

Software Manual



FM Measurement Demodulator for R&S[®] FSx

R&S[®] FS-K7

1141.1796.02



This Software Manual describes the following models:

- R&S®FMU
- R&S®FSG
- R&S®FSP
- R&S®FSQ
- R&S®FSU
- R&S®FSUP

Dear Customer,

throughout this manual, the FM Demodulator Application Software R&S® FS-K7 is abbreviated as R&S FS-K7. The Analyzers R&S® FSP, R&S® FSU and R&S® FSQ are abbreviated as , R&S FSU and R&S FSQ, respectively.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG
Trade names are trademarks of the owners.

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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.

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 $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
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 electrostática

					
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 $U_{\text{eff}} > 30 \text{ V}$ 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 sujetados 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.

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

DQS REG. NO 001954 QM UM

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1 Introduction

The following chapters describe the new operating functions of the FM demodulator option for Spectrum Analyzer R&S FSP. In the case of functions identical to those of the base unit, reference is made to the relevant chapter in the base unit manual.

The digital signal processing in R&S FSP, used in the analyzer mode for digital IF filters, is also ideally suited for demodulating FM or AM signals.

By sampling (digitization) already at the IF and digital downconversion to the baseband (I/Q), the demodulator achieves maximum accuracy and temperature stability. There is no evidence of typical errors of an analog downconversion and demodulation like AM \leftrightarrow FM conversion, deviation error, frequency response or frequency drift at DC coupling. Only the characteristics of the analog IF filter ahead of the A/D converter need to be taken into consideration.

Circuit Description - Block Diagrams

Fig 1-1 Block diagram of analyzer signal processing shows the analyzer's hardware from the IF to the processor. The IF filter is the resolution filter of the spectrum analyzer, with a bandwidth range from 300 kHz to 10 MHz. The A/D converter samples the IF (20.4 MHz) at 32 MHz.

Lowpass filtering and reduction of the sampling rate follow the downconversion to the complex baseband. The decimation depends on the selected demodulation bandwidth. The output sampling rate is set in powers of 2 between 15.625 kHz and 32 MHz. Useless oversampling at narrow bandwidths is avoided, saving computing time and increasing the maximum recording time.

The I/Q data is stored in memories each comprising 128 k words. The hardware triggering (external, IF power) controls the memory.

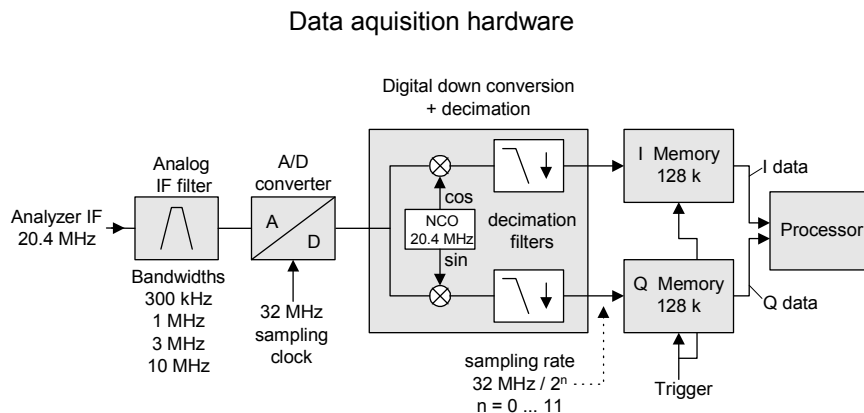


Fig 1-1 Block diagram of analyzer signal processing

The software demodulator runs on the main processor of the analyzer. The demodulation process is shown in Fig 1-2 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.

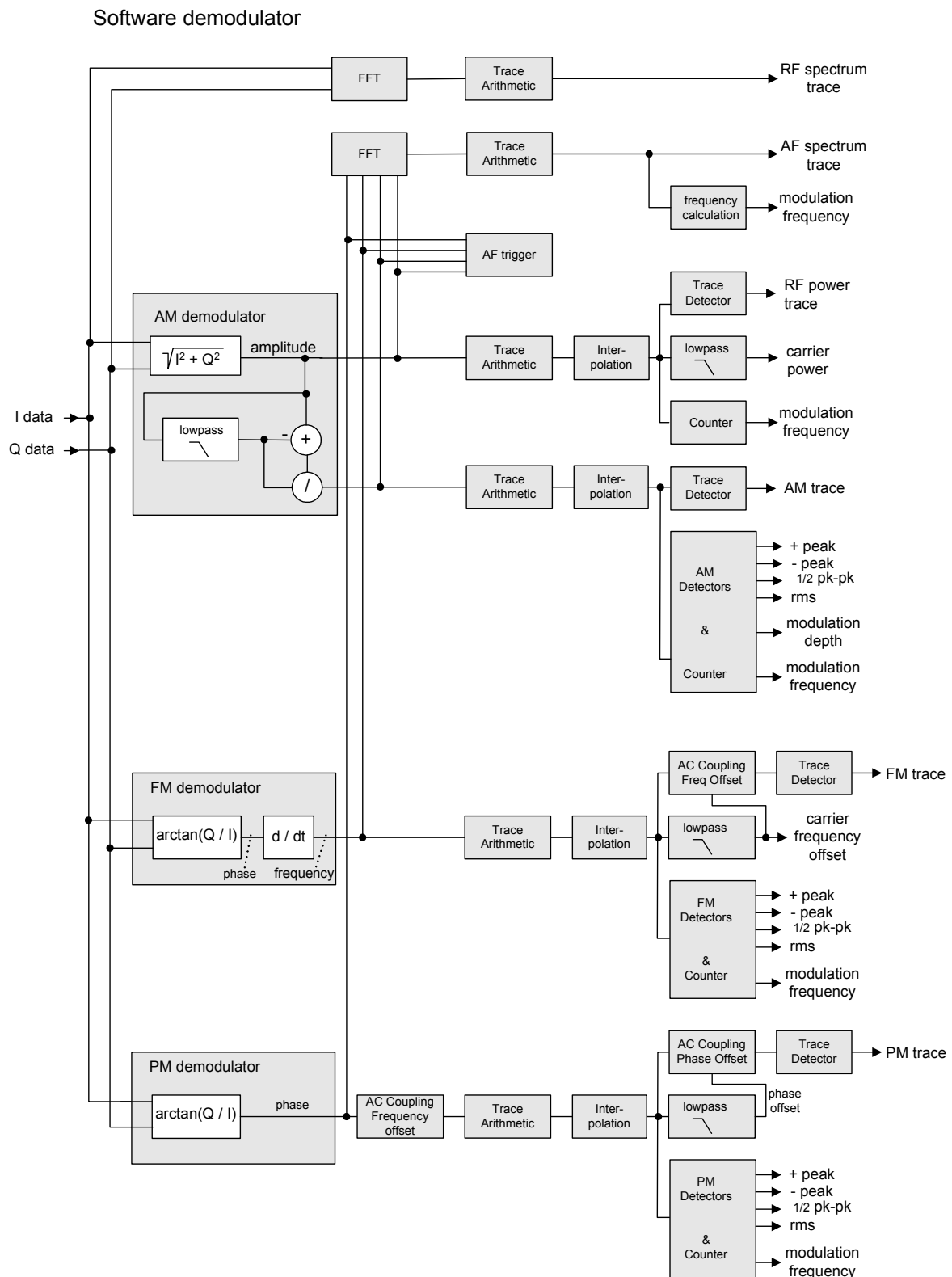


Fig 1-2 Block diagram of software demodulator

The AM-DC, PM-DC and FM-DC raw data of the demodulators is fed into the **trace arithmetic** block that combines consecutive data sets. Possible functions are: Clear Write, Max Hold, Min Hold and Average. The output data of the trace arithmetic can be read via **GPIB**. The recording length corresponds to the selected sampling rate of 1 to 128 k samples.

501 samples are required for on-screen display. If less data is recorded, the missing intermediate values are calculated by an **interpolation filter**.

If more than 501 samples are recorded, the interpolator becomes ineffective. In this case the **trace detector** reduces the number of samples to 501.

The trace detector combines several samples according to the functions selectable: Sample, Max Peak, Min Peak, Average, Autopeak, RMS. The **zoom** function does not combine any samples, but selects a sequence of 501 samples from the data set.

The data from the trace detector is displayed on the screen and can be read out via GPIB. They display level, phase versus time and/or frequency versus time.

In addition, important parameters are calculated:

- A **counter** determines the **modulation frequency** for AM, PM and FM.
- A **lowpass filter** suppresses the modulation frequency; the result is the average power = **carrier power** with AM and the average frequency = **carrier frequency offset** with FM. The deviation from the selected center frequency is displayed.
- **AC coupling** is possible with FM and PM display. To this end, the carrier frequency offset is subtracted from the FM DC data. In addition, the **frequency deviation** is determined from the trace data. +Peak, -Peak, ½ Peak-Peak and RMS are displayed.

Besides the demodulators, the spectrum of the I/Q data, the FM, the PM or the AM is calculated using **FFT**. The spectrum always comprises 501 samples.

Further Characteristics

IF Bandwidth

The **analog IF filter** improves the selectivity, but also causes signal distortions. The filter is negligible if:

$$\text{IF bandwidth} \geq 10 \times (\text{modulation frequency} + \text{frequency deviation})$$

Note: *IF bandwidths ≤ 3 MHz ensure sufficient image-frequency rejection.
If due to a wide signal bandwidth an IF bandwidth of 10 MHz has to be selected, signals are not allowed to be in the range from 6 MHz to 9 MHz above the receive frequency because they will be convoluted back into the useful band of 10 MHz.*

Demodulation Bandwidth

Digital filters determine the demodulation bandwidth. This 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 * (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 (Fig 1-3 Residual FM as a function of demodulation bandwidth).

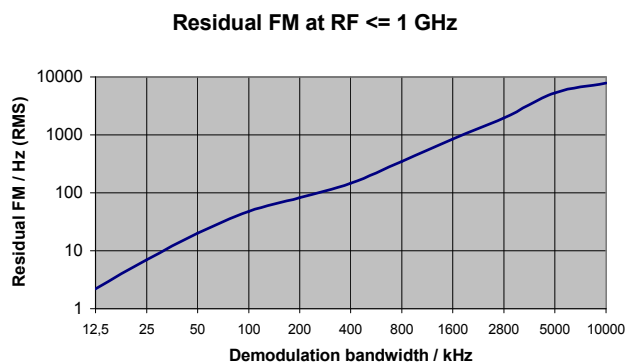


Fig 1-3 Residual FM as a function of demodulation bandwidth

AF Trigger

The FM demodulator option allows triggering to the demodulated signal. The display is stable if a minimum of five modulation periods are within the recording time.

In the AM and FM display, triggering is always DC-coupled. In the PM display, triggering is either AC- or DC-coupled, depending on the type of coupling set. Therefore triggering is possible directly to the point where a specific carrier level, phase or frequency is exceeded or not attained. This is particularly helpful when measuring transients if no external trigger signal is available.

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.

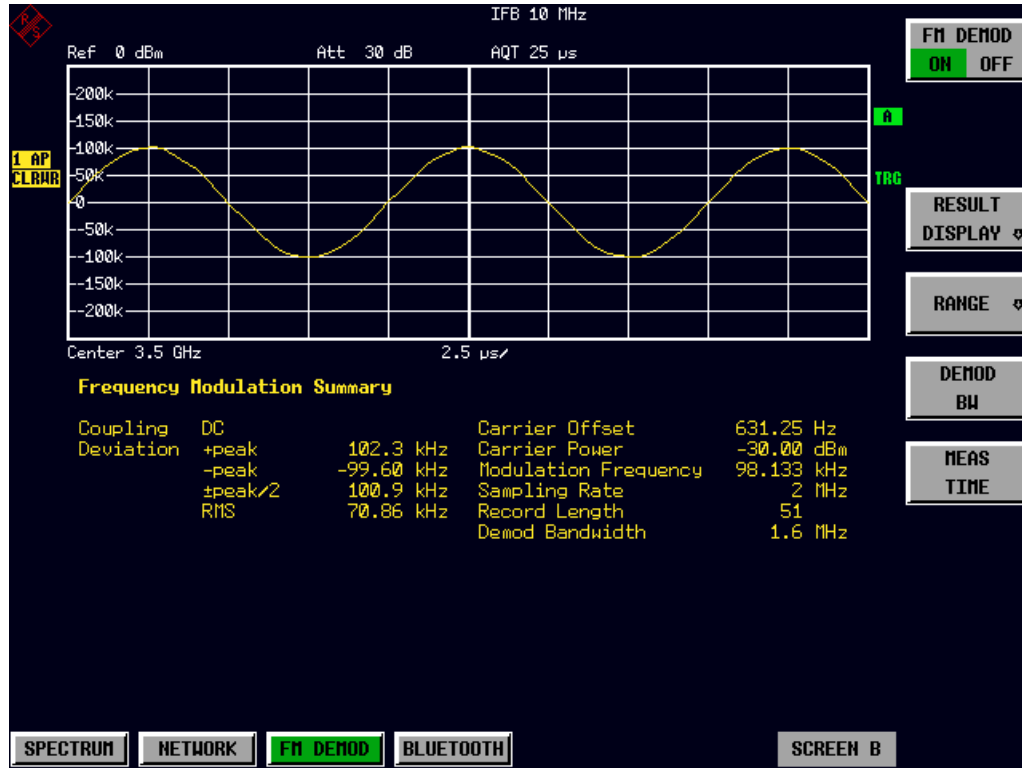
The mean carrier power for calculating the **AM** is also calculated with a digital filter that returns stable results after a measurement time of $\geq 3 \times 1 / \text{modulation frequency}$, i.e. at least three cycles of the AF signal must be recorded before a stable AM can be shown.

Contents – Chapter 2 "Settings"

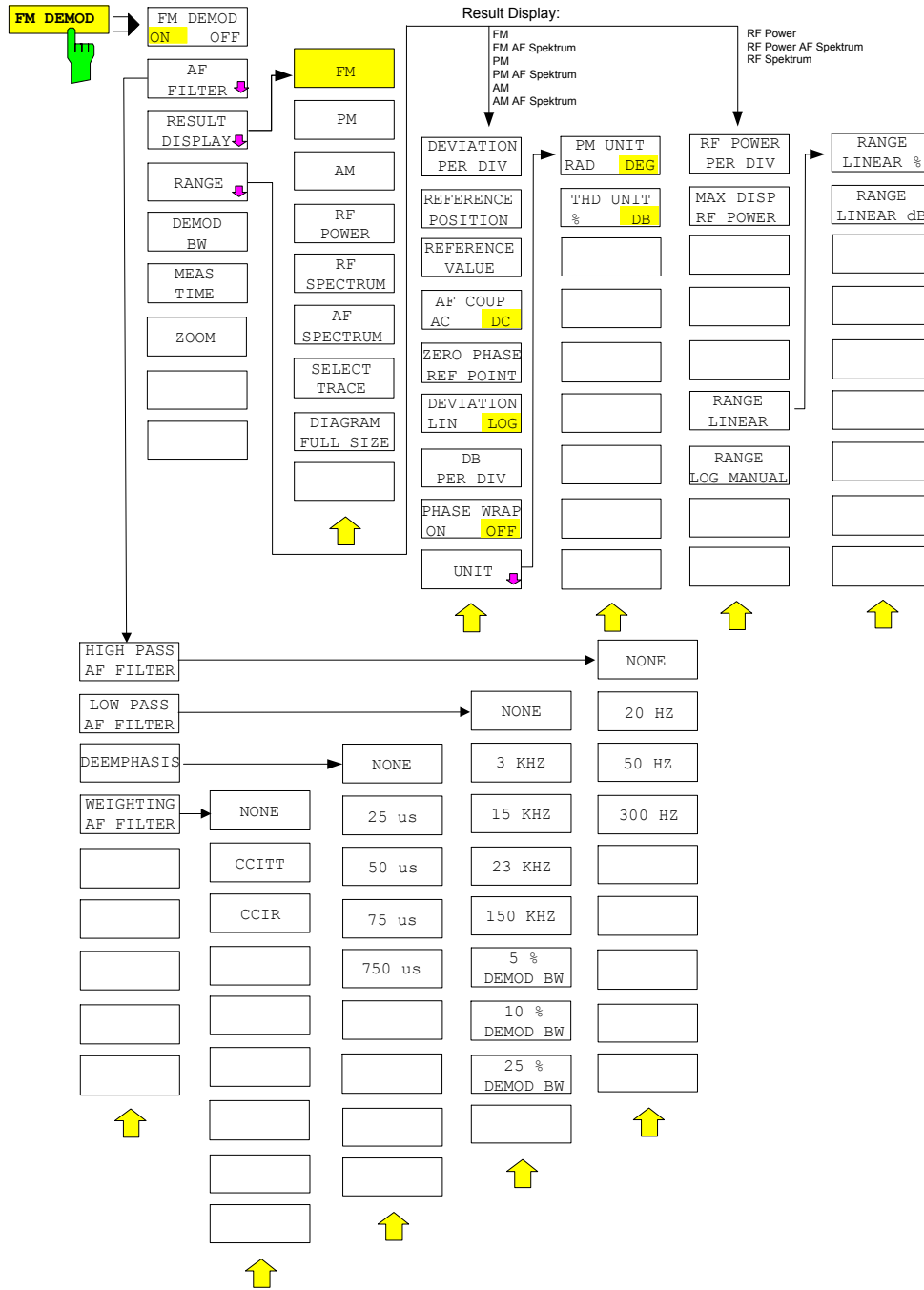
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2 Settings of the FM Demodulator

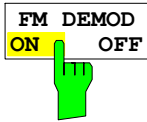
The *FM DEMOD* hotkey opens the menu for setting the FM demodulator functions. Simultaneously, the FM demodulator is activated.



FM Demodulator Main Menu



Note: The softkeys visible in the RANGE submenu depend on the selected measurement function (FM / PM / RF SPECTRUM / AF SPECTRUM).

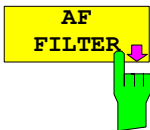


The *FM DEMOD ON / OFF* softkey switches the FM demodulator on or off. The FM demodulator default setting is *OFF*; however, when the *FM DEMOD* mode is selected, the demodulator is switched on automatically.

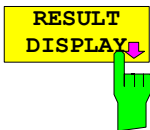
Notes:

- › The resolution bandwidth, video bandwidth and sweep time active before the demodulator is switched on are restored when the demodulator is switched off.
- › Similarly, the trace operating mode and detector are restored (the FM demodulator has separate trace settings).

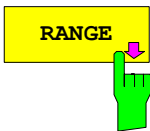
IEC/IEEE-bus command INST:SEL ADEM
 INST:NSEL 3



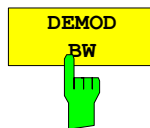
The *AF FILTER* softkey opens the submenu for selecting high pass or low pass filters and also a de-emphasis. (see chapter "Selection of Filter – *AF FILTER Menu*").



The *RESULT DISPLAY* softkey opens the submenu for selecting the measurement function required (see chapter "Selection of Display Mode – *RESULT DISPLAY Menu*").



The *RANGE* softkey opens the submenu for setting the display range of the measurement function selected (see chapter "Scaling of Measurement Results – *RANGE Menu*").



The *DEMOD BW* softkey selects the demodulation bandwidth of the FM demodulator. The demodulation bandwidth determines the sampling rate for recording the signal to be analyzed.

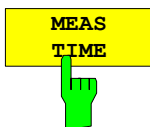
The following table shows the relation between demodulation bandwidth and sampling rate:

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with R&S FSQ-B72 only
50/85 MHz ⁽¹⁾	128 MHz	with R&S FSQ-B72 only
30 MHz	64 MHz	with R&S FSQ only
18 MHz	32 MHz	with R&S FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	This restriction only applies to R&S FSP and R&S FSU without B72: This filter is only flat for about 6 MHz, it has a 3dB decay at 7 MHz.
5 MHz	8 MHz	
3 MHz	4 MHz	
1.6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	

Demodulation bandwidth	Sampling rate	Comment
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of ≤ 3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

IEC/IEEE-bus command SENS : BAND : DEM 10MHz

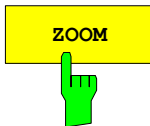


The *MEAS TIME* softkey opens an editor for entering the measurement time of the FM demodulator. The permissible value range depends on the demodulation bandwidth selected.

Demodulation bandwidth	Min. measurement time	Max. measurement time with AF trigger	Max. measurement time with other trigger
120 MHz	3.90625 ns	425 μ s	510 μ s
50 / 85 MHz	7.8125 ns	850 μ s	1.0 ms
30 MHz	15.625 ns	1.7 ms	2.0 ms
18 MHz	31.25 ns	3.4 ms	4.1 ms
10 MHz	31.25 ns	3.4 ms	4.1 ms
8 MHz	62.5 ns	6.8 ms	8.2 ms
5 MHz	125 ns	13.6 ms	16.3 ms
3 MHz	250 ns	27.2 ms	32.6 ms
1.6 MHz	500 ns	54.4 ms	65.3 ms
800 kHz	1 μ s	109 ms	131 ms
400 kHz	2 μ s	218 ms	261 ms
200 kHz	4 μ s	435 ms	522 ms
100 kHz	8 μ s	870 ms	1.04 s
50 kHz	16 μ s	1.74 s	2.09 s
25 kHz	32 μ s	3.48 s	4.18 s
12.5 kHz	64 μ s	6.96 s	8.36 s
6.4 kHz	128 μ s	13.9 s	16.7 s

Demodulation bandwidth	Min. measurement time	Max. measurement time with AF trigger	Max. measurement time with other trigger
3.2 kHz	256 μ s	27.8 s	33.4 s
1.6 kHz	512 μ s	55.7 s	66.8 s
800 Hz	1.024 ms	111 s	133 s
400 Hz	2.048 ms	222 s	267 s
200 Hz	4.096 ms	445 s	534 s
100 Hz	8.192 ms	891 s	1069 s

IEC/IEEE-bus command SENS:ADEM:MTIM 62.5US
 SENS:SWE:TIME 62.5US



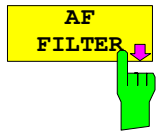
In many cases, the number of recorded test points exceeds by far the number of available pixels. Therefore several test points are combined to one pixel if the ZOOM function is inactive.

If the ZOOM function is activated, a 1-to-1 allocation is selected, i.e. each pixel corresponds to a recorded test point. The start of the zoom window can be determined in the associated field by entering the time.

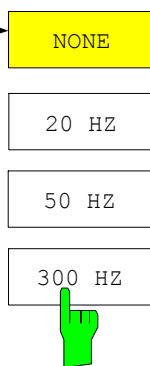
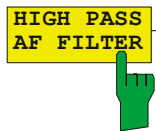
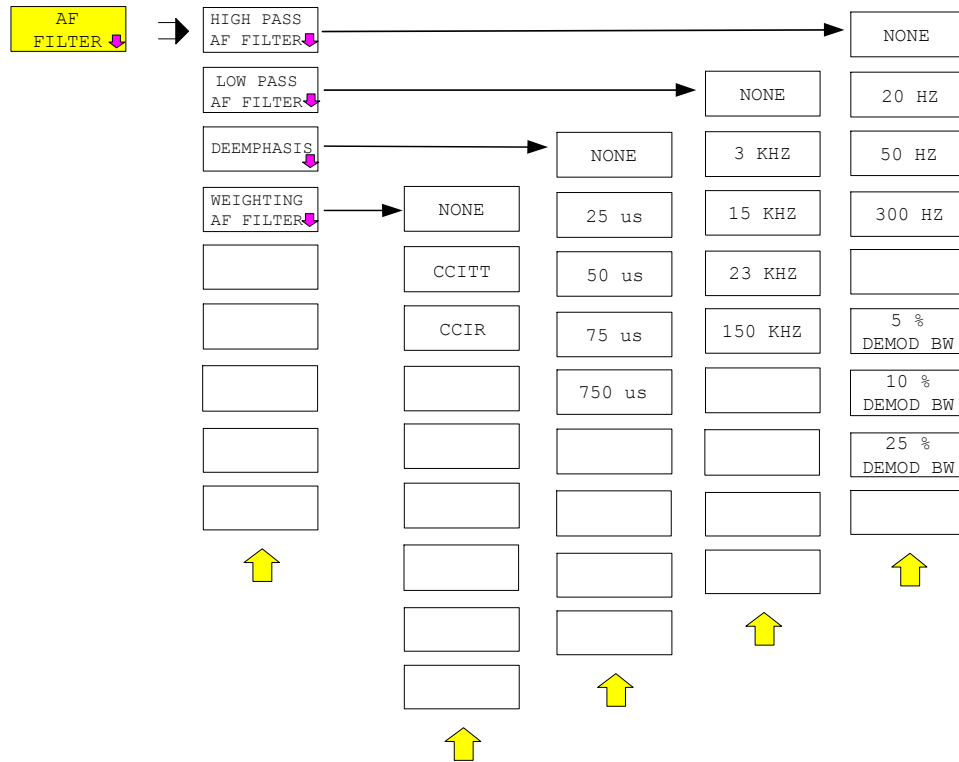
The zoom function is not available if the number of test points falls below the number of pixels in the diagram (R&S FSP:501, FSU/R&S FSQ: 625).

