is an FCH burst.
- ◆ 2nd value - area with:
0 = preamble
1 = data
- ◆ 3rd value - modulation with:
0 = BPSK
1 = QPSK
2 = 16QAM
3 = 64QAM
- ◆ 4th value - symbol length
This is an integer value giving the number of symbols in the current area.
- ◆ 5th value - power in dBm for the current area
This is returned as a float
- ◆ 6th value - EVM in dB for the current area
This is returned as a float.

Example:

Burst	Area	Modulation	Length	Power	EVM
FCH	Preamble	QPSK	1	-1.96	-43.75
	Data	BPSK	1	-2.96	-33.75
Burst 2	Preamble	QPSK	1	-3.96	-23.75
	Data	64QAM	26	-4.96	-13.75

SCPI would return the following:

```
B|A|M|L |P |E
u|r|o|e |o |V
r|e|d|n |w |M
s|a| | |e |
t| | |r |
```

```
0,0,1, 1,-1.96,-43.75,
0,1,0, 1,-2.96,-33.75,
2,0,1, 1,-3.96,-23.75,
2,1,3,26,-4.96,-13.75
```

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

For the IEEE 802.16e-2005 OFDMA standard, the data will be returned in repeating groups of 7 comma separated values as follows:

- ◆ 1st value - subframe number
- ◆ 2nd value - burst number
- ◆ 3rd value - burst type:
 - 1 = FCH
 - 2 = DL map
 - 3 = UL map
 - 4 = data
- ◆ 4th value - modulation where:
 - 1 = QPSK
 - 2 = 16QAM
 - 3 = 64QAM
- ◆ 5th value - number of slots
This is an integer value giving the number of slots associated with the burst.
- ◆ 6th value - power in dBm for the current area
This is returned as a float.
- ◆ 7th value - EVM in dB for the current area
This is returned as a float.

The number of repeating groups that are returned will be equal to the number of rows in the Burst Summary results.

Data will be returned in ASCII printable hexadecimal character format. TRACE1 is used for this measurement results.

14.5.16.9 Statistics CCDF - Complementary cumulative distribution function

Up to a maximum of 201 data points will be returned in addition to a data count value. The first value in the return data will represent the quantity of probability values that follow. Each of the potential 201 data points will be returned as probability value and will represent the total number of samples that are equal to or exceed the corresponding power level. Probability data will be returned up to the power level that contains at least one sample. It is highly unlikely that the full 201 data values will ever be returned.

Each probability value will be returned as a floating point number, with a value less than 1.

14.5.16.10 EVM vs Carrier

Two trace types are provided with this measurement. There is an average EVM value for each of the 53 channels or a repeating group of EVM values for each channel. The number of repeating groups will correspond to the number of fully analyzed trains. Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Average EVM values per channel
TRACE2	All EVM values per channel for each full train of the capture period

For the IEEE 802.16e-2005 standard, the number of sub carriers returned varies according to the FFT size.

Each EVM value will be returned as a floating point number, expressed in units of dBm or percentage.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

14.5.16.11 EVM vs Symbol

Three traces types are available with this measurement. The basic trace types show either the minimum, mean or maximum EVM value, as measured over the complete capture period.

The number of repeating groups that are returned will be equal to the number of measured symbols.

Each EVM value will be returned as a floating point number, expressed in units of dBm.

TRACE1	Minimum EVM values
TRACE2	Mean EVM values
TRACE3	Maximum EVM values

14.5.16.12 Frequency Sweep Measurements

Currently, there is only one measurement that is performed in frequency sweep mode. This is the Spectrum Mask measurement. No data will be returned for this measurement, should it be requested, until such time as a measurement has been previously run.

Running an IQ measurement will not generate results for this type of measurement.

14.5.16.13 Spectrum Mask

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1 Clear write values

TRACE2 Max hold values

LIST Spectrum Emission Mask (SEM) summary results (in WiBro standard only):

SEM summary results formats:

1st value index into table of results (1 - 9)

2nd value start frequency band (Hz)

3rd value stop frequency band (Hz)

4th value RBW (Hz)

5th value limit fail frequency (Hz)

6th value power absolute (dBm)

7th value power relative (dBc)

8th value limit distance (dB)

9th value failure flag (1 = fail, 0 = pass)

There are 5 rows of results for downlink, and 9 rows for uplink.

14.5.16.14 Spectrum ACPR

Result data will be returned as 501 trace points in floating point format. These trace points are obtained directly from the base system via the measurement API and the quantity is therefore a fixed value. Only an array of Y data will be returned.

TRACE1 Clear write values

TRACE2 Max hold values

TRACe[:DATA]

This command returns all the measured data that relates to the currently selected measurement type. All results are returned in ASCII format. The returned data depends on the currently selected measurement type. "[DISPlay:FORMat](#)" is not supported with this command.