IEC/IEEE-bus command SENS:ADEM:ZOOM ON
 SENS:ADEM:ZOOM:START 30US

Selection of Filter and Deemphasis – AF FILTER Menu



The *AF FILTER* softkey opens the submenu for selecting high pass or low pass filters and also a de-emphasis.



The *HIGH PASS AF FILTER* softkey opens the submenu for selecting the high pass filter.

The *20 HZ*, *50 HZ* and *300 HZ* softkeys 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 filters are designed as 2nd-order Butterworth filter (12 dB/octave).

The *NONE* softkey deactivates the AF high pass filter. Default is *NONE*.

The R&S FSP requires the option R&S FSP-B70 for the high pass filter.

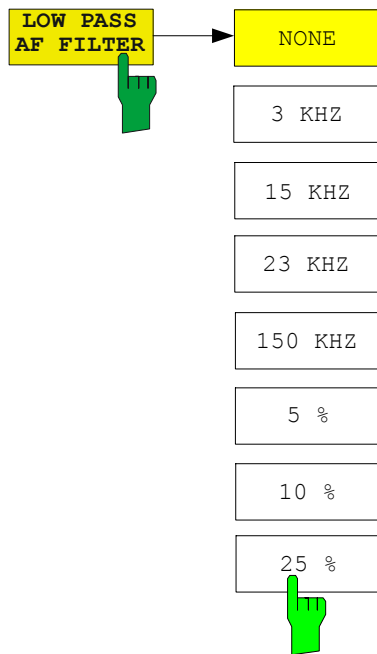
The high pass filter are active in the following demodulation bandwidth range:

- 20 Hz 100 Hz ≤ demodulation bandwidth ≤ 1.6 MHz
- 50 Hz 200 Hz ≤ demodulation bandwidth ≤ 4 MHz
- 300 Hz 800 Hz ≤ demodulation bandwidth ≤ 16 MHz

IEC/IEEE-bus commands:

SENS:FILT:HPAS:STAT ON | OFF

SENS:FILT:HPAS:FREQ 20 Hz | 50 Hz | 300 Hz



The *LOW PASS AF FILTER* softkey opens the submenu for selecting the low pass filter.

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 and 15 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 *5 %*, *10%* and *25% HZ* softkeys switch on a relative low pass filter. The filter (3 dB) can be selected in % of the demodulation bandwidth. The filters are designed as 5th-order Butterworth filter (30 dB/octave).

The *NONE* softkey deactivates the AF low pass filter. Default is *NONE*.

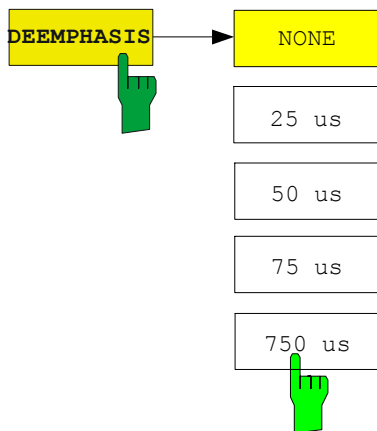
The R&S FSP requires the option R&S FSP-B70 for the absolute low pass filter 3 kHz, 15 kHz and 150 kHz. The relative low pass filters are always available.

The relative low pass filters are active for all demodulation bandwidth's. The absolute low pass filters are active in the following demodulation bandwidth range:

- 3 kHz 6.4 kHz ≤ demodulation bandwidth ≤ 4 MHz
- 15 kHz 50 kHz ≤ demodulation bandwidth ≤ 16 MHz
- 23 Hz 50 Hz ≤ demodulation bandwidth ≤ 8 MHz
- 150 kHz 400 kHz ≤ demodulation bandwidth ≤ 16 MHz

IEC/IEEE-bus commands:

```
SENS:FILT:LPAS:STAT ON | OFF
SENS:FILT:LPAS:FREQu:REL 5 | 10 | 25
SENS:FILT:LPAS:FREQ 3 kHz | 15 kHz | 23 kHz | 150 kHz
```



The *DEEMPHASIS* softkey opens the submenu for selecting the deemphasis.

The *25 us*, *50 us*, *75 us* and *750 us* softkeys switch on a de-emphasis with the given time constant.

The *NONE* softkey deactivates the de-emphasis. Default is *NONE*.

The R&S FSP requires the option R&S FSP-B70 for the de-emphasis.

The de-emphasis is active in the following demodulation bandwidth range:

- 25 μs 25 kHz ≤ demodulation bandwidth ≤ 30 MHz
- 50 μs 6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
- 75 μs 6.4 kHz ≤ demodulation bandwidth ≤ 18 MHz
- 750μs 800 Hz ≤ demodulation bandwidth ≤ 4 MHz

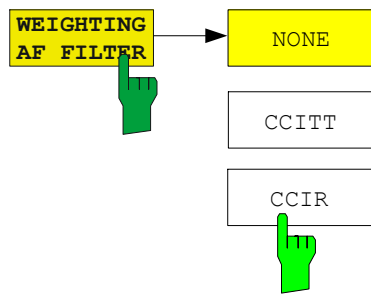
The following table shows the required demodulation bandwidth for an error less than 0.5 dB up to a maximum AF frequency.

Deemphasis	25 μs	50 μs	75 μs
Maximum AF Frequency	25 kHz	12 kHz	8 kHz
Required demodulation bandwidth	≥ 200 kHz	≥ 100 kHz	≥ 50 kHz

For higher AF frequencies the demodulation bandwidth must be increased.

IEC/IEEE-bus commands:

```
SENS:FILT:DEMP:STAT ON | OFF
SENS:FILT:DEMP:TCON 25 us | 50 us | 75 us | 750 us
```



The *WEIGHTING AF FILTER* softkey opens the submenu for selecting the weighting filter.

The *CCITT* (*CCITT P.53*) and *CCIR* (*CCIR unweighted*) softkeys switch on a weighting filter. The *CCIR unweighted* filter is the combination of the 20 Hz highpass and 23 kHz lowpass filter.

The *NONE* softkey deactivates the weighting filter.

The weighting filter are active in the following demodulation bandwidth range:

CCITT 25 kHz ≤ demodulation bandwidth ≤ 3 MHz

CCIR 50 kHz ≤ demodulation bandwidth ≤ 1.6 MHz

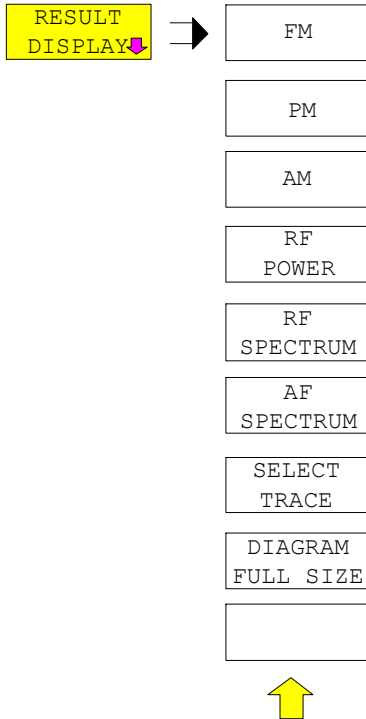
IEC/IEEE-bus commands

SENS:FILT:CCIT:STAT ON | OFF

SENS:FILT:CCIR:STAT ON | OFF

Selection of Display Mode – *RESULT DISPLAY* Menu

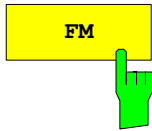
In order to display the measurement results the screen is divided in two halves:
In the upper half, the measurement results are displayed as a trace, in the lower half the results of additional evaluation functions are shown. The *RESULT DISPLAY* softkey allows the user to select the measurement results to be displayed.



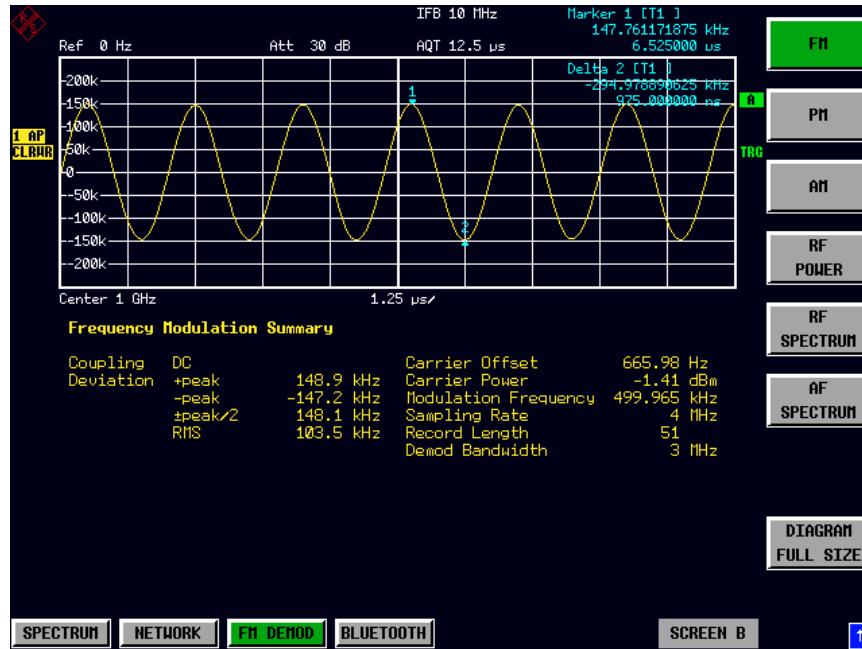
The *RESULT DISPLAY* softkey opens a submenu for selecting the measurement result to be displayed.

The demodulated FM, PM or AM signal, the RF signal in the time domain or the RF or AF frequency spectrum determined via FFT can be selected for display.

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.

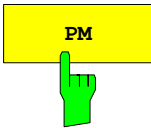


The *FM* softkey selects the demodulated FM signal for display. Depending on the *AF COUPLING AC/DC* selection in the *RANGE* menu, the average value of the demodulated signal is mapped onto the vertical center of the diagram (*AC* selected) or deviates from the center of the diagram by a signal-dependent frequency offset (*DC* selected).

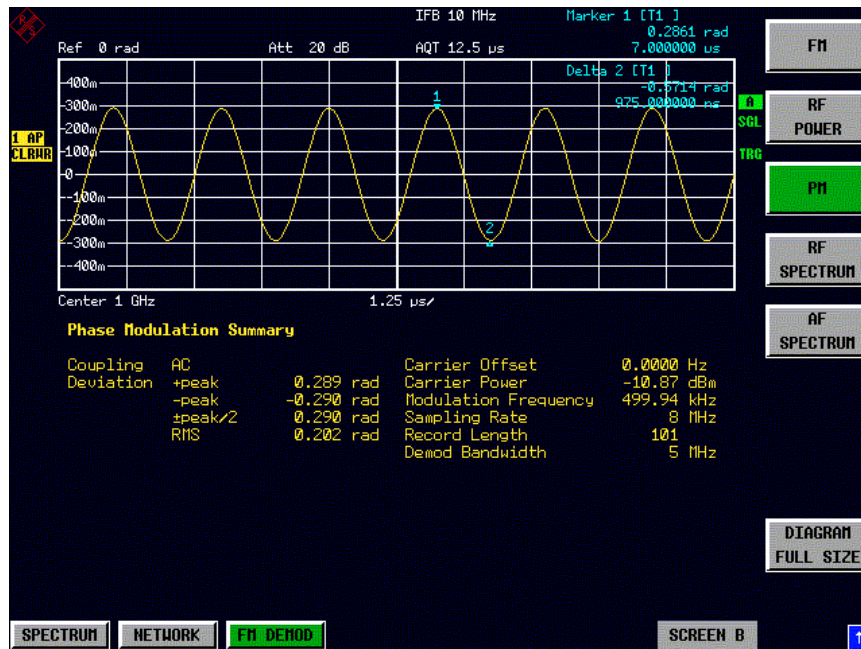


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to FM does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:FM'`

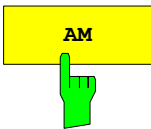


The *PM* softkey selects the display of the demodulated PM signal.

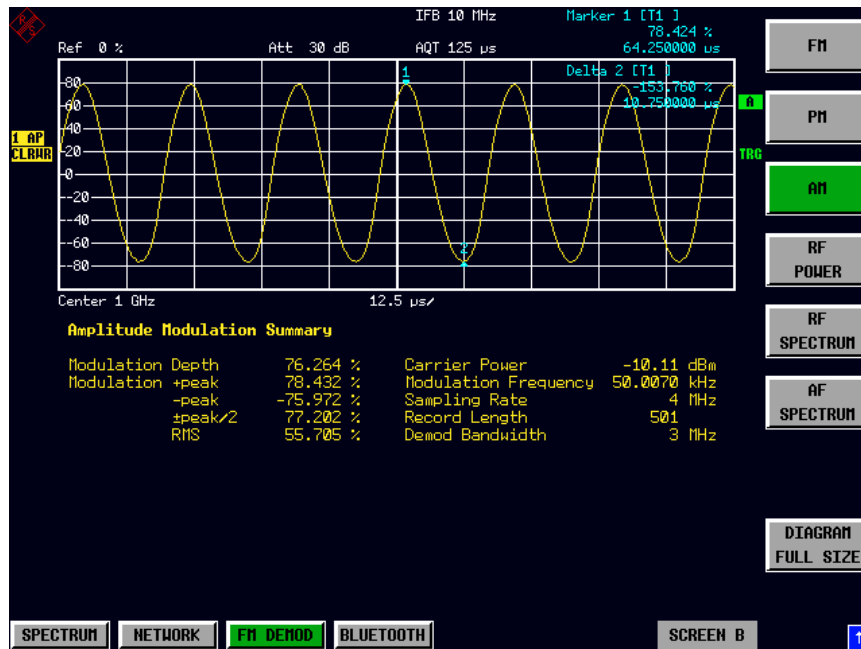


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *PM* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:PM'`

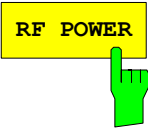


The *AM* softkey selects the display of the demodulated AM signal.

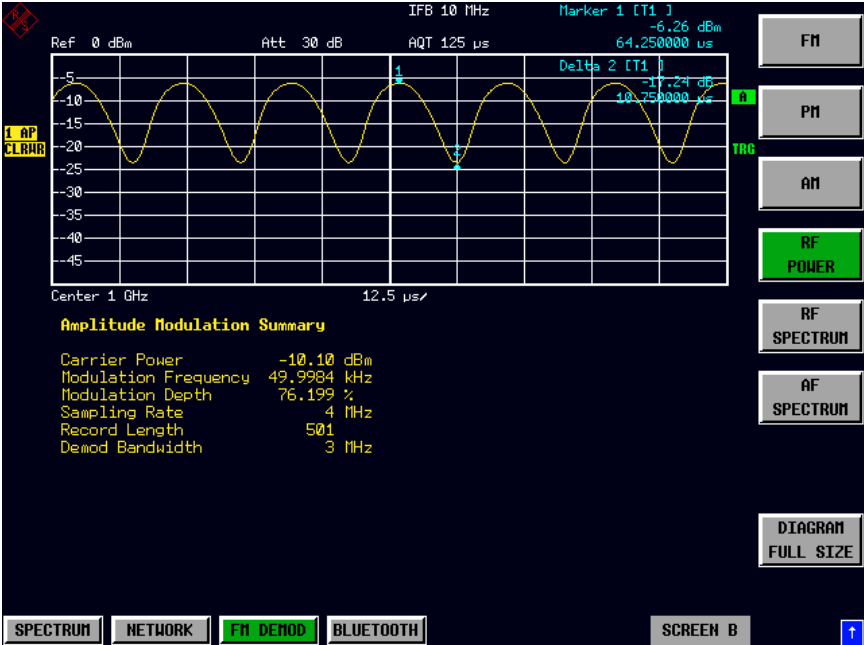


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *AM* does not trigger a new measurement.

IEC/IEEE-bus command `CALC:FEED 'XTIM:AM:REL'`

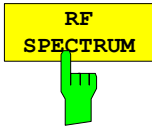


The *RF POWER* softkey selects the display of the RF signal in the time domain. In contrast to normal analyzer operation, the level values are determined from the recorded I/Q data set by means of summation.

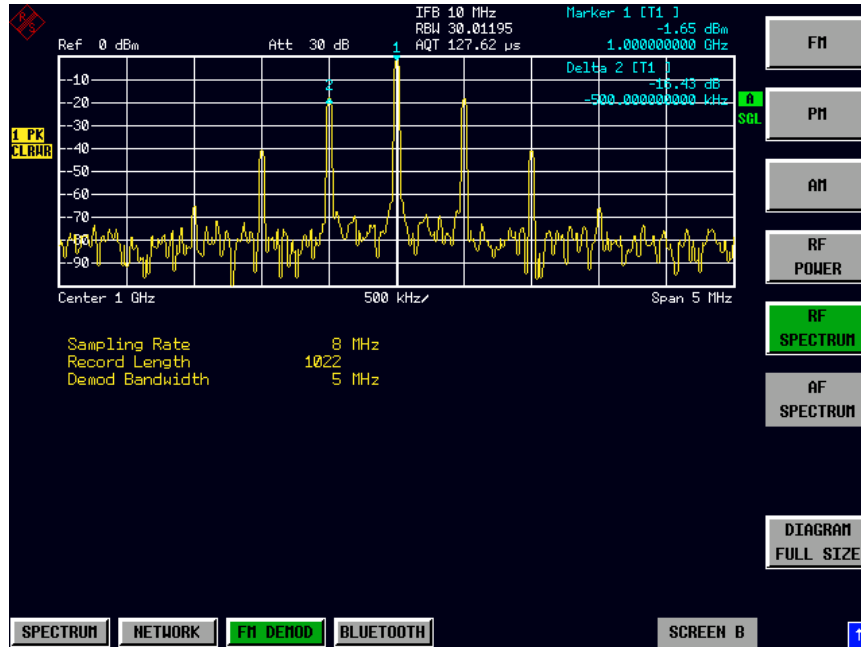


In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *RF POWER* does not trigger a new measurement.

IEC/IEEE-bus command CALC:FEED 'XTIM:RFP'



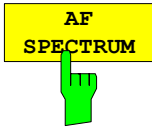
The *RF SPECTRUM* softkey selects the RF signal in the frequency domain for display. In contrast to normal spectrum analyzer operation, the measured values are determined using FFT from the recorded I/Q data set.



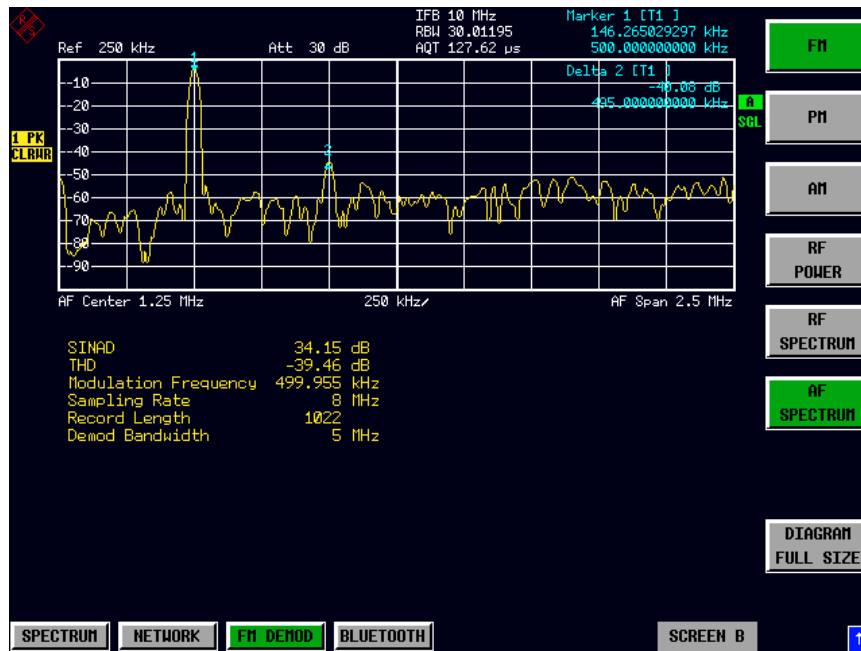
In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *SPECTRUM* does not trigger a new measurement.

IEC/IEEE-bus command

CALC:FEED 'XTIM:SPECTRUM'



The *AF SPECTRUM* softkey selects the display of the AF spectrum. The AF spectrum can be calculated from the FM signal, PM signal or the RF signal in the time domain. The softkey is not available if the RF spectrum display is selected.



In *SINGLE SWEEP* mode, the data is determined from the current I/Q data set, i.e. a change to *AF SPECTRUM* does not trigger a new measurement.

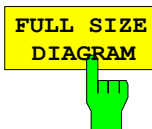
IEC/IEEE-bus command

```
CALC:FEED 'XTIM:FM:AFSP'
CALC:FEED 'XTIM:PM:AFSP'
CALC:FEED 'XTIM:AM:AFSP'
CALC:FEED 'XTIM:RFP:AFSP'
```



The *SELECT TRACE* softkey selects the trace, the data of which is to be displayed in the lower half of the screen.

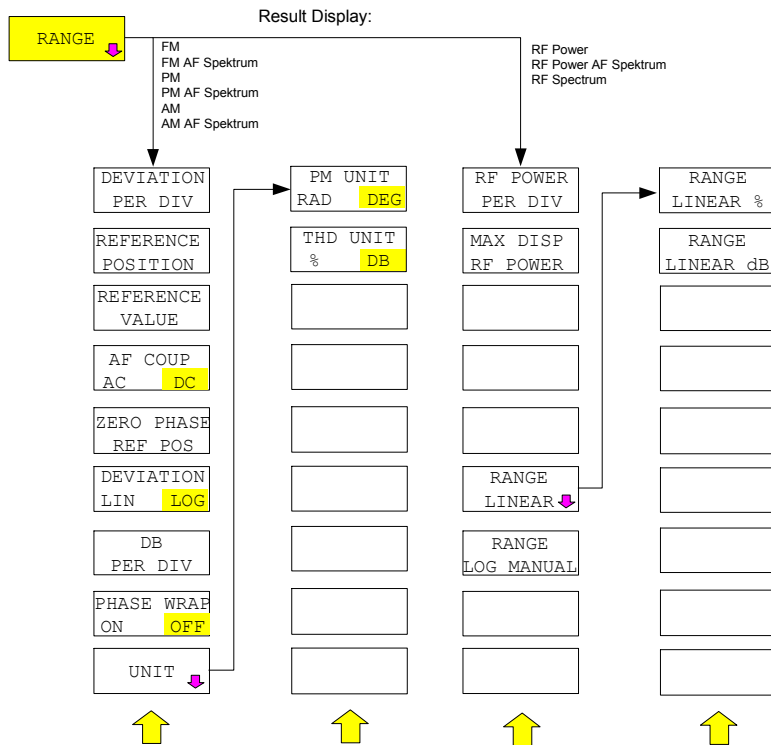
IEC/IEEE-bus command --



The *FULL SIZE DIAGRAM* switches the diagram to full screen size.

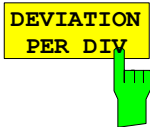
IEC/IEEE-bus command: DISP:SIZE LARG

Scaling of Measurement Results – RANGE Menu



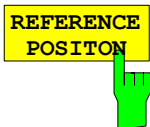
The *RANGE* softkey opens a submenu for determining the diagram scaling for the selected measurement. The softkeys visible depend on the selected measurement function (FM / RF POWER / PM / RF SPECTRUM):

Scaling Functions for FM, PM and AM Result Display



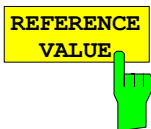
The *DEVIATION PER DIV* softkey allows the phase or frequency deviation to be displayed in the range 1 Hz/div to 1 MHz/div with the FM display and in the range 0.0001 rad/div to 1000 rad/div with the PM display. To prevent corruption of the measurement results, the IF bandwidth of the analyzer must be larger than the maximum frequency deviation plus modulation frequency (*IF BANDWIDTH* softkey in the *FM DEMOD* menu). The softkey is not available in the AF spectrum display of the FM or PM signal, as scaling in this case is performed via the *DB PER DIV* and *REFERENCE VALUE* softkeys.

```
IEC/IEEE-bus command      DISP:WIND:TRAC:Y:PDIV 50kHz
```



The *REFERENCE POSITION* softkey determines the position of the reference line for the phase or frequency deviation on the y axis of the diagram. In the default setting of the analyzer, this line corresponds to a frequency deviation of 0 Hz for the display of the FM signal or to a phase deviation of 0 rad for the display of the PM signal. 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 PM or FM signal and 100% (upper diagram border) for the AF spectrum display of the PM or FM signal.

```
IEC/IEEE-bus command      DISP:WIND:TRAC:Y:RPOS 50PCT
```



The *REFERENCE VALUE* softkey determines the frequency or phase deviation at the reference line of the y axis. The reference value is set separately for each display of the PM and FM signal and the AF spectrum of the PM and FM signal.

FM signal display:

The reference value makes it possible to take individual frequency offsets into account in the trace display (in contrast, the *AF COUP AC/DC* softkey permits automatic correction by the average frequency offset of the signal). Values between 0 and ± 10 MHz can be selected. The softkey is not available if the *AF COUP AC* function has been activated.

AF spectrum display of the FM signal:

In the default setting, the reference value defines the FM deviation at the upper diagram border. Values between 0 and 10 MHz can be selected.

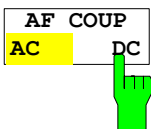
PM signal display:

The reference value makes it possible to take individual phase offsets into account in the trace display (in contrast, the *AF COUP AC/DC* softkey permits automatic correction by the average phase offset of the signal). Values between 0 and ± 10000 rad can be selected. The softkey is not available if the *AF COUP AC* function has been activated.

AF spectrum display of the PM signal:

In the default setting, the reference value defines the PM deviation at the upper diagram border. Values between 0 and 10000 rad can be selected.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RVAL 0HZ`



The *AF COUP AC/DC* softkey 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.

IEC/IEEE-bus command `SENS:ADEM:AF:COUP DC`



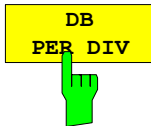
The *ZERO PHASE REF POS* softkey defines the position at which the phase of the PM-demodulated signal is set to 0 rad. The entry is made with respect to time. In the default setting, the first measured value is set to 0 rad. This softkey is available only in the PM display with DC coupling.

IEC/IEEE-bus command `SENS:ADEM:PM:RPO:X 10us`



The *DEVIATION LIN/LOG* softkey switches between logarithmic and linear display of the frequency deviation or phase deviation or modulation depth (AM). The softkey is only available in the AF spectrum deviation of the FM or PM or AM signal.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:SPAC LOG`



The *DB PER DIV* softkey makes it possible to select the FM or PM deviation or modulation depth to be displayed in the range 0.1 dB/div to 20 dB/div. The softkey is not available if linear display is set.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 5DB`



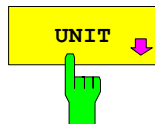
The *PHASE WRAP ON/OFF* softkey activates/deactivates phase wrap.

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 $>-180^\circ$.

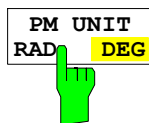
OFF The phase will not be wrapped.

This softkey is available in the PM signal displays.

IEC/IEEE-bus command `CALC:FORM PHAS | UPH`

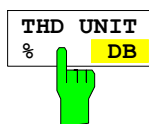


The *UNIT* softkey opens the submenu for selecting units.



The *PM UNIT RAD/DEG* softkey is used to select the unit for displaying PM signals.

IEC/IEEE-bus command `UNIT:ANGL RAD`



The *THD UNIT %/DB* softkey selects between % and dB for displaying the THD measurement result.

IEC/IEEE-bus command `UNIT:THD PCT | DB`

Scaling Functions for Result Displays with Level Display

MAX DISP
RF POWER



The *MAX DISP RF POWER* determines the maximum RF power to be displayed.

The selected value affects only the display. The reference level determines the dynamic range limit of the analyzer's A/D converter. If the input signal exceeds the selected reference level, the measurement results are impaired by A/D converter overloading. If a value higher than the reference level is selected for *MAX DISP RF POWER*, the dynamic range limit (= reference level) is highlighted by a red line on the screen:

———— POS x dBm —————

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RVAL 10 DBM`

RF POWER
LOG LIN



The *RF POWER LOG/LIN* softkey allows the user to select logarithmic or linear level display.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:SPAC LOG`

RF POWER
PER DIV



The *RF POWER PER DIV* softkey determines the *RELATIVE* power between two divisions on the y axis of the diagram.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 10 DB`

RANGE
LINEAR



The *RANGE LINEAR* softkey is identical to the softkey of the base unit.

RANGE
LINEAR %



The *RANGE LINEAR %* softkey is identical to the softkey of the base unit.

RANGE
LINEAR dB



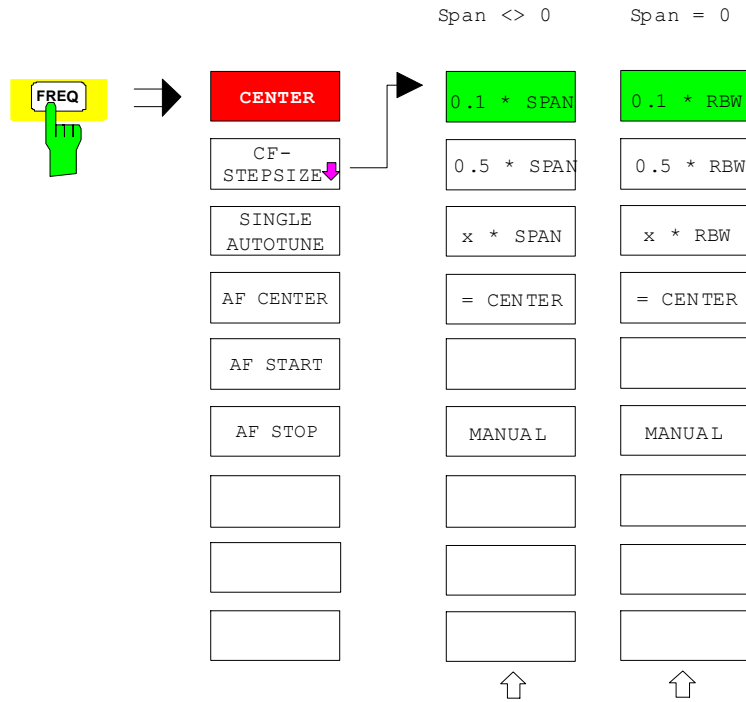
The *RANGE LINEAR dB* softkey is identical to the softkey of the base unit.

RANGE LOG
MANUAL



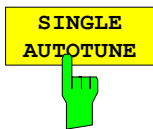
The *RANGE LOG MANUAL* softkey is identical to the softkey of the base unit.

FREQ Key



The *FREQ* menu functions are identical to those of the base unit.

If the AF spectrum display is active, the *AF CENTER*, *AF START* and *AF STOP* softkeys, with which the displayed frequency range is defined within the demodulation bandwidth, are also available.



This softkey activates an automatic signal search.

IEC/IEEE-bus command SENS:FREQ:CW:AFC ONC



The *AF CENTER* softkey allows the user to select the center frequency within the AF spectrum.

IEC/IEEE-bus command SENS:ADEM:AF:CENT 1MHZ



The *AF START* softkey allows the user to select the start frequency within the AF spectrum.

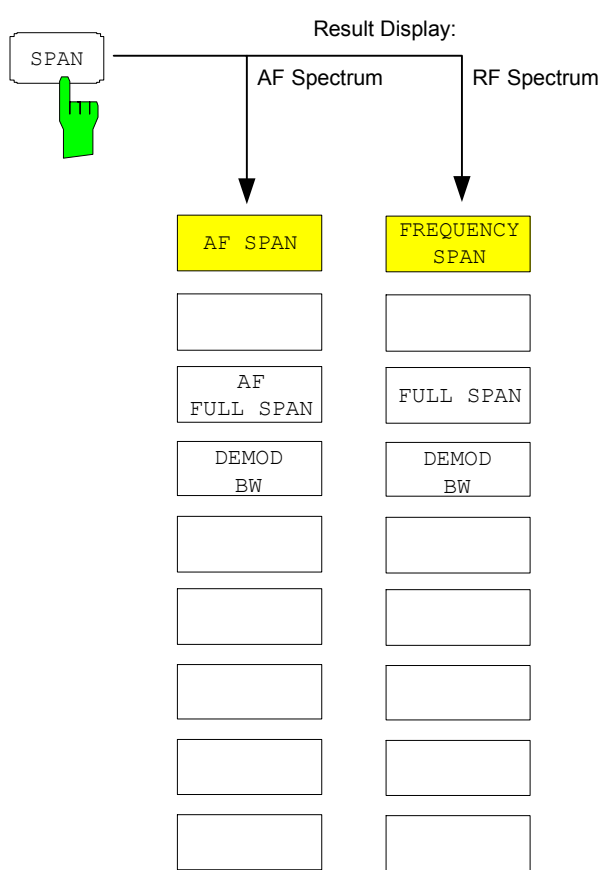
IEC/IEEE-bus command SENS:ADEM:AF:STAR 0HZ



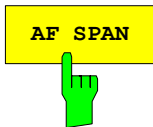
The *AF STOP* softkey allows the user to select the stop frequency within the AF spectrum. The maximum AF stop frequency corresponds to half the demodulation bandwidth.

IEC/IEEE-bus command SENS:ADEM:AF:STOP 2MHZ

SPAN Key

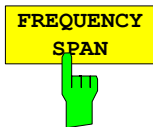


The *SPAN* menu allows the user to select the frequency range to be displayed if the spectrum displays of the FM demodulator are active.



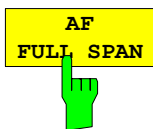
The *AF SPAN* softkey allows the user to select the frequency range if the *AF SPECTRUM* displays are active. Values between the sampling rate/200 and the demodulation bandwidth/2 can be selected.

IEC/IEEE-bus command SENS:ADEM:AF:SPAN 2.5 MHz



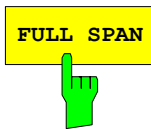
The *FREQUENCY SPAN* softkey allows the user to select the frequency range if the *RF SPECTRUM* display is active. Values between the sampling rate/200 and the demodulation bandwidth/2 can be selected.

IEC/IEEE-bus command SENS:ADEM:SPEC:SPAN:ZOOM
5 MHz



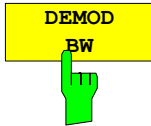
The *AF FULL SPAN* softkey sets the maximum frequency range if the *AF SPECTRUM* displays are active. The maximum frequency range corresponds to half the demodulation bandwidth.

IEC/IEEE-bus command SENS:ADEM:AF:SPAN:FULL



The *FULL SPAN* softkey sets the maximum frequency range if the RF spectrum display is active. The maximum frequency range corresponds to the demodulation bandwidth.

IEC/IEEE-bus command ADEM:SPEC:SPAN:ZOOM MAX

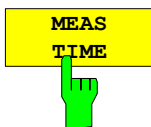


The demodulation bandwidth of the FM demodulator is selected with the *DEMOD BW* softkey.

Note:

The function is identical to the function of the DEMOD BW softkey in the FM DEMOD main menu.

IEC/IEEE-bus command SENS:BAND:DEM 10MHz



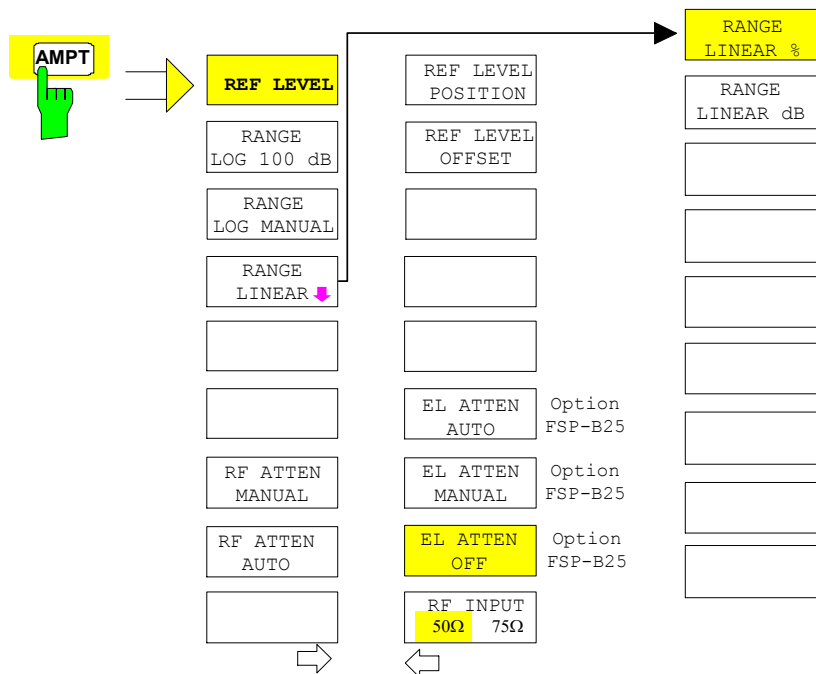
The *MEAS TIME* softkey opens the input field for the measurement time of the FM demodulator.

Note:

The function is identical to the function of the MEAS TIME softkey in the FM DEMOD main menu.

IEC/IEEE-bus command SENS:ADEM:MTIM 62.5US
SENS:SWE:TIME 62.5US

AMPT Key



The AMPT menu functions are identical to those of the base unit.

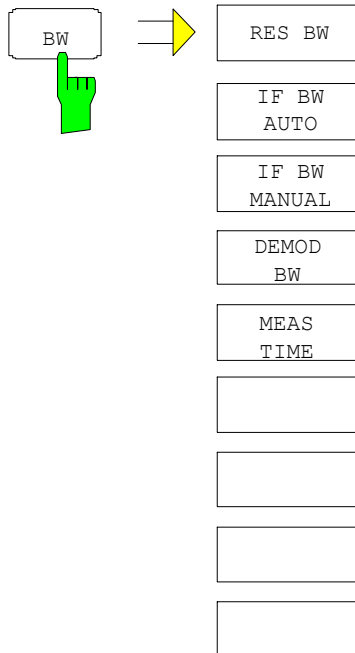
The following functions are only available with level displays:

- RANGE LOG 100 dB
- RANGE LOG MANUAL
- RANGE LINEAR

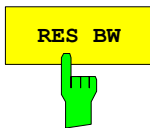
Note:

The REF LEVEL value defines the clipping level of the A/D converter and must therefore be set greater than or equal to the maximum power of the signal to be analyzed.

BW Key



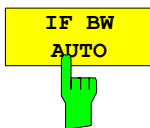
The *BW* menu comprises all functions relating to the band limiting of the analyzed signal.



If the Spectrum result display is active, the *RES BW* softkey selects the resolution bandwidth for the signal displayed. Note that these resolution bandwidths are obtained by means of FFT filters from 1 Hz to 10 MHz.

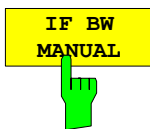
Notes: *The softkey is available only if the RF SPECTRUM or AF SPECTRUM result display is active.
The IF bandwidth is limited by analog LC filters using the IF BW MANUAL and IF BW AUTO softkeys.*

IEC/IEEE-bus command `SENS:ADEM:SPEC:BAND:RES 10 kHz`



The *IF BW AUTO* softkey couples the IF bandwidth of the analyzer (i.e. the bandwidth of the analog LC filters) to the selected demodulation bandwidth.

IEC/IEEE-bus command `SENS:BAND:RES:AUTO ON`

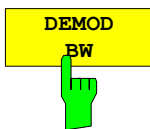


The *IF BW MANUAL* softkey allows the IF bandwidth of the analyzer to be entered (i.e. the bandwidth of the analog filters). Bandwidths from 300 kHz to 10 MHz can be selected.

IEC/IEEE-bus command `SENS:BAND:RES 1 MHz`

Notes: *Manual setting of the IF bandwidth is usually not required. If an IF bandwidth is set that is narrower than the value defined by AUTO coupling,*

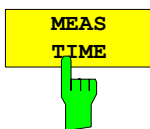
- a) *the RF frequency response is identical to that of the IF filter if the spectrum display is active,*
- b) *an AF frequency response corresponding to a lowpass filter equivalent to the IF filter occurs in the case of FM demodulation.*



The demodulation bandwidth of the FM demodulator is selected via the *DEMOD BW* softkey.

Note: *The function is identical to that of the DEMOD BW softkey in the FM DEMOD main menu.*

IEC/IEEE-bus command SENS:BAND:DEM 10MHz

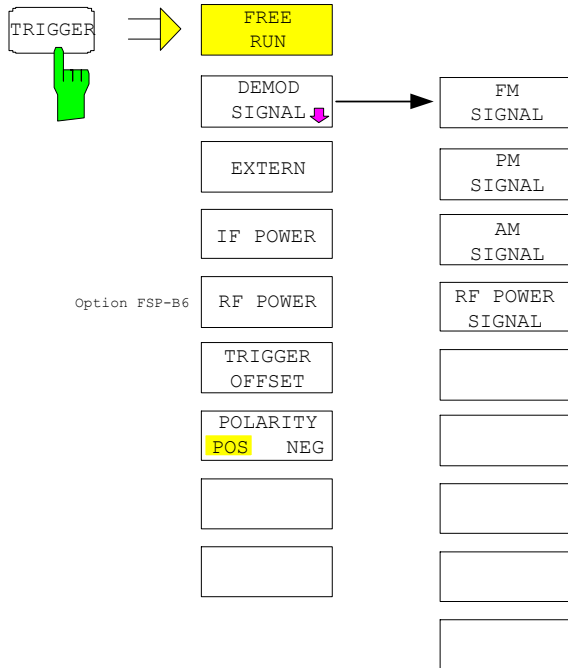


The *MEAS TIME* softkey opens the editor for entering the data-recording time of the FM demodulator.

Note: *The function is identical to that of the MEAS TIME softkey in the FM DEMOD main menu.*

IEC/IEEE-bus command SENS:ADEM:MTIM 62.5US
 SENS:SWE:TIME 62.5US

TRIG Key



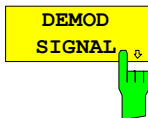
The *TRIG* key opens a menu for setting the different trigger sources and for selecting the trigger polarity. The active trigger mode is indicated by highlighting the associated softkeys.

To indicate that a trigger mode other than **FREE RUN** has been set, the **TRG** enhancement label is displayed on the screen. If two measurement windows are displayed, TRG is indicated next to the window in question.

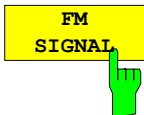


The *FREE RUN* softkey activates the free-running sweep, i.e. the measurement start is not triggered explicitly. When a measurement is completed, the next one starts immediately. *FREE RUN* is the default setting.

IEC/IEEE-bus command: `TRIG:SOUR IMM`



The *DEMOD SIGNAL* softkey opens the menu for selecting the various trigger sources.



With a modulated signal, the trigger source that is selected with the *FM SIGNAL* softkey is the point at which a specific absolute phase is reached by the input signal. The associated trigger threshold can be entered simultaneously.

Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Notes: For triggering with the *FM SIGNAL* trigger source to be successful, the measurement time must cover at least five periods of the audio signal. The triggering responds to the absolute frequency, i.e. it is always DC-coupled.

IEC/IEEE-bus command: `TRIG:SOUR FM`
`TRIG:LEV:FM 10 kHz`


PM SIGNAL

With a modulated signal, the trigger source that is selected with the *PM SIGNAL* softkey is the point at which a specific absolute frequency is reached. The associated trigger threshold can be entered simultaneously.

Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Note: *For triggering with the PM SIGNAL trigger source to be successful, the measurement time must cover at least five periods of the audio signal. Triggering is either AC- or DC-coupled, depending on the AF COUPLING AC/DC setting in the RANGE menu.*

IEC/IEEE-bus command: TRIG:SOUR PM
 TRIG:LEV:PM 0.2 rad

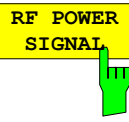

AM SIGNAL

With a modulated signal, the trigger source that is selected with the *AM SIGNAL* softkey is the point at which a specific modulation depth is reached. The associated trigger threshold can be entered simultaneously.

Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

Note: *For triggering with the AM SIGNAL trigger source to be successful, the measurement time must cover at least five periods of the audio signal.*

IEC/IEEE-bus command: TRIG:SOUR AMR
 TRIG:LEV:AM:REL 0.2 rad


RF POWER SIGNAL

With a modulated signal (AF signal), the trigger source that is selected with the *RF POWER SIGNAL* softkey is the point at which a specific signal level is reached. The associated trigger threshold can be entered simultaneously.

Measurement is triggered if the selected threshold is exceeded. A periodic signal modulated onto the carrier frequency can be displayed in this way.

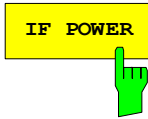
Note: *The RF POWER SIGNAL trigger differs from the RF POWER trigger in that the AF signal is taken into account rather than the RF signal. For triggering with the AM trigger source to be successful, the measurement time must cover at least five periods of the audio signal.*

IEC/IEEE-bus command: TRIG:SOUR AM
 TRIG:LEV:AM -30 dBm


EXTERN

The *EXTERN* softkey activates triggering by a TTL signal at the *EXT TRIGGER/GATE* input connector on the rear panel.

IEC/IEEE-bus command: TRIG:SOUR EXT
 SWE:EGAT:SOUR EXT



The *IF POWER* softkey activates triggering of measurement by means of signals outside the measurement channel.

To this end, the R&S FSP uses a level detector on the second intermediate frequency. The threshold of the level detector can be selected between -30 dBm and -10 dBm at the input mixer.

The R&S FSU also uses a level detector on the second intermediate frequency. The threshold of the level detector can be selected between -50 dBm and -10 dBm at the input mixer for R&S FSU.

This means that the input signal range within which the trigger responds can be calculated as follows:

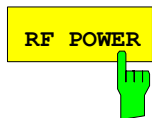
$$\text{Mixerlevel}_{\min} + \text{RFAtt} - \text{PreampGain} \leq \text{Input Signal} \leq \text{Mixerlevel}_{\max} + \text{RFAtt} - \text{PreampGain}$$

The bandwidth on the intermediate frequency is 10 MHz. The measurement is triggered if the trigger threshold is exceeded by a signal in a range of 5 MHz around the center frequency.