The following measurement types are available:

"[Constellation vs Symbol](#)" on page 1227

"[Constellation vs Carrier](#)" on page 1228

"[Power vs Time - Full Burst and Start / End Data](#)" on page 1228

"[Power vs Time - Full Subframe and Rising/Falling Subframe](#)" on page 1228

"[Spectrum Flatness/Group Delay/Flatness Difference](#)" on page 1229

"[Spectrum FFT](#)" on page 1230

"[Statistics Bitstream data](#)" on page 1230

"[Statistics Burst Summary data](#)" on page 1231

"[Statistics CCDF - Complementary cumulative distribution function](#)" on page 1232

"[EVM vs Carrier](#)" on page 1233

"[EVM vs Symbol](#)" on page 1233

"[Frequency Sweep Measurements](#)" on page 1233

"[Spectrum Mask](#)" on page 1234

"[Spectrum ACPR](#)" on page 1234

This command is a query only and thus has no *RST value.

Parameter

TRACE1 | TRACE2 | TRACE3 | TRACE4 | TRACE5 | TRACE6 | LIST

For details on the parameters refer to the corresponding measurement type (see list above).

Example

```
TRAC? TRACE2
```

The measurement data for the selected graph is returned.

Characteristics

*RST value: -

SCPI: conform

Mode

OFDM, OFDMA/WiBro

TRACe:IQ:DATA:MEMory?

For details refer to "[TRACe:IQ:DATA:MEMory?](#)".

TRACe:IQ:SRATe

This command allows the sample rate for IQ measurements to be specified.

Parameter

1440000 to 32.248E6 Hz

Example

```
TRAC:IQ:SRAT 2000000
```

Specifies a sample rate of 20 MHz.

Characteristics

*RST value: -

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.17 TRIGger Subsystem (WiMAX, K93)

The trigger subsystem is used to synchronize device action(s) with events.

Commands of the TRIGger Subsystem

- ◆ "[TRIGger\[:SEQuence\]:HOLDoff](#)"
- ◆ "[TRIGger\[:SEQuence\]:LEVel\[:EXTernal\]](#)"
- ◆ "[TRIGger\[:SEQuence\]:MODE](#)"
- ◆ "[TRIGger\[:SEQuence\]:LEVel:POWer](#)"
- ◆ "[TRIGger\[:SEQuence\]:LEVel:POWer:AUTO](#)"

TRIGger[:SEQuence]:HOLDoff

This command defines the length of the trigger delay. A negative delay time (pretrigger) can be set in zero span only.

Parameter

-3.25 ms to 837.33 ms

Example

```
TRIG:HOLD 500us
```

A holdoff period of 500 μ s is used after the trigger condition has been met.

Characteristics

*RST value: 0 s

SCPI: conform

Mode

OFDM, OFDMA/WiBro

TRIGger[:SEquence]:LEVel[:EXTernal]

This command defines the level of the external trigger input for which triggering will occur.

Parameter

0.5 V to 3.5 V

Example

```
TRIG:MODE EXT
```

Sets the power trigger mode.

```
TRIG:LEV 1 V
```

Sets the triggering level to 1 V.

Characteristics

*RST value: 1.4 V

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

TRIGger[:SEquence]:MODE

This command configures how triggering is to be performed.

Parameter

IMMEDIATE No triggering is performed. This corresponds to the Free Run trigger mode.

EXTernal The next measurement is triggered by the signal at the external trigger input e.g. a gated trigger.

POWER The next measurement is triggered by signals outside the measurement channel.

Example

```
TRIG:MODE IMM
```

No triggering is performed.

Characteristics

*RST value: IMMEDIATE

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

TRIGger[:SEQuence]:LEVel:POWer

This command sets the level of the input signal for which triggering will occur.

Parameter

-50 to 20 dBm

Example

```
TRIG:MODE POW
```

Sets the external trigger mode.

```
TRIG:LEV:POW 10 DBM
```

Sets the level to 10 dBm for RF measurement.

Characteristics

*RST value: -20 DBM

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

TRIGger[:SEQuence]:LEVel:POWer:AUTO

This command specifies whether or not an automatic power trigger level calculation is performed before each main measurement. The setting of this command is ignored if the setting for the "[TRIGger\[:SEQuence\]:LEVel\[:EXTernal\]](#)" command is not POWER.

Parameter

ON | OFF

Example

```
TRIG:LEV:POW:AUTO ON
```

Specifies that an automatic power trigger level calculation should be performed before the start of each main measurement.

Characteristics

*RST value: OFF

SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

14.5.18 UNIT Subsystem (WiMAX, K93)

The unit subsystem specifies the units for the specific result types.

Commands of the UNIT Subsystem:

- ◆ ["UNIT:EVM"](#)
- ◆ ["UNIT:PREamble"](#)
- ◆ ["UNIT:TABLE"](#)

UNIT:EVM

This command specifies the units for EVM results.

Parameter

DB EVM results returned in dB
PCT EVM results returned in %

Example

```
UNIT:EVM PCT  
EVM results to be returned in %.
```

Characteristics

*RST value: DB
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

UNIT:PREamble

This command specifies the units for Preamble error results.

Parameter

HZ Preamble error results returned in Hz
DEG Preamble error results returned in degrees

Example

```
UNIT:PRE HZ  
Preamble error results to be returned in Hz.
```

Characteristics

*RST value: Hz
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

UNIT:TABLE

This command specifies the parameters of the result summary that can be displayed as dB or degrees.

Parameter

DB results returned in dB
PCT results returned in %

Example

UNIT:TABLE DB
Results to be returned in dB.

Characteristics

*RST value: DB
SCPI: device-specific

Mode

OFDM, OFDMA/WiBro

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