For R&S FSU the bandwidth on the intermediate frequency is 80 MHz, which means that the measurement is triggered if the trigger threshold is exceeded in a range of 40 MHz around the center frequency.

This allows spurious signals to be measured, such as pulsed carriers, even if the carrier itself is not within the display frequency range.

IEC/IEEE-bus command: TRIG:SOUR IFP
 SWE:EGAT:SOUR IFP



The *RF POWER* softkey activates triggering of measurement by means of signals outside the measurement channel.

To this end, the analyzer uses a level detector on the first intermediate frequency. The threshold of the level detector can be selected between -50 dBm and -10 dBm at the input mixer. This means that the input signal range within which the trigger responds can be calculated as follows:

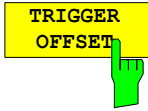
$$\text{Mixerlevel}_{\min} + \text{RFAtt} - \text{PreampGain} \leq \text{Input Signal} \leq \text{Mixerlevel}_{\max} + \text{RFAtt} - \text{PreampGain}$$

The bandwidth on the intermediate frequency is 80 MHz. The measurement is triggered if the trigger threshold is exceeded by the set frequency in a 40 MHz range.

This allows spurious to be measured, such as pulsed carriers, even if the carrier itself is not within the display frequency range.

Note: The function is only available with option TV and RF Trigger R&S FSP-B6.

IEC/IEEE-bus command: TRIG:SOUR RFP
 SWE:EGAT:SOUR RFP



The *TRIGGER OFFSET* softkey allows the user to enter a time offset between the trigger signal and the beginning of the measurement. Triggering is delayed (entry value >0) or advanced (entry value <0) by the time entered. The permissible setting range depends on the demodulation bandwidth and is given in the following table:

Demodulation bandwidth	Min. trigger offset	Max. trigger offset
120 MHz	-126 ns	31.7ms
50 / 85 MHz	-253 ns	63.5 ms
30 MHz	-507 ns	126.9 ms
18 MHz	-1 ms	253.9 ms
10 MHz	-2 ms	507.9 ms
8 MHz	-4.1 ms	1015.8 ms
5 MHz	-8.1 ms	2031.6 ms
3 MHz	-16.3 ms	4064.1 ms
1.6 MHz	-32.5 ms	8126.2 ms
800 kHz	-65 ms	16.2524 s
400 kHz	-130 ms	32.5048 s
200 kHz	-260.1 ms	65.0097 s
100 kHz	-520.2 ms	130.0193 s
50 kHz	-1040.4 ms	260.0386 s
25 kHz	-2080.7 ms	520.0773 s
12.5 kHz	-4151.5 ms	1040.1546 s
6.4 kHz	-8.322 s	2080.3 s
3.2 kHz	-16.64 s	4160.6 s
1:6 kHz	-33.29 s	8321.2 s
800 Hz	-66.58 s	16642 s
400 Hz	-133.1s	33284 s
200 Hz	-266.3 s	66569 s
100 Hz	-532.6 s	133139 s

IEC/IEEE-bus command TRIG:HOLD 10US



The *POLARITY POS/NEG* softkey determines the trigger slope polarity. The measurement sequence starts upon a positive or negative slope of the trigger signal. The valid setting is highlighted.

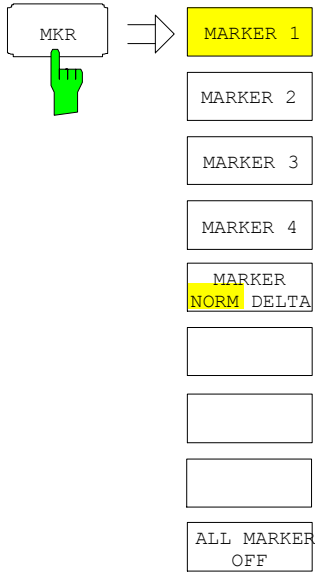
The setting is valid for all trigger modes except *FREE RUN*.

The default setting is *POLARITY POS*.

Note: *The function is available only for detector boards with model index ≥ 3. Previous boards ignore the setting.*

IEC/IEEE-bus command: TRIG:SLOP POS

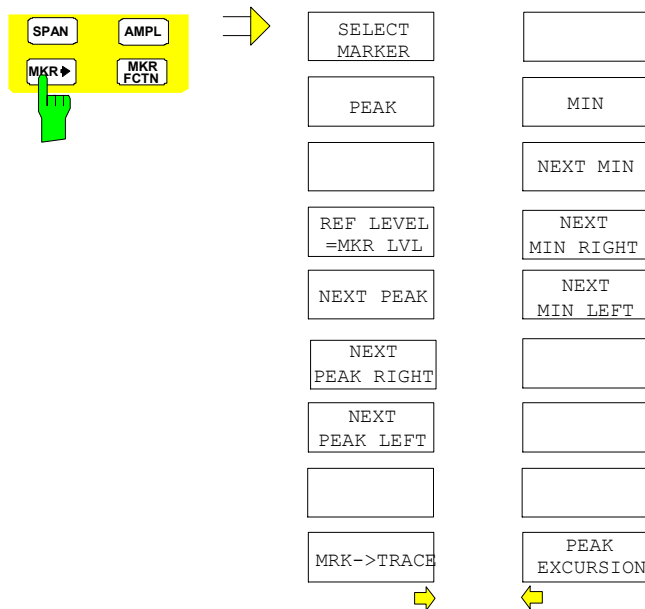
MKR Key



The *MKR* menu functions are identical to those of the base unit.

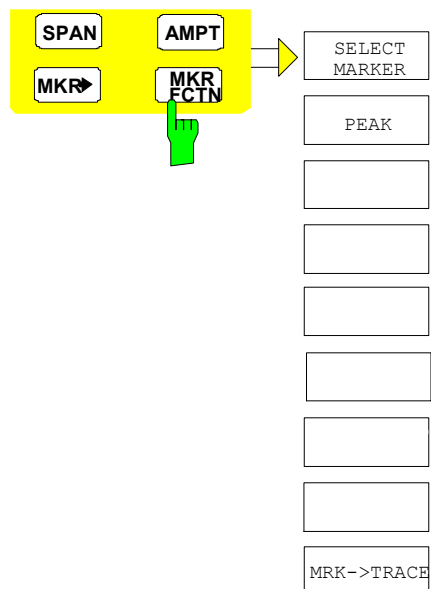
Only the measurement result display is coupled to the active result display and is in Hz if FM and FM AF spectrum are selected, in rad if PM and PM AF spectrum are selected, or in dBm or dB if RF POWER, RF POWER AF spectrum and RF SPECTRUM are selected.

MKR ⇒ Key



The *MKR ⇒* menu functions are identical to those of the base unit.
 The function *REF LEVEL = MKR LVL* is not available if the FM result display is active.

MKR FCTN Key



The available *MKR FCTN* menu functions are identical to those of the base unit.

MEAS Key

The *MEAS* menu functions are not available in the FM DEMOD mode.

Other Keys

The functions of the other keys are identical to those of the base unit. Please refer to the relevant chapters in the operating manual of the base unit.

Contents – Chapter 3 "Multicarrier Phase Measurement"

- 3 Multicarrier Phase Measurement..... 3.1**
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 - Flattop Method3.2
 - Group Delay Measurements.....3.2
 - Settings –MC PHASE RESPONSE Menu.....3.3
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3 Multicarrier Phase Measurement

Note: Multicarrier phase measurement is only supported by R&S FSQ and R&S FSG.

The Multicarrier Phase Measurement returns spectral magnitude and phase values of an input signal consisting of several unmodulated carriers. These results can further be used to calculate frequency response and group delay characteristics of radio channels.

Two different measurement methods are implemented to calculate the level and phase values versus frequency. The orthogonal method returns the result at the carrier frequencies only and offers superior performance and accuracy. The flattop method returns a more convenient spectrum plot showing also the transitions between the carriers and should be selected to get a spectral overview.

Orthogonal Method

The sample frequency and the FFT length are internally chosen such that their ratio equals the carrier spacing Δf .

$$\Delta f = \frac{\text{Sample Frequency}}{\text{FFT Length}}$$

Thus all carriers are orthogonal to each other within an observation interval of one FFT length and the FFT returns phase and level results exactly at the carrier frequencies. Several FFT results are averaged according to the selected measurement time. The FFT is preceded by a frequency correction to avoid intercarrier interference by matching the carrier frequencies to the FFT grid.

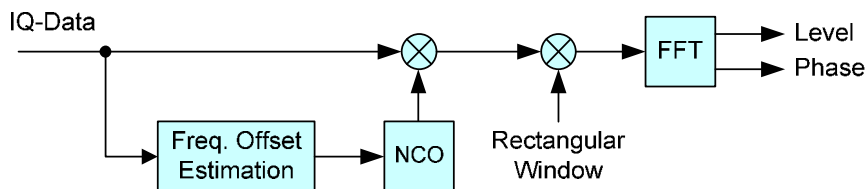


Fig. 3-1 Block diagram of the orthogonal measurement method

It is recommended to set the span according to the following equation:

$$\text{Span} = (\text{NumberOfCarriers} - 1) \cdot \Delta f .$$

Flattop Method

The IQ data signal is multiplied by a flattop window before performing the FFT. The flattop window guarantees correct level and phase values even if the carrier frequencies do not match the FFT grid, so this method is applicable if the carrier spacing is not uniform. The measurement time determines the FFT length and must be chosen high enough to avoid overlapping of the window responses of adjacent carriers. The resulting trace data contains also the transitions between the carriers.

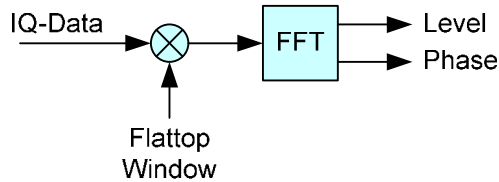


Fig. 3-2 Block diagram of the flattop measurement method

Group Delay Measurements

The group delay of a DUT is defined as the negative derivative of the phase response with respect to the angular frequency

$$\tau = -\frac{d\phi(\omega)}{d\omega}$$

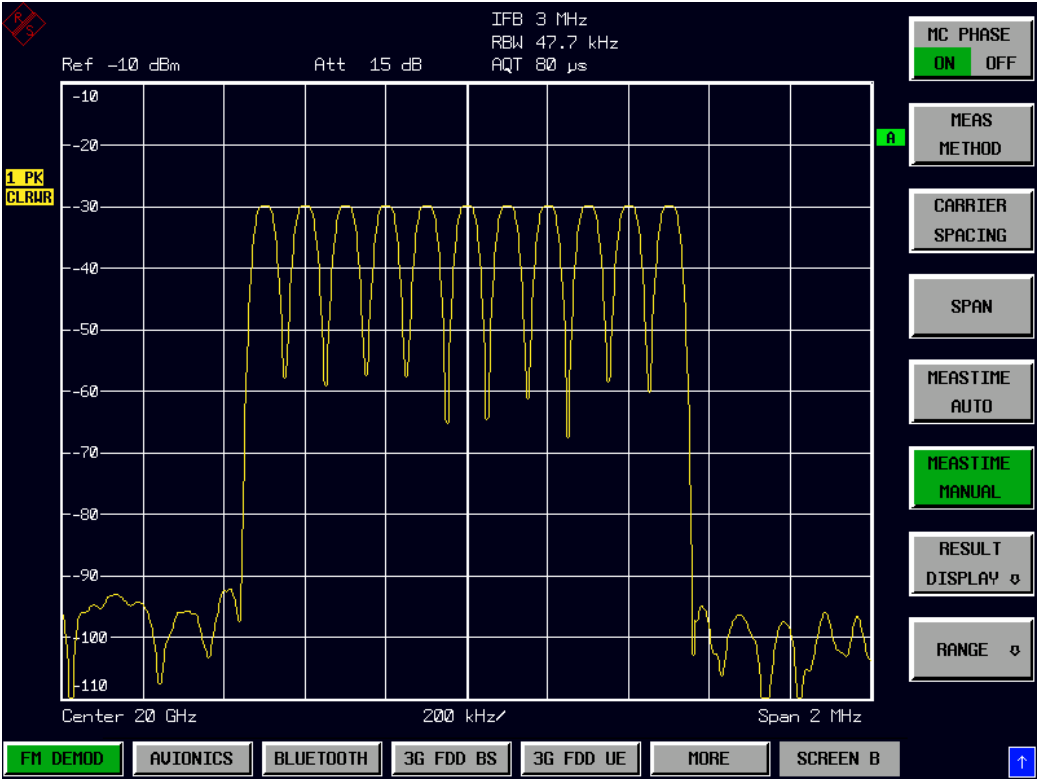
It is recommended to use an input signal with low crest factor and the orthogonal measurement method to get the phase response of the DUT. A calibration measurement should be performed to account for the internal frequency responses of the transmitter and the analyzer. A common reference frequency is mandatory. An external trigger must be used for absolute group delay measurements. The following list summarizes the necessary measurement and calculation steps:

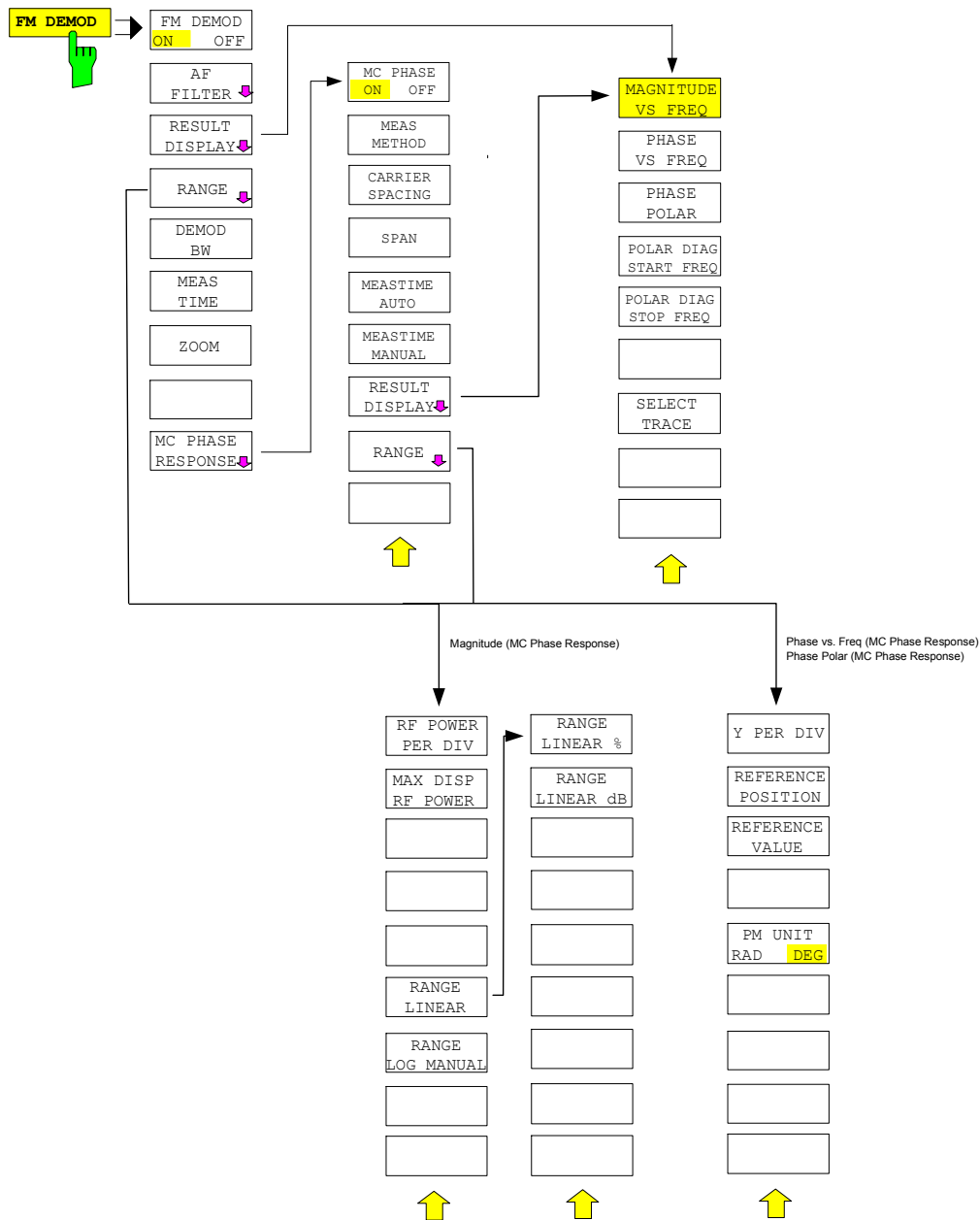
1. Calibration Measurement without DUT $\rightarrow \phi_{cal}(k)$
2. Measurement with DUT $\rightarrow \phi_{meas}(k)$
3. Calculate DUT Phase Response $\phi(k) = \phi_{meas}(k) - \phi_{cal}(k)$
4. Unwrap Phase Response

5. Calculate Group Delay $\tau(k) = -\frac{\phi(k) - \phi(k-1)}{2\pi \cdot \Delta f}$

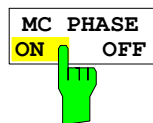
Settings –MC PHASE RESPONSE Menu

The *MC PHASE RESPONSE* softkey in the main menu of the FM demodulator opens the menu to perform multicarrier phase measurements.



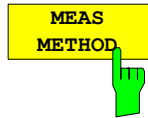


Note: The arrangement of the softkeys in the RANGE submenu depends on the set diagrams (Magnitude vs Freq / Phase vs Freq / Phase Polar).

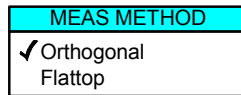


The **MC PHASE ON / OFF** softkey switches the multicarrier phase measurement on or off.

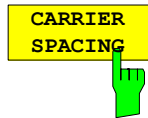
IEC/IEEE-bus command SENS1:ADEM ON
 SENS1:ADEM:MCPH:STAT ON



The softkey opens a list box to select between the method based on orthogonal and flattop-window measurement.



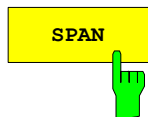
IEC/IEEE-bus command `SENS1:ADEM:MCPH:METH ORTH`



The *CARRIER SPACING* softkey defines the spacing between two carriers.

Note: For the method based on flattop-window measurement, the carrier spacing is only required to calculate the automatic measurement time.

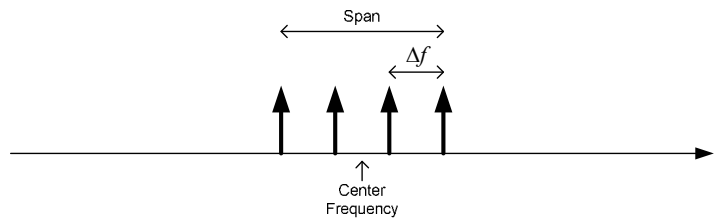
IEC/IEEE-bus command `SENS1:ADEM:MCPH:SPAC 100KHZ`



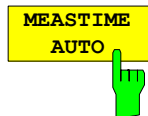
The *SPAN* softkey defines the number of carriers to be measured.

Example:

A span $\geq 3 * \text{carrier spacing } (\Delta f)$ is required to measure a signal with four carriers.

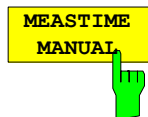


IEC/IEEE-bus command `SENS1:ADEM:SPEC:SPAN:MAX 3MHZ`



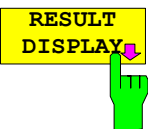
The *MEASTIME AUTO* softkey activates the automatic calculation of the recording length.

IEC/IEEE-bus command `SENS1:ADEM:MTIM:AUTO ON`



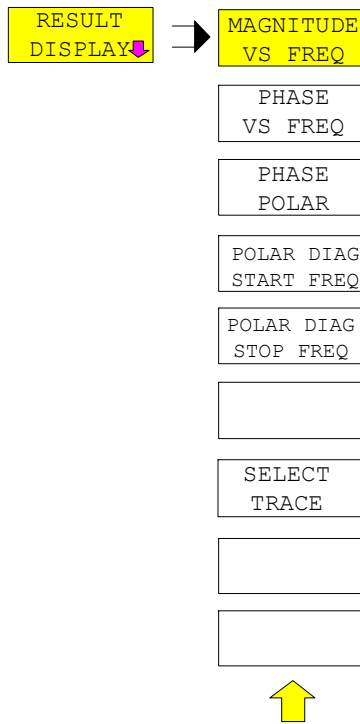
The *MEASTIME MANUAL* softkey opens a data entry field to manually enter the recording length.

IEC/IEEE-bus command `SENS1:ADEM:MTIM 1ms`



The *RESULT DISPLAY* softkey opens the submenu to select the required measurement function (s. section "Selection of Result Display – *RESULT DISPLAY*" Menu).

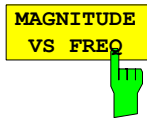
Selection of Result Display – *RESULT DISPLAY* Menu



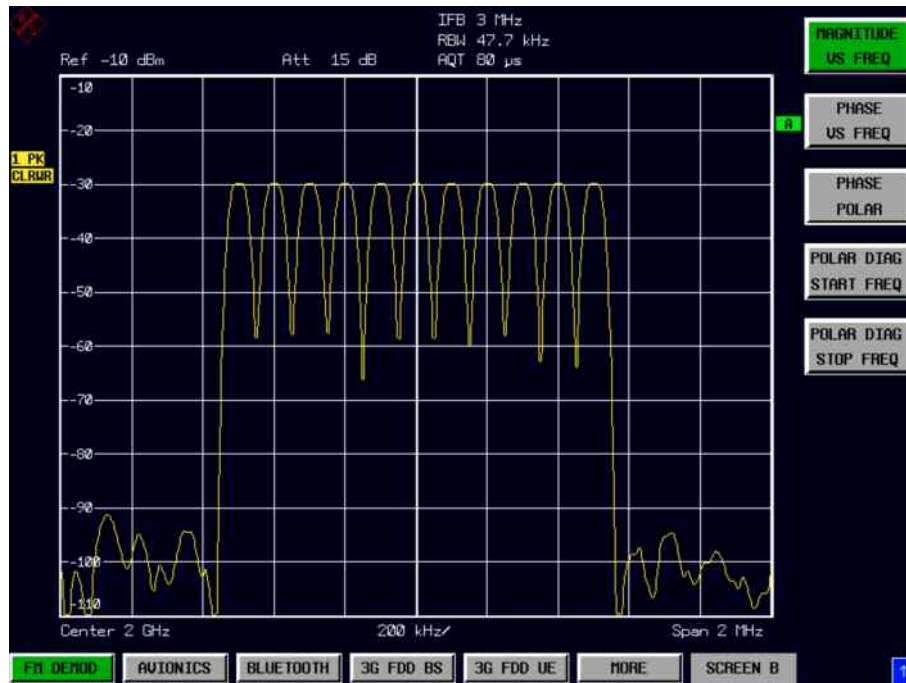
The *RESULT DISPLAY* softkey opens a submenu to select the measurement result to be displayed.

The magnitude or phase of the signal in the frequency domain or the phase in a polar diagram can be selected.

All results are determined by the I/Q data set recorded for the measurement. In the *SINGLE SWEEP* mode, the data set recorded once can be evaluated in all diagrams by simply switching over the result display.

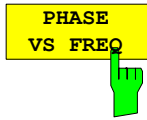


The *MAGNITUDE VS FREQ* softkey selects the level diagram of the signal in the frequency domain.

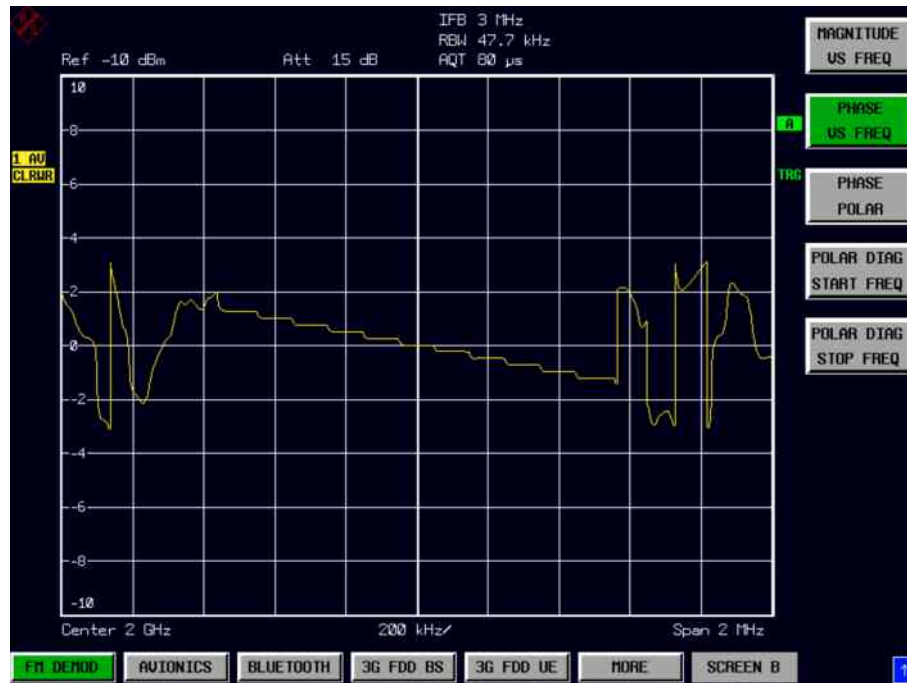


IEC/IEEE-bus command

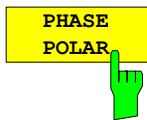
CALC:FEED `XFR:SPEC:MAGN`



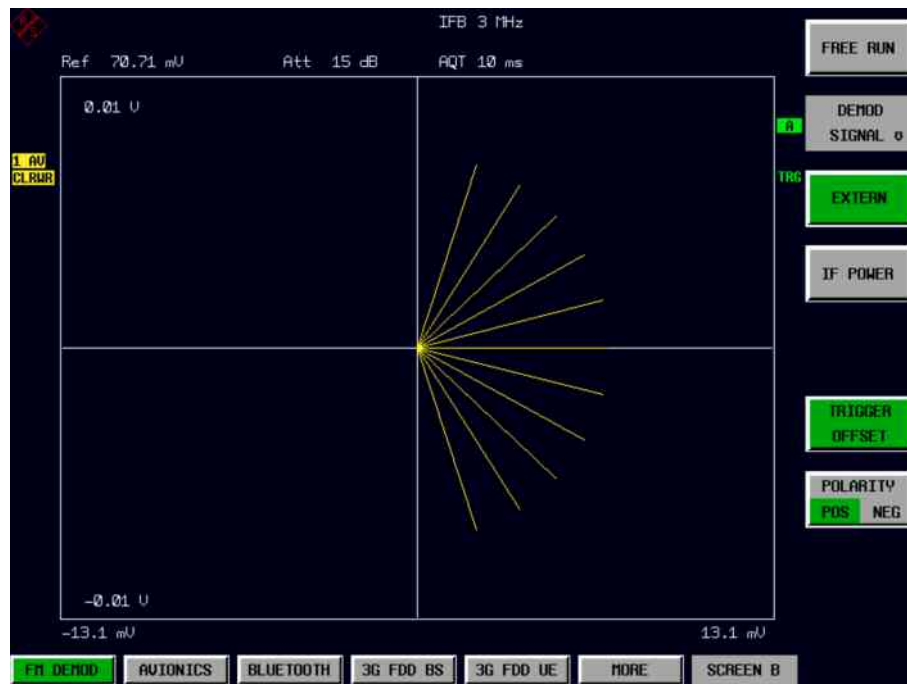
The *PHASE VS FREQ* softkey selects the phase diagram of the signal in the frequency domain.



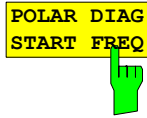
IEC/IEEE-bus command `CALC:FEED `XFR:SPEC:PHAS``



The *PHASE POLAR* softkey selects the phase diagram in a polar diagram. The displayed frequency domain is determined with the two softkeys *POLAR DIAG START FREQ* and *POLAR DIAG STOP FREQ*.

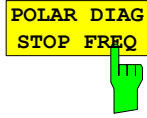


IEC/IEEE-bus command `CALC:FEED `SPEC:POL``



The *POLAR DIAG START FREQ* softkey determines the start frequency starting from which the phases are displayed in the polar diagram. In the *MAGNITUDE VS FREQ* and *PHASE VS FREQ* diagrams, the start frequency is characterized by a display line.

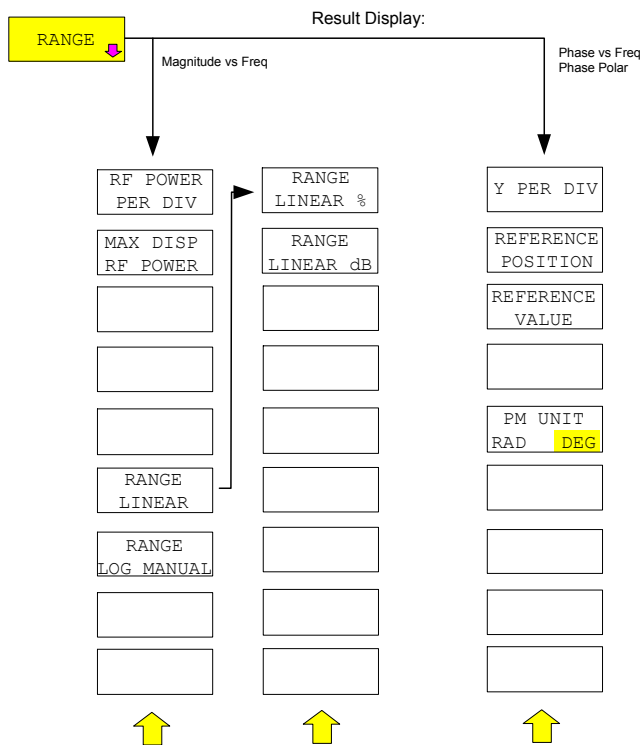
IEC/IEEE-bus command `CALC:ADEM:MCPH:POL:FREQ:STAR 100MHz'`



The *POLAR DIAG STOP FREQ* softkey determines the stop frequency up to which the phases are displayed in the polar diagram. In the *MAGNITUDE VS FREQ* and *PHASE VS FREQ* diagrams, the stop frequency is characterized by a display line.

IEC/IEEE-bus command `CALC:ADEM:MCPH:POL:FREQ:STOP 120MHz'`

Scaling of Measurement Results –RANGE Menu

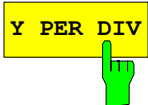


The *RANGE* softkey opens a submenu to determine the diagram scaling for the selected display.

The visible selection of the softkeys depends on the selected diagram (Magnitude vs Freq / Phase vs Freq / Phase Polar).

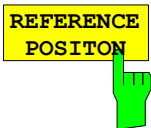
The scaling of the level diagram (Magnitude vs Freq) is identical to the level diagrams of analog demodulation (RF Power und RF Spectrum).

Scaling Functions for Result Displays with Phase Diagrams



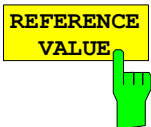
The *Y PER DIV* softkey determines the scaling of the Y axis for the two phase diagrams (Phase vs Freq / Phase Polar). To display the phase in the frequency domain, make the entry using the unit selected by means of the *PM UNIT RAD/DEG* softkey. In the polar diagram, the entry is made in Volt. The scaling of the X axis is coupled to the Y axis in the polar diagram.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:PDIV 0.5RAD`



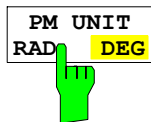
The *REFERENCE POSITION* softkey determines the position of the reference line for the phase diagram in the frequency domain. The default setting is 50 % (diagram center).

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RPOS 50PCT`



The *REFERENCE VALUE* softkey determines the value of the reference line for phase diagram in the frequency domain. The basic setting is 0 rad.

IEC/IEEE-bus command `DISP:WIND:TRAC:Y:RVAL 0RAD`



The *PM UNIT RAD/DEG* softkey allows you to select the unit for displaying phase values.

IEC/IEEE-bus command `UNIT:ANGL RAD`

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4 Remote Control - Description of Commands

The information in this chapter supplements and updates chapters 5 and 6 of the R&S FSP manual. This chapter contains the new commands that apply specifically to option R&S FS-K7 as well as the modified commands of the basic instrument provided they are used by R&S FS-K7.

Every attempt was made to ensure the highest possible compatibility of the R&S FS-K7 commands with those of analog demodulation of the FSE family. A few commands were included in the command set for this reason only.

In the description of menu operation in chapter 2, each softkey is indicated with the associated IEC/IEEE bus commands.

Note: *The measurements of the FM Demodulator mode are always carried out in screen A. Therefore, the commands where the numeric suffix selects the screen must either start with numeric suffix 1 (i.e. CALCulate1) or without a numeric suffix (i.e. CALCulate).*

Common Commands

COMMAND	PARAMETERS	UNIT	COMMENT
*OPT?			Option Identification Query; query only

*OPT?

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the installed options. The options are separated by commas. In the response string, the identification of option R&S FS-K7 is indicated at position 32:

Example:

0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,K7,0,0,0,0,0,0,0,0

CALCulate Subsystem

CALCulate:ADEMod Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2> :ADEMod :MCPHase :POLar :FREQuency :STARt :STATe :STOP :STATe	<numeric_value> <Boolean> <numeric_value> <Boolean>	HZ HZ	

:CALCulate1:ADEMod:MCPHase:POLar:FREQuency:STARt<numeric_value>

Multicarrier measurement: start frequency for range selection in polar diagram.

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement .
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on.
" :CALC1:ADEM:MCPH:POL:FREQ:STAR:STAT ON"
                               ' Switch on start frequency.
" :CALC1:ADEM:MCPH:POL:FREQ:STAR 20GHZ"
                               ' Set start frequency.
```

Characteristics: *RST value: -
SCPI: device-specific

:CALCulate1:ADEMod:MCPHase:POLar:FREQuency:STARt:STATe ON|OFF

Multicarrier measurement: activates start frequency for range selection in polar diagram and activates display line in the frequency diagram

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement.
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on.
" :CALC1:ADEM:MCPH:POL:FREQ:STAR:STAT ON"
                               ' Start frequency to default, activate display line.
```

Characteristics: *RST value: OFF
SCPI: device-specific

:CALCulate1:ADEMod:MCPHase:POLar:FREQuency:STOP<numeric_value>

Multicarrier measurement: stop frequency for range selection in polar diagram.

Example: ":SENS1:ADEM ON" 'Switch on Ademod measurement.
 ":SENS1:ADEM:MCPH:STAT ON" 'Multicarrier measurement on.
 ":CALC1:ADEM:MCPH:POL:FREQ:STOP:STAT ON"
 'Switch on stop frequency
 ":CALC1:ADEM:MCPH:POL:FREQ:STOP 20.001GHZ"
 'Set stop frequency.

Characteristics: *RST value: -
 SCPI: device-specific

:CALCulate1:ADEMod:MCPHase:POLar:FREQuency:STOP:STATe ON|OFF

Multicarrier measurement: activates stop frequency for range selection in polar diagram and activates display line in the frequency diagram.

Example: ":SENS1:ADEM ON" 'Switch on Ademod measurement.
 ":SENS1:ADEM:MCPH:STAT ON" 'Multicarrier measurement on.
 ":CALC1:ADEM:MCPH:POL:FREQ:STOP:STAT ON ' "
 'Stop frequency to default, activate display line.

Characteristics: *RST value: OFF
 SCPI: device-specific

CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem controls the delta marker functions in the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2> :DELTamarker<1...4> :Y?	--	--	query only

CALCulate<1|2>:DELTamarker<1...4>:Y?

This command queries the measured value of the selected delta marker in the indicated measurement window. The corresponding delta marker will be activated, if necessary. The output is always a relative value referred to marker 1.

To obtain a valid 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 on the activated measuring functions, the query result is output in the units below:

- Result display FM: Hz
- Result display PM: rad | deg
- Result display AM: %
- Result display RF POWER: dB (logarithmic display)
% (linear display)
- Result display RF SPECTRUM: dB (logarithmic display)
% (linear display)
- Result display AF SPECTRUM: dB (logarithmic display)
Hz | % | rad | deg (linear display)

Example:

```
"INIT:CONT OFF"  Switch to single-sweep mode
"CALC:DELT2 ON"  Switch on delta marker 2
"INIT;*WAI"      Start a sweep and wait for its end
"CALC:DELT2:Y?" Output measured value of delta marker 2.
```

Characteristics: *RST value: -
SCPI: device-specific

CALCulate:FEED Subsystem

The CALCulate:FEED subsystem selects the type of evaluation of the measured data. This corresponds to the selection of the Result Display in manual mode.

If the FM demodulator is active, the selection of the type of evaluation is independent of the measurement window. Therefore, the numeric suffix <1|2> is irrelevant and ignored.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2>: :FEED	<string>		no query

CALCulate<1|2>:FEED <string>

This command selects the trace data to be displayed.

Parameters:

<string>::=

'SPECTrum:POLar'	Multicarrier measurement: display of phase in polar diagram.
'XFRrequency:SPECTrum[:MAGNitude]'	Multicarrier measurement: magnitude diagram of RF spectrum.
'XFRrequency:SPECTrum:PHASe'	Multicarrier measurement: phase diagram of RF spectrum.
'XTIM:AM:RELative[:TDOMain]'	Demodulated AM signal in standardized display.
'XTIM:AM:RELative:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in standardized display, results referenced to traces 1 to 3.
'XTIM:AM[:ABSolute][:TDOMain]'	Demodulated AM signal in level display. Same as 'XTIM:RFPower'.
'XTIM:AM[:ABSolute]:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in level display, results referenced to traces 1 to 3. Same as 'XTIM:RFPower:AFSPectrum'.
'XTIM:RFPower[:TDOMain]'	Demodulated AM signal in level display.
'XTIM:RFPower:AFSPectrum<1...3>'	AF spectrum of the demodulated AM signal in level display, results referenced to traces 1 to 3.
'XTIM:FM[:TDOMain]'	Demodulated FM signal.
'XTIM:FM:AFSPectrum<1...3>'	AF spectrum of the demodulated FM signal, results referenced to traces 1 to 3.
'XTIM:PM[:TDOMain]'	Demodulated PM signal
'XTIM:PM:AFSPectrum<1...3>'	AF spectrum of the demodulated PM signal
'XTIM:AMSummary<1...3>[:ABSolute]'	AM results in level display, referenced to traces 1 to 3.
'XTIM:AMSummary<1...3>:RELative'	AM results in standardized display, referenced to traces 1 to 3.
'XTIM:FMSummary<1...3>'	FM results, referenced to traces 1 to 3
'XTIM:PMSummary<1...3>'	PM results, referenced to traces 1 to 3.
'XTIM:SPECTrum'	RF spectrum of the signal determined from the measured data via FFT.

Example: "CALC:FEED `XTIM:FM` " Select the display of the FM signal

Characteristics: *RST value: XTIM:FM'
SCPI: conforming

CALCulate:FORMat Subsystem

The CALCulate:FORMat subsystem defines the conversion of measured data.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2> :FORMat	PHASe UPHase		

:CALCulate<1|2>:FORMat PHASe | UPHase

This command activates the limitation to ±180°.

Parameter: PHASe: Limitation to ±180°
 UPHase: Unwrapped

Example: " :CALC:FORM PHAS " activated the limitation to ±180°.

Characteristics:: *RST value: UPAS
 SCPI: conforming

CALCulate:MARKer Subsystem

The CALCulate:MARKer subsystem controls the marker functions in the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2> :MARKer<1...4> :PEXCursion :Y?	<numeric_value> --	DB DEG RAD HZ PCT --	 query only

CALCulate<1|2>:MARKer<1...4>:PEXCursion <numeric_value>

This command defines the peak excursion, i.e. the spacing below the trace maximum which must be attained before a new maximum is recognized, or the spacing above the trace minimum which must be attained before a new minimum is recognized. The set value is valid for all markers and delta markers.

The unit of the numerical value depends on the active display.

Example: "CALC:MARK:PEXC 10dB" ' SPECTRUM display
 "CALC:MARK:PEXC 100 Hz" ' FM DEMOD display

Characteristics: *RST value: 50 kHz (for FM displays)
 0.5 RAD (for PM displays)
 5 PCT (for standardized AM displays)
 6 dB (for level displays)
 SCPI: device-specific

The numeric suffix <1...4> in MARKer is irrelevant.

CALCulate<1|2>:MARKer<1...4>:Y?

This command queries the measured value of the selected marker in the selected measurement window. The corresponding marker is activated before or switched to marker mode, if necessary. To obtain a valid 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.

Example: "INIT:CONT OFF" Switch to single-sweep mode
 "CALC:MARK2 ON" Switch on marker 2
 "INIT;*WAI" Start a sweep and waits for its end
 "CALC:MARK2:Y?" Output the measured value of marker 2.

Characteristics: *RST value: -
 SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNction:ADEMod:AM[:RESult<1...3>]? PPEak|MPEak|MIDDLE|RMS

This command queries the results of the AM modulation measurement. The numeric suffix (:RESult<1...3>) indicates whether trace 1, 2 or 3 is selected.

PPEak Result of measurement with detector +PK
 MPEak Result of measurement with detector -PK
 MIDDLE Result of averaging \pm PK/2
 RMS Result of measurement with detector RMS

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED XTIM:AM:REL:TDOM" 'Switch on AM result display
 "DISP:TRAC ON" 'Switch on trace
 "CALC:MARK:FUNC:ADEM:AM? PPE" 'Query the peak value

Characteristics: *RST value: -
 SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNction:ADEMod:CARRier[:RESult<1...3>]?

This command queries the carrier power.

With the RF power result display, the carrier power is determined from trace 1 to 3 as specified in the numeric suffix. With all other result displays, the carrier power is determined from the current trace data (CLR/WRITE trace).

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED XTIM:RFP" 'Switch on RF power result display
 "CALC:MARK:FUNC:ADEM:CARR?" 'Query carrier power

Characteristics: *RST value: -
 SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNction:ADEMod:FERRor[:RESult<1...3>]?

This command queries the frequency error with FM and PM demodulation. With FM demodulation, trace 1 to 3 is selected with the numeric suffix (:RESult<1...3>). With PM demodulation, the frequency error is determined from the current measurement data (CLR/WRITE trace).

The mean offset thus determined differs from that calculated in the [SENSe:]ADEMod:FM:OFFSet? query, since, for determining the frequency deviation, the modulation is removed by means of lowpass filtering, producing results that are different from those obtained by averaging with the SENSe:... command. This command is available only for traces in the FM and PM result displays. If any other result display is selected, this command is disabled.

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED XTIM:FM:TDOM" 'Switch on FM result display
 "CALC:MARK:FUNC:ADEM:FERR? " 'Query frequency error of trace 1

Characteristics: *RST value: -
 SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNction:ADEMod:FM[:RESult<1...3>]? PPEak|MPEak|MIDDLE|RMS

This command queries the results of FM modulation measurement. The numeric suffix indicates whether trace 1, 2 or 3 is selected.

PPEak Result of measurement with detector +PK
 MPEak Result of measurement with detector -PK
 MIDDLE Result of averaging \pm PK/2
 RMS Result of measurement with detector RMS

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED XTIM:AM:REL:TDOM" 'Switch on AM result display
 "DISP:TRAC ON" 'Switch on trace
 "CALC:MARK:FUNC:ADEM:AM? PPE" 'Query the peak value

Characteristics: *RST value: -
 SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:MDEPth:RESult?

This command queries the AM modulation depth in the indicated measurement window. A complete sweep with synchronization to sweep end must be performed between switching on the function and querying the measured value to obtain a valid query result. This is only possible in single sweep mode.

The numeric suffix <1 to 4> of :MARKer is irrelevant for this command.

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 in screen A.
	"INIT;*WAI"	'Starts a sweep and waits for the end.
	"CALC:MARK:FUNC:MDEP:RES?"	'Outputs the measured value of screen A.

Characteristics: *RST value: -
SCPI: device-specific

This command is only a query and therefore has no *RST value.

CALCulate<1|2>:MARKer<1 to 4>: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 analyzer calculates the power at the marker positions 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 to 4> of :MARKer is irrelevant with 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 in screen A.
	"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

CALCulate:UNIT Subsystem

The CALCulate:Unit subsystem defines the units for the parameters that can be set and the measurement results.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate<1 2> :UNIT :ANGLE	DEG RAD		

CALCulate<1|2>: UNIT:ANGLE DEG | RAD

This command selects the unit for angles.

Example: "CALC:UNIT:ANGL DEG"

Characteristics: *RST value: RAD
SCPI: device-specific

DISPlay Subsystem

The DISPLAY subsystem controls the selection and presentation of textual and graphic information as well as of trace data on the display.

COMMAND	PARAMETERS	UNIT	COMMENT
DISPlay [:WINDow<1 2>] :TRACe<1...3> :Y [:SCALe] :PDIVision :RPOSition :RVALue :SPACing	 <numeric_value> <numeric_value> <numeric_value> LINear LOGarithmic LDB	 DB HZ PCT DEG RAD PCT DB HZ PCT DEG RAD --	

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:PDIVision <numeric_value>

This command defines the scaling of the Y-axis in the current unit.

Separate scalings are maintained for the following displays:V

- FM display
- PM display
- AM display
- Logarithmic AF spectrum display

The numeric suffix in TRACe<1...3> is irrelevant.

Example: "DISP:WIND1:TRAC:Y:PDIV 10KHz" 'Set Y scale to
'10 kHz/div.

Characteristics: *RST value: 50 kHz (FM display)
2 rad (PM display)
20 PCT (AM display)
10 dB (AF spectrum display)
SCPI: conforming

This command is only available with option R&S FS-K7 (FM Demodulator).

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RPOSition 0...100PCT

This command defines the position of the reference value in the selected measurement window. The numeric suffix in TRACe<1...3> is irrelevant.

Separate reference positions are maintained for the following displays:

- RF power, RF spectrum and AF spectrum of the RF power
- FM, PM and AM
- AF spectrum of the FM, PM and A

Example: "DISP:WIND1:TRAC:Y:RPOS 50PCT"

Characteristics: *RST value: 100 PCT(level display)
50 PCT (FM, PM or AM display)
100 PCT(AF spectrum display of the FM, PM or AM)
SCPI: conforming

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y[:SCALe]:RVALue <numeric_value>

This command defines the reference value assigned to the reference position, thus corresponding to the REFERENCE VALUE parameter in manual control. Separate reference values are maintained for the various displays.

The numeric suffix in TRACe<1...3> is irrelevant.

Example: "DISP:WIND1:TRAC:Y:RVAL 0" defines the display value of the reference position at 0 dB

Characteristics: *RST value: 0 Hz
 0 rad (PM display)
 0 PCT (AM display)
 250 kHz (FM AF spectrum display)
 10 rad (PM AF spectrum display)
 100 PCT (AM AF spectrum display)
 SCPI: device-specific

DISPlay[:WINDow<1|2>]:TRACe<1...3>:Y:SPACing LINear | LOGarithmic | LDB

This command switches between linear and logarithmic display in the selected window. In the case of linear display, 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.

The numeric suffix for TRACe<1...3> is irrelevant.

Example: "DISP:WIND1:TRAC:Y:SPAC LIN"

Characteristics: *RST value: LOGarithmic
 SCPI: conforming

INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

COMMAND	PARAMETERS	UNIT	COMMENT
INSTrument :NSElect [:SElect]	<numeric_value> SANalyzer ADEMod		

INSTrument:NSElect 1|3

This command switches between the operating modes by means of numbers.

Parameter: 1: Spectrum analysis mode
3: FM demodulator mode

Example: "INST:NSEL 1" Switch to *SPECTRUM* mode

Characteristics: *RST value: 1
SCPI: conforming

INSTrument[:SElect] SANalyzer | ADEMod

This command switches between the operating modes by means of text parameters.

Parameter: ADEMod: FM demodulator mode
SANalyzer: Spectrum analysis mode

Example: "INST SAN" Switch to *SPECTRUM* mode

Characteristics: *RST value: SANalyzer
SCPI: conforming

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, i.e. it is not necessary to include the SENSe node in command sequences.

[SENSe:]ADEMod Subsystem

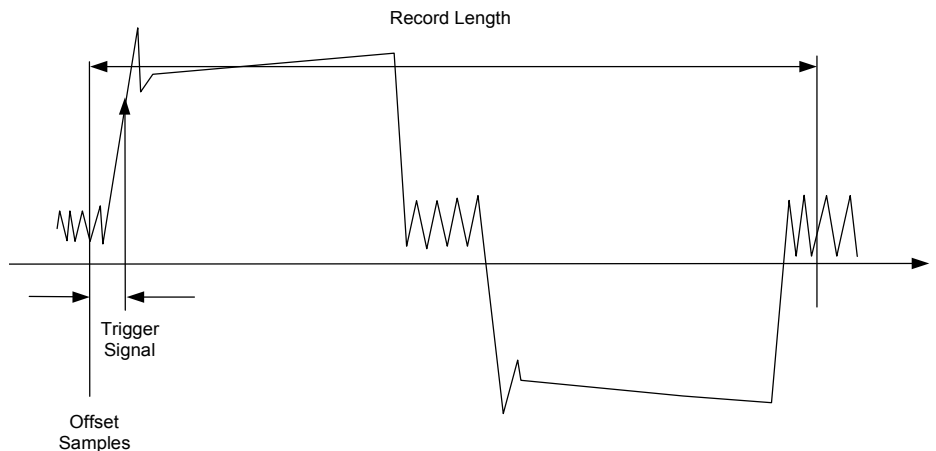
The purpose of the commands defined below is to set up the R&S FSP spectrum analyzer for the measurement of FM, PM and AM modulated signals in a way that allows to obtain as many measurement results as possible with a single shot measurement.

For this purpose, the R&S FSP has been equipped with a demodulator that is capable of performing both FM and AM demodulation at a time. Additionally maximum, minimum and average or current values can be obtained in parallel over a selected number of measurements. In order to make it suitable for bursted signals the demodulator can be configured in terms of pretrigger time, sample rate and record length.

Notes: *Demodulation will be performed offline, i.e. on signals previously stored into memory. The I/Q memory available for this purpose is 2 x 128 k samples. The sampling rate can be selected in the range from 15.625 to 32 MHz. The R&S FS-K supports measurement data rates up to 64 MHz, and the option R&S FS-K-B72 supports rates up to 256 MHz.*

Example: In the case of a *Bluetooth* signal, the signal in question is described in the following diagram:

Frequency versus time:



Measurement results of interest are:

- FM offset
- FM deviation (maximum and minimum) for signal modulated with '1' values only.
- FM deviation (maximum and minimum) for signal modulated with '0' values only.
- AM modulation depth for positive and negative burst ramp.

These values can be obtained by external computations from the frequency or amplitude versus time data. For this purpose, the R&S FSP will deliver the following results:

- Demodulated FM signal (current values, averaged, maxhold or minhold selectable)

- Demodulated AM signal (current values, averaged, maxhold or minhold selectable)
- FM offset (current value or averaged selectable)

The following settings are required on the R&S FSP:

- Types of demodulation to be performed simultaneously (AM/FM)
- Sampling rate
- Record length
- Trigger source (free run/external)
- Pretrigger samples
- Number of measurements for average/maxhold/minhold

In addition, the required measurement results need to be configured for each type of demodulation. The R&S FSP can simultaneously determine multiple types of demodulation with a maximum of 3 different result types. The following result types can be selected:

- WRITeThe current measurement results are determined.
- AVERAgeThe measurement results are averaged over a specified number of measurements
- MAXHoldThe maximum result values are determined over a specified number of measurements
- MINHoldThe minimum result values are determined over a specified number of measurements

In practice, the commands defined below are used as follows:

The instrument is set first. Then a measurement is started and the result list read in after synchronization to the end of the measurement. This method permits the control computer to be used for other tasks while the R&S FSP is performing the measurement.

Note: *Analog demodulation is only available for screen A. Therefore, it is not permissible to enter "SENSe2..." for the commands of the SENSe:ADEMod subsystem.*

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :ADEMod :AF :CENTer :COUPling :SPAN :FULL :START :STOP :BANDwidth :DEModulation :BWIDth :DEModulation :MTIME :AUTO :RLENgth? :SET [:STATe] :SRATE? :ZOOM :START [:STATe]	<numeric_value> AC DC <numeric_value> -- <numeric_value> <numeric_value> <numeric_value> <numeric_value> <numeric_value> <Boolean> <numeric_value>, <numeric_value>, IMMediate EXTernal IFPower RFPower AF AM AMRelative FM PM, POSitive NEGative, <numeric_value>, <numeric_value> <Boolean>	HZ HZ HZ HZ HZ S HZ, --, --, --, --, -- S	query only query only

[SENSe:]ADEMod:AF:CENTer <numeric_value>

This command sets the center frequency for the display of the AF spectrum.

Example: "ADEM ON" 'Switch on FM demodulator
"CALC:FEED 'XTIM:FM:AR&S FSP' 'Switch on "FM AF spectrum" display
or
"CALC:FEED 'XTIM:RFP:AR&S FSP' 'Switch on "AF spectrum of the
'RF power signal" display
"ADEM:BAND 5 MHz" 'Set meas. bandwidth to 5 MHz
"ADEM:AF:CENT 500kHz" 'Set AF center frequency to 500 kHz
"ADEM:AF:SPAN 200kHz" 'Set AF span to 200 kHz

Characteristics: *RST value: 1.25 MHz
SCPI: device-specific

[SENSe:]ADEMod:AF:COUPling AC | DC

This command selects the coupling of the AF path.

Example: "ADEM:AF:COUP DC" ' Switch on DC coupling.

Characteristics: *RST value: AC
SCPI: device-specific

[SENSe:]ADEMod:AF:SPAN <numeric_value>

This command sets the span for the display of the AF spectrum.

The span is limited to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED 'XTIM:FM:AR&S FSP 'Set "FM AF spectrum" display
 or
 "CALC:FEED 'XTIM:RFP:AR&S FSP 'Switch on "AF spectrum of the
 'RF power signal" display
 "ADEM:BAND 5 MHz" 'Set meas. bandwidth to 5 MHz
 "ADEM:AF:CENT 500kHz" 'Set AF center frequency to 500 kHz
 "ADEM:AF:SPAN 200kHz" 'Set AF span to 200 kHz

Characteristics: *RST value: 2.5 MHz
 SCPI: device-specific

[SENSe:]ADEMod:AF:SPAN:FULL

This command sets the maximum span for the display of the AF spectrum.

The maximum span corresponds to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED 'XTIM:FM:AR&S FSP 'Switch on "FM AF spectrum" display
 or
 "CALC:FEED 'XTIM:RFP:AR&S FSP 'Switch on "AF spectrum of the
 'RF power signal" display
 "ADEM:BAND 5 MHz" 'Set meas. bandwidth to 5 MHz
 "ADEM:AF:SPAN:FULL" 'Set AF span to 2.5 MHz

Characteristics: *RST value: -
 SCPI: device-specific

[SENSe:]ADEMod:AF:START <numeric_value>

This command sets the start frequency for the display of the AF spectrum.

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED 'XTIM:FM:AR&S FSP 'Switch on "FM AF spectrum" display
 or
 "CALC:FEED 'XTIM:RFP:AR&S FSP 'Switch on "AF spectrum of the
 'RF power signal" display
 "ADEM:BAND 5 MHz" 'Set meas. bandwidth to 5 MHz
 "ADEM:AF:STAR 0kHz" 'Set AF start frequency to 0 kHz
 "ADEM:AF:STOP 500kHz" 'Set AF stop frequency to 500 kHz

Characteristics: *RST value: 0 MHz
 SCPI: device-specific

[SENSe:]ADEMod:AF:STOP <numeric_value>

This command sets the stop frequency for the display of the AF spectrum. The stop frequency is limited to half the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example: "ADEM ON" 'Switch on FM demodulator
 "CALC:FEED 'XTIM:FM:AR&S FSP 'Switch on "FM AF spectrum" display
 or
 "CALC:FEED 'XTIM:RFP:AR&S FSP 'Switch on "AF spectrum of the
 'RF power signal" display
 "ADEM:BAND 5 MHz" 'Set meas. bandwidth to 5 MHz
 "ADEM:AF:STAR 0kHz" 'Set AF start frequency to 0 kHz
 "ADEM:AF:STOP 500kHz" 'Set AF stop frequency to 500 kHz

Characteristics: *RST value: 2.5 MHz
 SCPI: device-specific

[SENSe:]ADEMod:BANDwidth | BWIDth:DEModulation<numeric_value>

This command defines the demodulation 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 defined by the sampling rates.

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with R&S FSQ-B72 only
50 MHz/85 MHz ⁽¹⁾	128 MHz	with R&S FSQ-B72 only
30 MHz	64 MHz	with R&S FSQ only
18 MHz	32 MHz	with R&S FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	This restriction only applies to R&S FSP and R&S FSU without B72: This filter is only flat for about 6 MHz, it has a 3dB decay at 7 MHz.
5 MHz	8 MHz	
3 MHz	4 MHz	
1,6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of ≈3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

Example: "ADEM:BAND:DEM 1MHz" Set test bandwidth to 1 MHz.

Characteristics: *RST value: 5 MHz
 SCPI: device-specific

[SENSe:]ADEMod:MTIME <numeric_value>

This command sets the measuring time for the analog demodulation.

Example: "ADEM:MTIM 62.5us" 'Set measurement time to 62.5 μ s.

Characteristics: *RST value: 62.5us
SCPI: device-specific

[:SENSe1]:ADEMod:MTIME:AUTO ON|OFF

This command activates/deactivates the automatic measurement time of the multicarrier measurement.

Example: ":SENS1:ADEM ON" 'Switch on Ademod measurement.
":SENS1:ADEM:MCPH:STAT ON" 'Multicarrier measurement on.
":SENS1:ADEM: MTIM:AUTO OFF" ' Set measurement time to manual
setzen.

Characteristics: *RST value: OFF
SCPI: device-specific

[SENSe:]ADEMod:RLENgth?

This command returns the currently set record length for the analog demodulation.

Example: "ADEM:RLEN?" Return the current record length.

Characteristic: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:SET<sample rate>,<record length>,<trigger source>,<trigger slope>,<offset samples>,<# of meas>

This command configures the FM demodulator of the R&S FSP.

Parameter:

<sample rate>:	Frequency at which measured values are taken from the A/D converter and stored in I/Q memory. Value range: 122.0703125 Hz, 244.140625 Hz, 488.28125 Hz, 976.5625 Hz, 1.953125 kHz, 3.90625 kHz, 7.8125 kHz, 15.625 kHz, 31.25 kHz, 62.5 kHz, 125 kHz, 250 kHz, 500 kHz, 1 MHz, 2 MHz, 4 MHz, 8 MHz, 16 MHz, 32 MHz
<record length>:	Number of samples to be stored in I/Q memory. Value range: 1 to 130560 (128 * 1024 - 512)
<trigger source>:	Selection of the trigger source for the demodulator. Valid values: IMMEDIATE EXTERNAL IFFPower FM AM AMRelative PM
<trigger slope>:	Trigger slope selected. Valid values: POSITIVE NEGATIVE The value indicated here will be ignored for <trigger source> = IMMEDIATE.
<offset samples>:	Number of samples to be used as an offset to the trigger signal. Value range: -65024 to 130560 (= -64 * 1024 + 512 to 128 * 1024 - 512) The indicated value is ignored for <trigger source> = IMMEDIATE
<# of meas>:	Number of measurements. The value indicated here is particularly necessary for the AVERAGE/MAXHOLD/MINHOLD function. Value range: 0 to 32767

Example:

ADEMod:SET 8MHz,32000,EXT,POS,-500,30

will perform a measurement with the following settings:

sample rate	= 8 MHz
record length	= 32000
trigger source	= EXTERNAL
trigger slope	= POSITIVE
offset samples	= -500 (= 500 samples before trigger occurs)
# of meas	= 30

Characteristics:

*RST values: sample rate= 8 MHz
record length= 501
trigger source = IMMEDIATE
trigger slope = POSITIVE
offset samples = 0
of meas = 0

SCPI: device-specific

[SENSe:]ADEMod:SRATE?

This command returns the currently set sampling rate for the analog demodulation.

Example:

"ADEMod:SRATE?" Return the current sampling rate.

Characteristics:

*RST value: -
SCPI: device-specific

[SENSe:]ADEMod[:STATe] ON | OFF

This command switches on the FM demodulator of the instrument. The instrument will be set to time-domain measurement (span = 0) at the current center frequency.

Note: *The measurement is always performed in screen A. Split-screen operation will be switched off as soon as the demodulator is activated.*

Example: "ADEM ON" Switch on the FM demodulator

Characteristics: *RST value: OFF
SCPI: device-specific

[SENSe:]ADEMod:ZOOM:START 0 s to measurement time

This command selects the start time for displaying the individual measurement values of the FM demodulator. The maximum value depends on the measurement time set in the instrument; this value can be queried with ADEM:ZOOM:START? MAX.

If the zoom function has been switched on, 501 (R&S FSP) or 625 (R&S FSU and R&S FSQ) measurement points will be displayed starting at the time that has been set.

Example: "ADEM:ZOOM ON" Switch on zoom function
"ADEM:ZOOM:STAR 500us" Set display starting point to 500 μ s

Characteristics: *RST value: 0 s
SCPI: device-specific

[SENSe:]ADEMod:ZOOM[:STATe>] ON | OFF

This command switches the zoom function for the measurement data of the FM demodulator on or off. Depending on the selected measurement time and demodulation bandwidth, more measurement points are captured than can be shown on the display.

If the zoom function has been switched on, exactly 501 (R&S FSP) or 625 (R&S FSU and R&S FSQ) measurement points from the measured value memory will be shown starting at the time defined with [SENSe:]ADEM:ZOOM:START.

If the zoom function has been switched off, all measurement points will be compressed down to the number of points available on the display by means of data reduction.

Example: "ADEM:ZOOM ON" Switch on the zoom function.

Characteristics: *RST value: OFF
SCPI: device-specific

[SENSe:]ADEMod:AM Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :ADEMod :AM [:ABSolute] :AFSPectrum :RESult? [:TYPE] [:TDOMain] :RESult? [:TYPE] :RELative :AFSPectrum :RESult? [:TYPE] [:TDOMain] :RESult? [:TYPE]	 WRITE AVERage MAXHold MINHold WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF WRITE AVERage MAXHold MINHold WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF WRITE AVERage MAXHold MINHold WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF WRITE AVERage MAXHold MINHold WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF, WRITE AVERage MAXHold MINHold VIEW OFF		

[SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the RF signal in the time domain for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameters: <result type>: WRITE The current measured values are returned.
 AVERAge The measurement results averaged over the specified number of measurements are returned.
 MAXHold The maximum result over the specified number of measurements is returned.
 MINHold The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.*

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or V (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

where

#4 Number of digits in the following number of data bytes (= 4 in the example)

1024 Number of following data bytes (# of DataBytes = 1024 in the example)

<value x> 4-byte floating point value

Examples:

ADEM:SET 8MHz,32000,EXT,POS,-500,30	'Set demodulator
ADEM:FM AVER,MAXH,MINH	'Select FM results to be measured
ADEM:AM WRIT,OFF,OFF	'Select results of the RF signal to be measured in the time domain
	'measured in the time domain
ADEM:AM:AR&S FSP WRIT,OFF,OFF	'Select the AF spectrum results of the RF signal to be measured in the time domain
	'domain
ADEM ON	'Switch on demodulator
INIT;*WAI	'Start measurement and wait for end
FORM ASC	'Select output format
ADEM:FM:RES? AVER	'Read FM average value result data
ADEM:FM:RES? MAXH	'Read FM MAXHold result data
ADEM:FM:RES? MINH	'Read FM MINHold result data
ADEM:AM:RES? WRIT	'Read current AM result data
ADEM:AM:AFSP:RES? WRIT	'Read current AF spectrum result data of the RF signal in the time domain
	'domain

Characteristics: *RST value: -
 SCPI: device-specific

[SENSe:]ADEMod:AM[:ABSolute]:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the RF signal in the time domain to be measured simultaneously.

Parameters: <result type 1/2/3>:

WRITE	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Note:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the RF signal in the time domain will be calculated.

The result type AF spectrum of the RF signal in the time domain cannot be activated simultaneously with other AF spectra.

Examples:

ADEM:AM:AR&S FSP AVER,MAXH,MINH	Determine average, maximum and minimum simultaneously
ADEM:AM:AR&S FSP WRIT,OFF,OFF	Determine only the current measurement results
ADEM:AM:AR&S FSP OFF,OFF,OFF	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:AM:RELative:AFSPectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the AM-demodulated signal for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameter: <result type>: WRITe The current measured values are returned.
 AVERage The measurement results averaged over the specified number of measurements are returned.
 MAXHold The maximum result over the specified number of measurements is returned.
 MINHold The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE]. Otherwise, a query error will be generated.*

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or % (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

where

#4 Number of digits in the following number of data bytes (= 4 in the example)

1024 Number of following data bytes (# of DataBytes = 1024 in the example)

<value x> 4-byte floating point value

Examples:

ADEM:SET 8MHz,32000,EXT,POS,-500,30	'Set demodulator
ADEM:FM AVER,MAXH,MINH	'Select the FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF	'Select the AM results to be measured
ADEM:AM:REL:AR&S FSP WRIT,OFF,OFF	'Select the AF spectrum results of the demodulated AM signal to be measured
ADEM ON	'Switch on demodulator
INIT;*WAI	'Start measurement and wait for end
FORM ASC	'Select output format
ADEM:FM:RES? AVER	'Read FM average value result data
ADEM:FM:RES? MAXH	'Read FM MAXHold result data
ADEM:FM:RES? MINH	'Read FM MINHold result data
ADEM:AM:REL:RES? WRIT	'Read current AM result data
ADEM:AM:REL:AFSP:RES? WRIT	'Read current AF spectrum result data of the demodulated AM signal

Characteristics: *RST value: -
 SCPI: device-specific

[SENSe:]ADEMod:AM:RELative:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the AM-demodulated signal to be measured simultaneously.

Parameter:	<result type 1/2/3>:	
	WRITE	The current measured values are recorded.
	AVERage	The measurement results are averaged over the specified number of measurements.
	MAXHold	The maximum result over the specified number of measurements is determined.
	MINHold	The minimum result over the specified number of measurements is determined.
	VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
	OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time. Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously. If all result types are set to OFF, no AF spectrum of the AM-demodulated signal will be calculated. The result type AF spectrum of the AM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

ADEM:AM:REL:AR&S FSP	AVER,MAXH,MINH	Determine average, maximum and minimum value simultaneously
ADEM:AM:REL:AR&S FSP	WRIT,OFF,OFF	Determine only the current measured values
ADEM:AM:REL:AR&S FSP	OFF,OFF,OFF	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
 SCPI: device-specific

[SENSe:]ADEMod:AM:RELative[:TDOMain]:RESult?<result type>

This command reads out the result data of the AM demodulation for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

<result type>:

WRITE	The current measured values are returned.
AVERage	The measurement results averaged over the specified number of measurements are returned.
MAXHold	The maximum result over the specified number of measurements is returned.
MINHold	The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:AM:RELative[:TDOMain][:TYPE]. Otherwise, a query error will be generated.*

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is %.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

where

#4 Number of digits in the following number of data bytes (= 4 in the example)
 1024 Number of following data bytes (# of DataBytes = 1024 in the example)
 <value x> 4-byte floating point value

Examples:

```

ADEM:SET 8MHz,32000,EXT,POS,-500,30 'Set demodulator
ADEM:FM AVER,MAXH,MINH 'Select FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF 'Select AM results to be measured
ADEM ON ' Switch on demodulator
INIT;*WAI ' Start measurement and wait for end
FORM ASC ' Select output format
ADEM:FM:RES? AVER ' Read FM average result data
ADEM:FM:RES? MAXH ' Read FM MAXHold result data
ADEM:FM:RES? MINH ' Read FM MINHold result data
ADEM:AM:REL:RES? WRIT 'Read current AM result data

```

Characteristics: *RST value: -
 SCPI: device-specific

[

SENSe:JADEMod:AM:RELative[:TDOMain][:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the result types to be measured simultaneously in the case of AM demodulation.

Parameter:

<result type 1/2/3>:

WRITe	The current measured values are recorded.
AVERAge	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously

If all result types are set to OFF, the AM demodulator will be switched off.

Examples:

ADEM:AM:REL	AVER,MAXH,MINH	Determine average, maximum and minimum value simultaneously
ADEM:AM:REL	WRIT,OFF,OFF	Determine only the current measured values
ADEM:AM:REL	OFF,OFF,OFF	Switch off the AM demodulator

Characteristics: *RST values: WRITe,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:FM Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :ADEMod :FM :AFSPpectrum :RESult?	WRITe AVERAge MAXHold MINHold		
[:TYPE]	WRITe AVERAge MAXHold MINHold VIEW OFF, WRITe AVERAge MAXHold MINHold VIEW OFF, WRITe AVERAge MAXHold MINHold VIEW OFF		
:OFFSet?	IMMediate AVERAge		
[:TDOMain] :RESult?	WRITe AVERAge MAXHold MINHold		
[:TYPE]	WRITe AVERAge MAXHold MINHold VIEW OFF, WRITe AVERAge MAXHold MINHold VIEW OFF, WRITe AVERAge MAXHold MINHold VIEW OFF		

[SENSe:]ADEMod:FM:AFSPpectrum:RESult? <result type>

This command reads out the result data of the AF spectrum of the FM-demodulated signal for the specified result type. The format of the output data is defined using the FORMat command.

Note: *Traces cannot be queried when VIEW is active.*

Parameter: <result type>: WRITe The current measured values are returned.
 AVERAge The measurement results averaged over the specified number of measurements are returned.
 MAXHold The maximum result over the specified number of measurements is returned.
 MINHold The minimum result over the specified number of measurements is returned.

Note: *The specified result type must be one that was configured with the command [SENSe:]ADEMod:FM:AFSPpectrum[:TYPE]. Otherwise, a query error will be generated.*

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is dBm (logarithmic display) or V (linear display).

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#41024<value1><value2>...<value n>

where

#4 Number of digits in the following number of data bytes (= 4 in the example)

1024 Number of following data bytes (# of DataBytes = 1024 in the example)

<value x> 4-byte floating point value

Examples:

ADEM:SET 8MHz,32000,EXT,POS,-500,30	'Set demodulator
ADEM:FM AVER,MAXH,MINH	'Select FM results to be measured
ADEM:AM:REL WRIT,OFF,OFF	'Select AM results to be measured
ADEM:FM:AR&S FSP WRIT,OFF,OFF	'Select AF spectrum results of the demodulated FM signal to be measured
ADEM ON	'Switch on demodulator
INIT;*WAI	'Start measurement and wait for end
FORM ASC	'Select output format
ADEM:FM:RES? AVER	'Read FM average result data
ADEM:FM:RES? MAXH	'Read FM MAXHold result data
ADEM:FM:RES? MINH	'Read FM MINHold result data
ADEM:AM:RES? WRIT	'Read current AM result data
ADEM:FM:AFSP:RES? WRIT	'Read current AF spectrum result data of the demodulated FM signal

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:FM:AFSPpectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the FM-demodulated signal to be measured simultaneously.

Parameter: <result type 1/2/3>: WRITe	The current measured values are recorded.
AVERAge	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result over the specified number of measurements is determined.
MINHold	The minimum result over the specified number of measurements is determined.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the FM-demodulated signal will be calculated.

The result type AF spectrum of the FM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

ADEM:FM:AR&S FSP AVER,MAXH,MINH	Determine average, maximum and minimum value simultaneously
ADEM:FM:AR&S FSP WRIT,OFF,OFF	Determine only the current measured values
ADEM:FM:AR&S FSP OFF,OFF,OFF	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:FM:OFFSet?<result type>

This command calculates the FM offset of the current measured data set. If averaging has been activated prior to data acquisition (using the command [SENSe:]ADEMod:FM[:TYPE]), the average FM offset can also be obtained by setting <result type> = AVERAge. The average FM offset obtained in this way differs from the one calculated by CALC:MARK:FUNC:ADEM:FERR?, since, for determination of the frequency deviation, the modulation is removed by means of lowpass filtering, producing results that are different from those obtained by averaging.

Parameters:

<result type>:

IMMediate	The current measurement results are used for calculating the FM offset.
AVERAge	The measurement results averaged over the specified number of measurements are used for calculation of the FM offset.

Notes:

If no average measurement has been active during the last measurement sequence, only the command [SENSe:]ADEMod:FM:OFFSet? IMMEDIATE will return a valid result (data to calculate the FM 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      'Set demodulator to perform
                                           '30 measurements
ADEM:FM AVER,OFF,OFF                     'Set FM results to perform
                                           'averaging
ADEM:AM OFF,OFF,OFF                     'Switch off AM demodulation
ADEM ON                                   'Switch on FM demodulator
INIT;*WAI                                 'Start measurement and wait
                                           'for end
ADEM:FM:OFFS? IMM                       'Read FM offset of last
                                           'measurement of the sequence
                                           'of 30
ADEM:FM:OFFS? AVER                       'Read FM offset averaged
                                           'over 30 measurements

```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:FM[:TDOMain]:RESult?<result type>

This command reads the result data obtained by FM demodulation depending on the type indicated as a parameter. The data format of the output data is defined by the FORMat command.

Note: Traces cannot be queried when VIEW is active.

Parameter:

<result type>:

WRITe	The current trace data is recorded.
AVERAge	The measurement results averaged over the specified number of measurements are obtained.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.

Note: The specified result type must be one that was configured with the command [SENSe:]ADEMod:FM[:TYPE]. Otherwise, a query error will be generated.

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit is Hz.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

```
#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 (# of DataBytes = 1024 in the example)
<value x>  4-byte floating point value
```

Examples:

```
ADEM:SET 8MHz,32000,EXT,POS,-500,30  'Set demodulator 'parameters
ADEM:FM AVER,MAXH,MINH              'Select FM results to measure
ADEM:AM WRIT,OFF,OFF                'Select AM results to measure
ADEM ON                              'Switch on demodulator
INIT;*WAI                           'Start measurement and wait
                                     'for end
FORM ASC                             'Select output format
ADEM:FM:RES? AVER                   'Read FM average results
ADEM:FM:RES? MAXH                   'Read FM MAXHold results
ADEM:FM:RES? MINH                   'Read FM MINHold result data
ADEM:AM:RES? WRIT                   'Read current AM results
```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:FM[:TDOMain][:TYPE]<result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by FM demodulation.

Parameters:

```
<result type 1/2/3>:  WRITe      The current measured values are recorded.
                     AVERage    The measurement results are averaged over the
                               specified number of measurements.
                     MAXHold    The maximum result is determined over the
                               specified number of measurements.
                     MINHold    The minimum result is determined over the specified
                               number of measurements.
                     VIEW       The measurement result is frozen on the display, i.e.
                               it is not recalculated in further measurements.
                     OFF        The result type is not used.
```

Notes: *Settings different from OFF can be assigned to only one result type at a time.
Together with other signals, a maximum of six traces can be activated simultaneously.
For example, three FM and three PM result types can be activated simultaneously.
The FM demodulator is deactivated by setting all result types to OFF.*

Examples:

```
ADEM:FM AVER,MAXH,MINH Determine average, maximum and minimum value
                               simultaneously
ADEM:FM WRIT,OFF,OFF  Determine only the current measurement result
ADEM:FM OFF,OFF,OFF  Switch off the FM demodulator
```

Characteristics: *RST values: WRITe,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:MCPHase Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :ADEMod :MCPHase :METHod :POLar :RESult? :SPACing :STATe	ORTHogonal FLATtop <numeric_value> <Boolean>	HZ	Nur Abfrage

[:SENSe1]:ADEMod:MCPHase:METHod ORTHogonal|FLATtop

The command selects the method for the multicarrier measurement.

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on .
" :SENS1:ADEM:MCPH:METH ORTH1" ' Select method.
```

Characteristics: *RST value: ORTH
SCPI: device-specific

[:SENSe1]:ADEMod:MCPHase:POLar:RESult?

Multicarrier measurement: query of polar trace irrespective of selected diagram, Returns list with magnitude/phase pairs.

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on ..
" :SENS1:ADEM:MCPH:POL:RESult?" ' Trace query
```

Characteristics: *RST value: -
SCPI: device-specific

[:SENSe1]:ADEMod:MCPHase:SPACing <numeric_value>

The command enters the carrier spacing of the multicarrier measurement.

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on .
" :SENS1:ADEM:MCPH: SPAC 100KHZ" 'Enter spacing.
```

Characteristics: *RST value: -
SCPI: device-specific

[:SENSe1]:ADEMod:MCPHase:STATe ON|OFF

The command activates/deactivates the multicarrier phase measurement.

Example:

```
" :SENS1:ADEM ON"           ' Switch on Ademod measurement
" :SENS1:ADEM:MCPH:STAT ON"  ' Multicarrier measurement on
```

Characteristics: *RST value: OFF
SCPI: device-specific

Examples:

ADEM:SET 8MHz,32000,EXT,POS,-500,30	'Set demodulator
ADEM:PM AVER,MAXH,MINH	'Select PM results to be measured
ADEM:AM:REL WRIT,OFF,OFF	'Select AM results to be measured
ADEM:PM:AR&S FSP WRIT,OFF,OFF	'Select AF spectrum results of the demodulated PM signal to be measured
ADEM ON	'Switch on demodulator
INIT;*WAI	'Start measurement and wait for end
FORM ASC	'Select output format
ADEM:PM:RES? AVER	'Read PM average result data
ADEM:PM:RES? MAXH	'Read PM MAXHold result data
ADEM:PM:RES? MINH	'Read PM MINHold result data
ADEM:AM:RES? WRIT	'Read current AM result data
ADEM:PM:AFSP:RES? WRIT	'Read current AF spectrum result data of the demodulated PM signal

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:PM:AFSPectrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the AF spectrum result types of the PM-demodulated signal to be measured simultaneously.

Parameter:	<result type 1/2/3>:	
	WRITE	The current measured values are recorded.
	AVERage	The measurement results are averaged over the specified number of measurements.
	MAXHold	The maximum result over the specified number of measurements is determined.
	MINHold	The minimum result over the specified number of measurements is determined.
	VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
	OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three PM and three PM result types can be activated simultaneously.

If all result types are set to OFF, no AF spectrum of the PM-demodulated signal will be calculated.

The result type AF spectrum of the PM-demodulated signal cannot be activated simultaneously with other AF spectra.

Examples:

ADEM:PM:AR&S FSP AVER,MAXH,MINH	Determine average, maximum and minimum value simultaneously
ADEM:PM:AR&S FSP WRIT,OFF,OFF	Determine only the current measured values
ADEM:PM:AR&S FSP OFF,OFF,OFF	Switch off calculation of the AF spectrum

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:PM:RPOint[:X] 0s to measurement time

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.

Example: "ADEM:PM:RPO:X 500us" Set the position where the phase to 0 rad setting to 500 μ s.

Characteristics: *RST value 0 s
SCPI: conforming

[SENSe:]ADEMod:PM[:TDOMain]:RESult?<result type>

This command reads the result data obtained by PM demodulation depending on the type indicated as a parameter. The data format of the output data is defined by the FORMat command.

Note: Traces cannot be queried when VIEW is active.

Parameter: <result type>: WRITe The current trace data is recorded.
AVERage The measurement results averaged over the specified number of measurements are obtained.
MAXHold The maximum result is determined over the specified number of measurements.
MINHold The minimum result is determined over the specified number of measurements.

Note: The specified result type must be one that was configured with the command [SENSe:]ADEMod:PM[:TYPE]. Otherwise, a query error will be generated.

Return values:**ASCII format (FORMat ASCII):**

In this case, the command will return a list of comma-separated values (CSV) of the measured values in floating point format. The output unit depends on the unit selected - either RAD or DEG.

Binary format (FORMat REAL,32):

In this case, the command will return binary data (Definite Length Block Data according to IEEE 488.2), with each measured value formatted in 32-bit IEEE 754 floating point format. The response string will have the following structure:

#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 (# of DataBytes = 1024 in the example)

<value x> 4-byte floating point value

Examples:

```

ADEM:SET 8MHz,32000,EXT,POS,-500,30 'Set demodulator 'parameters
ADEM:PM AVER,MAXH,MINH 'Select PM results to measure
ADEM:AM WRIT,OFF,OFF 'Select AM results to measure
ADEM ON 'Switch on demodulator
INIT;*WAI 'Start measurement and wait
'for end
FORM ASC 'Select output format
ADEM:PM:RES? AVER 'Read PM average results
ADEM:PM:RES? MAXH 'Read PM MAXHold results
ADEM:PM:RES? MINH 'Read PM MINHold result data
ADEM:AM:RES? WRIT 'Read current AM results

```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:PM[:TDOMain] [:TYPE]<result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by PM demodulation.

Parameters: <result type 1/2/3>:

WRITE	The current measured values are recorded.
AVERage	The measurement results are averaged over the specified number of measurements.
MAXHold	The maximum result is determined over the specified number of measurements.
MINHold	The minimum result is determined over the specified number of measurements.
VIEW	The measurement result is frozen on the display, i.e. it is not recalculated in further measurements.
OFF	The result type is not used.

Notes:

Settings different from OFF can be assigned to only one result type at a time.

Together with other signals, a maximum of six traces can be activated simultaneously. For example, three PM and three PM result types can be activated simultaneously.

The PM demodulator is deactivated by setting all result types to OFF.

Examples:

ADEM:PM AVER,MAXH,MINH Determine average, maximum and minimum value simultaneously

ADEM:PM WRIT,OFF,OFF Determine only the current measurement result

ADEM:PM OFF,OFF,OFF Switch off the PM demodulator

Characteristics: *RST values: WRIT,OFF,OFF
SCPI: device-specific

[SENSe:]ADEMod:SPECTrum Subsystem

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :ADEMod :SPECTrum :BANDwidth [:RESolution] :BWIDth [:RESolution] [:MAGNitude] :RESult? [:TYPE] :PHASe :RESult? :TYPE :RESult? :SPAN [:MAXimum] :ZOOM [:TYPE]	<numeric_value> <numeric_value> WRITe AVERage MAXHold MINHold WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF WRITe AVERage MAXHold MINHold WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF WRITe AVERage MAXHold MINHold WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF, WRITe AVERage MAXHold MINHold VIEW OFF	HZ HZ HZ HZ	Option FM-Demodulator

[SENSe:]ADEMod:SPECTrum:BANDwidth|BWIDth[:RESolution] 1 Hz to 10 MHz

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 and the sampling rate indirectly set via ADEM:SPEC:SPAN:MAX or ADEM:BAND. 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.

Example: "ADEM ON" ' Switches on the FM demodulator
"CALC:FEED XTIM:SPEC' ' Switches on the result display RF spectrum
or "CALC:FEED XTIM:FM:AFSP' ' Switches on the result display AF
'spectrum of FM
or "CALC:FEED XTIM:RFP:AFSP' 'Switches on the result display AF spectrum
'of RF power signal
"ADEM:BAND:RES 61.2kHz" 'Sets the resolution bandwidth to 61.2 kHz.

Characteristics: *RST value: 61.2 kHz
SCPI: device-specific

[[:SENSe1]:ADEMod:SPECTrum[:MAGNitude]:RESult? WRITe | AVERAge| MAXHold | MINHold

This command queries the magnitude trace irrespective of the diagram in the multicarrier measurement.

Example:

```

":SENS1:ADEM ON"           ' Switch on Ademod measurement.
":SENS1:ADEM:MCPH:STAT ON" ' Multicarrier measurement on.
":CALC1:FEED 'XFR:SPEC'"  ' Magnitude diagram.
":SENS1:ADEM:SPEC:TYPE WRIT, OFF, OFF"
                             ' Trace mode
":SENS1:ADEM:SPEC: RESult? WRIT" ' Trace query

```

Characteristics: *RST value: -
SCPI: device-specific

[[:SENSe1]:ADEMod:SPECTrum[:MAGNitude]:TYPE

WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF,
WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF,
WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF

This command sets the trace mode for magnitude in the multicarrier measurement.

Example:

```

":SENS1:ADEM ON"           ' Switch on Ademod measurement
":SENS1:ADEM:MCPH:STAT ON" ' Multicarrier measurement on.
":CALC1:FEED 'XFR:SPEC'"  ' Magnitude diagram.
":SENS1:ADEM:SPEC:TYPE WRIT, OFF, OFF"
                             ' Trace mode

```

Characteristics: *RST value: -
SCPI: device-specific

[[:SENSe1]:ADEMod:SPECTrum:PHASe:RESult? WRITe | AVERAge| MAXHold | MINHold

This command queries the phase trace irrespective of the diagram in the multicarrier measurement.

Example:

```

":SENS1:ADEM ON"           ' Switch on Ademod
measurement                ' measurement
":SENS1:ADEM:MCPH:STAT ON" ' Multicarrier measurement on.
":CALC1:FEED 'XFR:PHAS'"  ' Phase diagram.
":SENS1:ADEM:SPEC:PHAS:TYPE WRIT, OFF, OFF"
                             ' Trace mode
":SENS1:ADEM:SPEC:PHAS: RES? WRIT" ' Trace query

```

Characteristics: *RST value: -
SCPI: device-specific

[[:SENSe1]:ADEMod:SPECTrum:PHASe:TYPE

WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF,
WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF,
WRITe | AVERAge | MAXHold | MINHold | VIEW | OFF

This command sets the trace mode for phase in the multicarrier measurement.

Example:

```

":SENS1:ADEMod ON"         ' Switch on Ademod measurement.
":SENS1:ADEM:MCPH:STAT ON" ' Multicarrier measurement on.
":CALC1:FEED 'XFR:PHAS'"  ' Phase diagram.
":SENS1:ADEM:SPECTrum:PHASe:TYPE WRIT, OFF, OFF"
                             ' Trace mode

```

Characteristics: *RST value: -
SCPI: device-specific

[SENSe:]ADEMod:SPECTrum:RESult? <result type>

This command reads the result data obtained by RF SPECTrum measurement depending on the type indicated as a parameter. The data format of the output data block is defined by the FORMat command.

Note: *It is not possible to read out trace data when result type VIEW is selected.*

Parameters: <result type>:

WRITe	The current measurement results will be obtained
AVERAge	The measurement results will be averaged over the given # of measurements
MAXHold	The maximum result values will be obtained over the given # of measurements
MINHold	The minimum result values will be obtained over the given # of measurements

Notes: *The result type indicated must be one of those configured by [SENSe:]ADEMod:SPEC[:TYPE]. Otherwise a query error will be generated.*

Return Values:**ASCII Format (FORMat ASCII):**

In this case the command will yield a list of comma separated values (CSV) of the measured values in floating point format. The output unit is dBm.

Binary Format (FORMat REAL,32):

In this case the command will yield 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 x> 4-Byte-Floating Point Value

Examples:

ADEM:SET 8MHz, 32000, EXT, POS, -500, 30	'Sets up demodulator parameters
ADEM:SPEC AVER, MAXH, MINH	'Sets up RF spectrum results 'to measure
ADEM:SPEC WRIT, OFF, OFF	'Sets up AM results to measure
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 values: -
SCPI: device-specific

[SENSe:]ADEMod:SPECTrum:SPAN[:MAXimum] <numeric_value>

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 (SENS:ADEM:BAND).

Demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with R&S FSQ-B72 only
50 MHz/85 MHz ⁽¹⁾	128 MHz	with R&S FSQ-B72 only
30 MHz	64 MHz	with R&S FSQ only
18 MHz	32 MHz	with R&S FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	This restriction only applies to R&S FSP and R&S FSU without B72: This filter is only flat for approx. 6 MHz; it has a 3 dB decay at 7 MHz.
5 MHz	8 MHz	
3 MHz	4 MHz	
1,6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of =3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz.

Example:

"ADEM ON"	'Switches on the FM demodulator
"CALC:FEED 'XTIM:SPEC'"	'Switches on result display RF spectrum
"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

[SENSe:]ADEMod:SPECTrum:SPAN:ZOOM <numeric_value>

This command sets the frequency range for result display of RF spectrum determined from FM demodulation data. The frequency range for result display is limited to the maximum span (SENS:ADEM:SPEC:SPAN:MAX) or to the measurement bandwidth of analog demodulation (SENS:ADEM:BAND).

Example:

"ADEM ON"	'Switches on the FM demodulator
"CALC:FEED XTIM:SPEC"	'Switches on result display RF spectrum"
"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

[SENSe:]ADEMod:SPECTrum[:TYPE] <result type 1>,<result type 2>,<result type 3>

This command selects the result types to be created in parallel by the RF SPECTrum measurement with active analog demodulation.

Parameters: <result type 1/2/3>.: WRITe The current measurement results will be obtained

AVERAge The measurement results will be averaged over the given # of measurements

MAXHold The maximum result values will be obtained over the given # of measurements

MINHold The minimum result values will be obtained over the given # of measurements

VIEW The measurement results are frozen and displayed, i.e. they are not calculated for subsequent measurements.

OFF The result type will not be used.

Notes:

*Each value besides OFF can only be assigned to one result type at a time.
Together with other signals, a maximum of six traces can be activated simultaneously. For example, three FM and three PM result types can be activated simultaneously.
If all result types are set to OFF, switch off calculation of the AF spectrum*

Examples: 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 FM demodulation off

Characteristics: *RST values: OFF,OFF,OFF
SCPI: device-specific

SENSe:BANDwidth Subsystem

This subsystem controls the setting of the analyzer's filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :BANDwidth :DEMod [:RESolution] :AUTO :BWIDth :DEMod [:RESolution] :AUTO	<numeric_value> <numeric_value> <Boolean> <numeric_value> <numeric_value> <Boolean>	HZ HZ -- HZ HZ --	

[SENSe<1|2>:]BANDwidth|BWIDth:DEMod <numeric_value>

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.

Rounded off demodulation bandwidth	Sampling rate	Comment
120 MHz	256 MHz	with R&S FSQ-B72 only
50/85 MHz ⁽¹⁾	128 MHz	with R&S FSQ-B72 only
30 MHz	64 MHz	with R&S FSQ only
18 MHz	32 MHz	with R&S FSQ only
10 MHz	32 MHz	
8 MHz	16 MHz	This restriction only applies to R&S FSP and R&S FSU without B72: This filter is only flat for approx. 6 MHz; it has a 3 dB decay at 7 MHz.
5 MHz	8 MHz	
3 MHz	4 MHz	
1.6 MHz	2 MHz	
800 kHz	1 MHz	
400 kHz	500 kHz	
200 kHz	250 kHz	
100 kHz	125 kHz	
50 kHz	62.5 kHz	
25 kHz	31.25 kHz	
12.5 kHz	15.625 kHz	
6.4 kHz	7.8125 kHz	
3.2 kHz	3.90625 kHz	
1.6 kHz	1.953125 kHz	
800 Hz	976.5625 Hz	
400 Hz	488.28125 Hz	
200 Hz	244.140625 Hz	
100 Hz	122.0703125 Hz	

(1) The demodulation bandwidth at a sampling rate of 128 MHz depends on the center frequency that has been set. At a center frequency of =3.6 GHz, the demodulation bandwidth is 50 MHz; at higher center frequencies, it is 85 MHz

Example: "ADEM: BAND: DEM 1MHz" Set test bandwidth to 1 MHz

Characteristics: *RST value: 5 MHz
SCPI: device-specific

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] <numeric_value>

This command sets the IF bandwidth of the demodulator.

Analog resolution filters are available that are implemented as LC filters with four circuits (R&S FSP) or 5 circuits (R&S FSU/R&S FSQ).

Instrument	IF bandwidth	Steps
R&S FSP	300 kHz to 10 MHz	1,3,10
R&S FSU	200 kHz to 10 MHz	1,2,3,5,10
R&S FSQ	200 kHz to 50 MHz	1,2,3,5,10

If the resolution bandwidth is modified, coupling to the demodulation bandwidth is automatically switched off.

Example: "BAND 1MHz" Set IF bandwidth to 1 MHz

Characteristics: *RST value: - (AUTO is set to ON)
SCPI: conforming

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF

This command automatically couples the IF bandwidth to the demodulation bandwidth ($BW_{RBW} = 10 * BW_{Demod}$).

Example: "BAND:AUTO OFF" Switch off coupling of the IF bandwidth to the demodulation bandwidth

Characteristics: *RST value: ON
SCPI: conforming

SENSe:FILTer Subsystem

This subsystem controls the setting of the high pass and low pass filters and the deemphasis .

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] FILTer			
:CCIR [:STATe]	<Boolean>	--	
:CCITt [:STATe]	<Boolean>	--	
:CMESsage [:STATe]	<Boolean>	--	
:DEMPHasis [:STATe]	<Boolean>	--	
:TCONstant	<numeric_value>	s	
:LPASs			
:FREQuency [:ABSolute]	<numeric_value>	HZ	
:RELative [:STATe]	<Boolean>	--	
:HPASs			
:FREQuency [:STATe]	<numeric_value> <Boolean>	HZ --	

[SENSe:]FILTer:CCIR[:STATe] ON | OFF

This command activates den Bewertungsfilter CCIR.

The weighting filter is active in the following demodulation bandwidth range:
 $50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 1.6 \text{ MHz}$

The CCIR unweighted filter is the combination of the 20 Hz highpass and 23 kHz lowpass filter.

Beispiel: "SENS:FILT:CCIR:STAT ON"

Eigenschaften: *RST-Wert: NONE
 SCPI: gerätespezifisch

[SENSe:]FILTer:CCITt[:STATe] ON | OFF

This command activates den Bewertungsfilter CCITT (CCITT P.53).

The weighting filter is active in the following demodulation bandwidth range:
 $25 \text{ kHz} \leq \text{demodulation bandwidth} \leq 3 \text{ MHz}$

Beispiel: "SENS:FILT:CCIT:STAT ON"

Eigenschaften: *RST-Wert: NONE
 SCPI: gerätespezifisch

[SENSe<1|2>:]FILTer:DEMPHasis[:STATe] ON | OFF

This command activates the selected deemphasis.

Example: "FILT:DEMP ON"

Characteristics: *RST value: -
 SCPI: device-specific

[SENSe<1|2>:]FILTer:DEMPHasis:TCONstant 25 us | 50 us | 75 us | 750 us

This command selects the de-emphasis with the given time constant

The R&S FSP requires the option R&S FSP-B70 for the de-emphasis.

The de-emphasis is active in the following demodulation bandwidth range:

25 μ s	25 kHz \leq demodulation bandwidth \leq 30 MHz
50 μ s	6.4 kHz \leq demodulation bandwidth \leq 18 MHz
75 μ s	6.4 kHz \leq demodulation bandwidth \leq 18 MHz
750 μ s	800 Hz \leq demodulation bandwidth \leq 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 μ s	50 μ s	75 μ s	750 μ s
Maximum AF Frequency	25 kHz	12 kHz	8 kHz	800 Hz
Required demodulation bandwidth	\geq 200 kHz	\geq 100 kHz	\geq 50 kHz	\geq 6.4 kHz

For higher AF frequencies the demodulation bandwidth must be increased.

Example: "FILTer:DEMPH:TCON 75us"

Characteristics: *RST value: -
SCPI: device-specific

[SENSe<1|2>:]FILTer:HPASs:FREQuency 20 Hz | 50 Hz | 300 Hz

This command selects the high pass filter. The filters are indicated by the 3 dB cutoff frequency. The filters are designed as 2nd-order Butterworth filter (12 dB/octave).

The R&S FSP requires the option R&S FSP-B70 for the high pass filter.

The high pass filter are active in the following demodulation bandwidth range:

20 Hz	100 Hz \leq demodulation bandwidth \leq 1.6 MHz
50 Hz	200 Hz \leq demodulation bandwidth \leq 4 MHz
300 Hz	800 Hz \leq demodulation bandwidth \leq 16 MHz

Example: "FILTer:HPAS:FREQ 300"

Characteristics: *RST value: -
SCPI: device-specific

[SENSe<1|2>:]FILTer:HPASs[:STATe] ON | OFF

This command activates the selected high pass filter.

Example: "FILTer:HPAS ON"

Characteristics: *RST value: -
SCPI: device-specific

[SENSe<1|2>:]FILTer:LPASs:FREQuency[:ABSolute] 3kHz | 15 kHz | 23 kHz | 150 kHz

This command selects the 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 R&S FSP requires the option R&S FSP-B70 for the absolute low pass filter. The relative low pass filters are active for all demodulation bandwidth's.

The high pass filter are active in the following demodulation bandwidth range:

3 kHz	$6.4 \text{ kHz} \leq \text{demodulation bandwidth} \leq 4 \text{ MHz}$
15 kHz	$50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 16 \text{ MHz}$
23 kHz	$50 \text{ kHz} \leq \text{demodulation bandwidth} \leq 16 \text{ MHz}$
150 kHz	$400 \text{ kHz} \leq \text{demodulation bandwidth} \leq 16 \text{ MHz}$

Example: "FILT:LPAS:FREQ 3kHz"

Characteristics: *RST value: -
SCPI: device-specific

[SENSe<1|2>:]FILTer:LPASs:FREQuency:RELative 5 | 10 | 25 PCT

This command selects the relative low pass filter. The filter (3 dB) can be selected in % of the demodulation bandwidth. The filters are designed as 5th-order Butterworth filter (30 dB/octave).

The relative low pass filters are active for all demodulation bandwidth's. They are always available.

Example: "FILT:LPAS:REL 10PCT"

Characteristics: *RST value: -
SCPI: device-specific

[SENSe<1|2>:]FILTer:LPASs[:STATe] ON | OFF

This command activates the selected low pass filter.

Example: "FILT:LPAS ON"

Characteristics: *RST value: -
SCPI: device-specific

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. The measurement windows are selected by SENSe1 (screen A) and SENSe2 (screen B).

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1 2>] :FREQuency :CW: :AFC	<numeric_value> ONCE		

[SENSe<1|2>:]FREQuency:CW:AFC ONCE

This command executes an automatic signal search.

Example: "FREQ:CW:AFC ONCE"

Characteristics: *RST value: -
SCPI: conforming

This command is an event and therefore has no *RST value and no query.

TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETERS	UNIT	COMMENT
TRACe<1 2> [:DATA]	TRACE1 TRACE2 TRACE3 TRACE4, <block> <numeric_value>...	-	

TRACe<1|2>[:DATA] TRACE1| TRACE2| TRACE3, <block> | <numeric_value>

This command transfers trace data from the control computer to the instrument, the query reads trace data out of the instrument.

Note:

With active FM Demodulator (option R&S FS-K7), only the trace data that are displayed are read out and reloaded. Part of the measured data that can be queried with the marker, however, is derived from the raw data. These measurement results are no longer available after reloading a trace, the query commands cause a query error.

Example: "TRAC TRACE1,"+A\$ (A\$: Data list in current format)
 "TRAC2? TRACE1"

Return values:

Scaling of the data is in the currently set level unit.

ASCII format (FORMat ASCII):

In this case, the command will return a list of comma separated values (CSV) of the measured values.

The number of test points is 501 (R&S FSP) or 625 (R&S FSU/R&S FSQ).

Binary format (FORMat REAL,32):

In this case, the command returns binary data (Definite Length Block Data according to IEEE 488.2), with the measured values arranged in subsequent lists of I and Q data in 32-bit IEEE 754 floating point format. The response string will have the following structure:

R&S FSP: #42004<meas value 1><meas value value2>...<meas value 501>

R&S FSU/R&S FSQ: #42500<meas value 1><meas value value2>...<meas value 625>

with

#4 Number of digits in the following number of data bytes (= 4 in the example)

2004/2005 Number of the following data bytes (# of DataBytes, = 2004/2005 in the example)

<meas value x> 4-byte floating point value

Characteristics: *RST value: -
 SCPI: conforming

The trace data is transferred in the current format (corresponding to the command FORMat ASCiI|REAL). The device-internal trace memory is addressed using the trace names 'TRACE1' to 'TRACE3'.

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. In ASCII format, this data consists of values separated by commas. If the transfer takes place using the REAL format (REAL,32), the data is transferred in block format.

The parameter of the query is the trace name TRACE1 to TRACE3, it indicates which trace memory will be read out.

Saving and recalling trace data together with the device settings to/from the device-internal hard disk or to/from a floppy is controlled via the commands "MMEMory:STORe:STATe" and "MMEMory:LOAD:STATe", respectively. Trace data is selected with "MMEMory:SElect[:ITEM]:ALL" or "MMEMory:SElect[:ITEM]:TRACe". Trace data in ASCII format (ASCII FILE EXPORT) is exported with the command "MMEM:STORe:TRACe".

The transfer format for the trace data depends on the instrument setting:
501 (R&S FSP) or 625 (R&S FSU and R&S FSQ) results are output in the unit selected for display.

Note: *With AUTO PEAK detector, only positive peak values can be read out.*

FORMAT REAL,32 is to be used as format for binary transmission.

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. An external trigger signal can be applied to the connector at the rear panel of the instrument.

COMMAND	PARAMETERS	UNIT	COMMENT
TRIGger<1 2> [:SEquence] :HOLDoff :LEVel :AM [:ABSolute] :RELative :FM :IFPower :PM :RFPower :VIDeo :SLOPe :SOURce	<numeric_value> <numeric_value> <numeric_value> <numeric_value> <numeric_value> <numeric_value> POSitive NEGative IMMediate EXTernal VIDeo IFPower RFPower TV AF AM AMRelative FM	S DBM PCT HZ DBM RAD DBM PCT	Option R&S FSP-B6 TV- und RF-Trigger TV, RFPOWer nur mit Option R&S FSP-B6

TRIGger<1|2>[:SEquence]:HOLDoff -100...+100s

This command defines the length of the trigger delay.

Example: "TRIG:HOLD 500us"

Characteristics: *RST value: 0s
SCPI: conforming

TRIGger<1|2>[:SEquence]:LEVel:AM[:ABSolute] -100...+30dBm

This command sets the level when AM modulated signals are used as trigger source.

Note: For triggering with the AF, AM and FM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Example: "TRIG:LEV:AM -30 dBm" Set the AM trigger threshold to -30 dBm

Characteristics: *RST value: -20 dBm
SCPI: device-specific

TRIGger<1|2>[:SEquence]:LEVel:AM:Relative -100...+30dBm

This command sets the den modulation depth when AM modulated signals are used as trigger source.

Note: For triggering with the AF, AM and FM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.

Example: "TRIG:LEV:AM:REL -10 PCT" stellt die AM-Triggerschwelle auf - 10 PCT

Characteristics: *RST value: 0 PCT
SCPI: device-specific

TRIGger<1|2>[:SEQUence]:LEVel:FM -10...+10MHz

This command sets the level when FM modulated signals are used as trigger source.

Example: "TRIG:LEV:AM 10 kHz" Set the FM trigger threshold to 10 kHz

Characteristics: *RST value: 0 Hz
SCPI: device-specific

TRIGger<1|2>[:SEQUence]:LEVel:IFPower -30...-10DBM

This command sets the level for the IF power trigger source.

Example: "TRIG:LEV:IFP -20DBM"

Characteristics: *RST value: -20 DBM
SCPI: device-specific

TRIGger<1|2>[:SEQUence]:LEVel:PM -1000...+1000RAD

This command sets the phase when PM-modulated signals are used as a trigger source.

Note: For triggering with the AF, AM, AMR, PM and FM trigger sources to be successful, the measurement time must cover at least five periods of the audio signal

Example: "TRIG:LEV:PM 1.2 RAD" Set the PM trigger threshold to 1.2 rad

Characteristics: *RST value: 0 RAD
SCPI: device-specific

TRIGger<1|2>[:SEQUence]:LEVel:RFPower -50...-10DBM

This command sets the level for the RF power trigger source.

Example: "TRIG:LEV:RFP -20DBM"

Characteristics: *RST value: -20 DBM
SCPI: device-specific

This command is only available in conjunction with option TV and RF-Trigger R&S FSP-B6.

TRIGger<1|2>[:SEQUence]:SLOPe POSitive|NEGative

This command selects the slope of the trigger signal. The selection of the trigger slope is valid for all trigger signal sources.

Example: "TRIG:SLOP NEG"

Characteristics: *RST value: POSitive
SCPI: conforming

TRIGger<1|2>[:SEQUence]:SOURce IMMEDIATE | EXTERNAL | VIDEO | IFPOWER | RFPower | TV | AF | AM | AMR | FM | PM

This command selects the trigger source for the start of a sweep

Notes: *The selection of RFPower and TV is only possible with option R&S FSP-B6 (TV and RF-Trigger).*

Parameters:

- IMMEDIATE = Automatic triggering of the next measurement at the end of the previous one. The parameter corresponds to the FREE RUN setting.
- EXTERNAL = The next measurement is triggered by the signal at the external trigger input
- VIDEO = The next measurement is triggered by the detection of a signal at the video filter output. VIDEO cannot be selected if the FM demodulator is active.
- IFPOWER = The next measurement is triggered by the detection of a signal at the instrument IF (10 MHz bandwidth).
- RFPower = The next measurement is triggered by the detection of a signal at the instrument RF (80 MHz bandwidth). (only R&S FSP/ESCI/ESPI)
- TV = The next measurement is triggered by the detection of a TV signal according to the settings of the TRIGger:SEQUence:VIDEO-subsystem. TV cannot be selected if the FM demodulator is active.
- FM = The next measurement is triggered on detection of an FM modulated signal (equivalent to 'FM')
- AMR = The next measurement is triggered on detection of an audio signal after AM demodulation
- AM = The next measurement is triggered on detection of an RF signal in the time domain.
- PM = The next measurement is triggered on detection of an audio signal after PM demodulation

Note: *For triggering with the AF, AM and FM trigger sources to be successful, the measurement time must cover at least 5 periods of the audio signal.*

Example: "TRIG:SOUR EXT" Select the external trigger input as source for the trigger signal

Characteristics: *RST value: IMMEDIATE
SCPI: conforming

UNIT Subsystem

The UNIT subsystem defines the units of the parameters to be set and measurement results.

COMMAND	PARAMETERS	UNIT	COMMENT
UNIT :ANGLE :THD	DEG RAD PCT DB		

UNIT:ANGLE DEG | RAD

This command selects the unit for angles.

Example: "UNIT:ANGL DEG"

Characteristics: *RST value: RAD
SCPI: conforming

UNIT:THD DB | PCT

Selects the unit for THD measurements

Example: "UNIT:THD PCT"

Characteristics: *RST value: DBM
SCPI: device-specific

Table of Softkeys and Hotkeys including Assignment of Remote-Control Commands

This chapter contains the assignment of the remote-control commands to those softkey menus that differ from the base unit with regard to the FM demodulator option. The operating manual of the base unit covers the assignment of the unchanged menus.

FM Demodulator Main Menu

FM DEMOD	
FM DEMOD ON OFF	INSTRument:SElect ADEMod INSTRument:NSElect 3
AF FILTER	---
HIGH PASS AF FILTER	---
NONE	[SENSe:]FILTer:HPASs OFF
20 Hz	[SENSe:]FILTer:HPASs ON [SENSe:]FILTer:HPASs:FREQ 20
50 Hz	[SENSe:]FILTer:HPASs ON [SENSe:]FILTer:HPASs:FREQuency 50
300 Hz	[SENSe:]FILTer:HPASs ON [SENSe:]FILTer:HPASs:FREQuency 300
LOW PASS AF FILTER	---
NONE	[SENSe:]FILTer:LPASs OFF
5% DEMODO BW	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency:RELative 5PCT
10% DEMODO BW	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency:RELative 10PCT
25% DEMODO BW	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency:RELative 25PCT
3 kHz	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency 3kHz
15 kHz	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency 15kHz
23 kHz	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency 23kHz

150 kHz	[SENSe:]FILTer:LPASs ON [SENSe:]FILTer:LPASs:FREQuency 150kHz
DEEMPHASIS	---
NONE	[SENSe:]FILTer:DEMPhasis OFF
25 us	[SENSe:]FILTer:DEMPhasis ON [SENSe:]FILTer:DEMPhasis:TCON 25us
50 us	[SENSe:]FILTer:DEMPhasis ON [SENSe:]FILTer:DEMPhasis:TCON 50us
75 us	[SENSe:]FILTer:DEMPhasis ON [SENSe:]FILTer:DEMPhasis:TCON 75us
750 us	[SENSe:]FILTer:DEMPhasis ON [SENSe:]FILTer:DEMPhasis:TCONstant 750us
WEIGING FILTER	---
CCITT	[SENSe:]FILTer:CCITt:STAT ON OFF [SENSe:]FILTer:CCIR:STAT ON OFF
CCIR	[SENSe:]FILTer:DEMPhasis ON [SENSe:]FILTer:DEMPhasis:TCONstant 25us
RESULT DISPLAY	---
FM	CALCulate<1 2>:FEED 'XTIME:FM[:TDOMain]'
PM	CALCulate<1 2>:FEED 'XTIME:PM[:TDOMain]'
AM	CALCulate<1 2>:FEED 'XTIME:AM:RELative'
RF POWER	CALCulate<1 2>:FEED 'XTIME:RFPower'
RF SPECTRUM	CALCulate<1 2>:FEED 'XTIME:SPECTRUM'
AF SPECTRUM	CALCulate<1 2>:FEED 'XTIME:FM:AFSPectrum' CALCulate<1 2>:FEED 'XTIME:PM:AFSPectrum' CALCulate<1 2>:FEED 'XTIME:AMSummary:RELative:AFSPectrum' CALCulate<1 2>:FEED 'XTIME:RFPower:AFSectrum<1...3>'
SELECT TRACE	---

DIAGRAM FULL SIZE	DISPlay[:WINDow<1 2>]:SIZE LARGE SMALL
RANGE	---
DEVIATION PER DIV	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:PDIvision <numeric_value>
REFERENCE POSITION	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:RPOsition <numeric_value>
REFERENCE VALUE	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:RVALue <numeric_value>
AF COUP AC DC	[SENSe:]ADEMode:AF:COUPling AC DC
ZERO PHASE REF POS	[SENSe:]ADEMode:PM:RPOint:X <numeric_value>
DEVIATION LIN LOG	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LINear LOGarithmi c
DB PER DIV	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:PDIvision <numeric_value>
PHASE WRAP ON OFF	CALCulate<1 2>:FORMat PHASe
UNIT	---
PM UNIT RAD DEG	UNIT:ANGLe RAD DEG
THD UNIT % DB	UNIT:THD PCT DB
MAX DISP RF POWER	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:RVALue <numeric_value>
RANGE LINEAR	
RANGE LINEAR %	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LINear
RANGE LINEAR DB	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LDB
RANGE LOG MANUAL	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LOG DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SCALE <num_value>
RF POWER PER DIV	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:PDIvision <numeric_value>
DEMOD BW	[SENSe:]BANDwidth:DEM 10MHz
MEAS TIME	[SENSe:]ADEMod:MTIME 62.5US [SENSe:]SWEep:TIME 62.5US
ZOOM	[SENSe:]ADEMod:ZOOM ON [SENSe:]ADEMod:ZOOM:STARt 30US

FREQ Key

CENTER	[SENSe:] FREQuency:CENTer <num_value>
CF- SREPSIZE	
0.1 * SPAN	[SENSe:] FREQuency:CENTer:STEP:LINK SPAN; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor 10PCT
0.5 * SPAN	[SENSe:] FREQuency:CENTer:STEP:LINK SPAN; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor 50PCT
X * SPAN	[SENSe:] FREQuency:CENTer:STEP:LINK SPAN; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor <num_value>
0.1 * RBW	[SENSe:] FREQuency:CENTer:STEP:LINK RBW; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor 10PCT
0.5 * RBW	[SENSe:] FREQuency:CENTer:STEP:LINK RBW; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor 50PCT
X * RBW	[SENSe:] FREQuency:CENTer:STEP:LINK RBW; [SENSe:] FREQuency:CENTer:STEP:LINK:FACTor <num_value>
= CENTER	without function in IEC/IEEE-bus mode
MANUAL	[SENSe:] FREQuency:CENTer:STEP <num_value>
SINGLE AUTOTUNE	[SENSe:] FREQuency:CW:AFC ONCe
AF CENTER	[SENSe:] ADEMod:AF:CENTer <num_value>
AF START	[SENSe:] ADEMod:AF:START <num_value>
AF STOP	[SENSe:] ADEMod:AF:STOP <num_value>

SPAN Key

AF SPAN	[SENSe:] ADEMod:AF:SPAN <num_value>
FREQUENCY SPAN	[SENSe:] ADEMod:SPECTrum:SPAN:ZOOM
AF FULL SPAN	[SENSe:] ADEMod:AF:SPAN FULL

FULL SPAN	[SENSe:]ADEMod:SPECTrum:SPAN:ZOOM MAX
DEMOD BW	[SENSe:]BAND:DEM 10MHz
MEAS TIME	[SENSe:]ADEM:MTIM 62.5US [SENSe:]SWE:TIME 62.5US

AMPT Key

REF LEVEL	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y[:SCALe]:RLEVel <num_value>
RANGE LINEAR	
RANGE LINEAR %	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LINear
RANGE LINEAR DB	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LDB
RANGE LOG 100 dB	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LOGarithmic; DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y[:SCALe] 100 dB
RANGE LOG MANUAL	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y:SPACing LOGarithmic; DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y[:SCALe] <num_value>
RF ATTEN MANUAL	INPut:ATTenuation <num_value>
RF ATTEN AUTO	INPut:ATTenuation:AUTO ON
REF LEVEL POSITION	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y[:SCALe]:RPOsition <num_value>
REF LEVEL OFFSET	DISPlay[:WINDow<1 2>]:TRACe<1...3>:Y[:SCALe]:RLEVel:OFFSet <num_value>
EL ATTEN AUTO	INPut:EATT:AUTO ON (only with option R&S FSP-B25)
EL ATTEN MANUAL	INPut:EATT <num_value> (only with option R&S FSP-B25)
EL ATTEN OFF	INPut:EATT:STATe OFF (only with option R&S FSP-B25)
RF INPUT 50Ω 75Ω	INPut:IMPedance 50 75

BW Key

RES BW	[SENSe:]ADEM:SPEC:BAND:RES 10 kHz
IF BW AUTO	[SENSe:]BAND:RES:AUTO ON
IF BW MANUAL	[SENSe:]BAND:RES 1 MHz

DEM BW	[SENSe:]BAND:DEM 10MHz
MEAS TIME	[SENSe:]ADEMod:MTIME 62.5US [SENSe:]SWEep:TIME 62.5US

TRIG Key

FREE RUN	TRIGger:SOURce IMMEDIATE
DEM SIGNAL	---
FM SIGNAL	TRIGger:SOURce FM .. TRIGger:LEVel:FM <numeric_value>
PM SIGNAL	TRIGger:SOURce PM . TRIGger:LEVel:PM <numeric_value>
AM SIGNAL	TRIGger:SOURce AMRelative TRIGger:LEV:AM:REL <numeric_value>
RF POWER SIGNAL	TRIGger:SOURce AM TRIGger:LEVel:AM:[:ABSolute] <numeric_value>
EXTERN	TRIGger:SOURce EXT.....ernal
IF POWER	TRIGger:SOURce IFPower
TRIGGER OFFSET	TRIGger:HOLDoff <numeric_value>
POLARITY POS NEG	TRIGger:SLOPe POS

MKR Key

MARKER 1..4	CALCulate<1 2>:MARKer<1...4>[:STATe] ON OFF; CALCulate<1 2>:MARKer<1...4>:X <numeric value>; CALCulate<1 2>:MARKer<1...4>:Y? CALCulate<1 2>:DELTamarker1[:STATe] ON OFF; CALCulate<1 2>:DELTamarker<1...4>:X <numeric value>; CALCulate<1 2>:DELTamarker<1...4>:Y?
MARKER NORM DELTA	CALCulate<1 2>:DELTamarker<1...4>[:STATe] ON OFF;
ALL MARKER OFF	CALCulate<1 2>:MARKer<1...4>:AOFF CALCulate<1 2>:DELTamarker<1...4>:AOFF

MKR ⇒ Key

SELECT MARKER	without function in IEC/IEEE-bus mode
PEAK	CALCulate<1 2>:MARKer<1...4>:MAXimum[:PEAK] CALCulate<1 2>:DELTamarker<1...4>:MAXimum[:PEAK]
REF LEVEL = MKR LVL	CALCulate<1 2>:MARKer<1...4>:FUNCTION:REFERENCE
NEXT PEAK	CALCulate<1 2>:MARKer<1...4>:MAXimum:NEXT CALCulate<1 2>:DELTamarker<1...4>:MAXimum:NEXT
NEXT PEAK RIGHT	CALCulate<1 2>:MARKer<1...4>:MAXimum:RIGHT CALCulate<1 2>:DELTamarker<1...4>:MAXimum:RIGHT
NEXT PEAK LEFT	CALCulate<1 2>:MARKer<1...4>:MAXimum:LEFT CALCulate<1 2>:DELTamarker<1...4>:MAXimum:LEFT
MKR-> TRACE	CALCulate<1 2>:MARKer<1...4>:TRACE <numeric value> CALCulate<1 2>:DELTamarker<1...4>:TRACE <numeric value>
MIN	CALCulate<1 2>:MARKer<1...4>:MINimum[:PEAK] CALCulate<1 2>:DELTamarker<1...4>:MINimum[:PEAK]
MIN NEXT	CALCulate<1 2>:MARKer<1...4>:MINimum:NEXT CALCulate<1 2>:DELTamarker<1...4>:MINimum:NEXT
NEXT MIN RIGHT	CALCulate<1 2>:MARKer<1...4>:MINimum:RIGHT CALCulate<1 2>:DELTamarker<1...4>:MINimum:RIGHT
PEAK EXCURSION	CALCulate<1 2>:MARKer<1...4>:PEXCursion <num_value>

MKR FCTN Key

SELECT MARKER	without function in IEC/IEEE-bus mode
PEAK	CALCulate<1 2>:MARKer<1...4>:MAXimum[:PEAK] CALCulate<1 2>:DELTamarker<1...4>:MAXimum[:PEAK]
MKR-> TRACE	CALCulate<1 2>:MARKer<1...4>:TRACE <numeric value> CALCulate<1 2>:DELTamarker<1...4>:TRACE <numeric value>

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