

R&S®FS-K8

Application Firmware for Bluetooth Measurements

Software Manual



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The Software Manual describes the following R&S®FS-K8 options:

- R&S®FS-K8

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R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

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The following abbreviations are used throughout this manual:

R&S®FS-K8 is abbreviated as R&S FS-K8.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Symbols and safety labels

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

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

Tags and their meaning

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

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

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

Operating states and operating positions

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

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

Electrical safety

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

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

Basic Safety Instructions

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

Operation

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

Repair and service

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

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

Waste disposal

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

Informaciones elementales de seguridad

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

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

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

Informaciones elementales de seguridad

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

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

Símbolos y definiciones de seguridad

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

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

Palabras de señal y su significado

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



PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.



ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.



ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.



AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

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

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

Funcionamiento

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

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

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Informaciones elementales de seguridad

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

Transporte

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

Eliminación

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

Qualitätszertifikat

Certificate of quality

Certificat de qualité

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO9001 und ISO14001 zertifiziert.

Der Umwelt verpflichtet

- ▮ Energie-effiziente, RoHS-konforme Produkte
- ▮ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ▮ ISO 14001-zertifiziertes Umweltmanagementsystem

Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO9001 and ISO14001.

Environmental commitment

- ▮ Energy-efficient products
- ▮ Continuous improvement in environmental sustainability
- ▮ ISO 14001-certified environmental management system

Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO9001 et ISO14001.

Engagement écologique

- ▮ Produits à efficience énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001

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Documentation Overview

The user documentation for the R&S FS-K8 is divided as follows:

R&S®FMU

R&S®FSG

R&S®FSMR

R&S®FSP

R&S®FSQ

R&S®FSU

R&S®FSUP

1 Introduction

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

1.1 Bluetooth Overview

1.1.1 Bluetooth Technical Parameters

Frequency Bands	USA / Europe 2402 + (0...78) MHz France 2454 + (0...22) MHz
Channel Spacing	1 MHz
Modulation	GFSK
Tx filter	Gaussian
BT	0.5
Modulation Index	0.28 – 0.35 nominal 0.32
Frequency Deviation	160 kHz settled 141 kHz 010101 suite
Bandwidth -3dB -20dB	220 kHz 1 MHz
Bit Rate	1 Mbps
Bit Length	1 µsec
Slot Length (Frequency Hopping)	625 µsec
Packet Sizes	1, 3, 5 slot packets

1.1.2 Power Classes

Power Class	Maximum (P _{max})	Nominal	Minimum (P _{min})	Power Control
1	100 mW (20 dBm)		1 mW (0 dBm)	from P _{min} (< +4 dBm) to P _{max}
2	2.5 mW (4dBm)	1 mW (0 dBm)	0.25 mW (-6dBm)	optional
3	1 mW (0dBm)			optional

1.1.3 Structure of a Bluetooth Data Packet

Every Bluetooth data packet is divided into 3 basic section: Access Code, Header and Payload. The following figures show the order and bit lengths of the individual sections:

access code 72 bits			54 bits header	240 / 1496 / 2744 bits payload*)
4 bits preamble	64 bits sync word	4 bits trailer		

*) During EUT evaluation the payload contains certain bit sequences: PRBS9 (Pseudo Random Bit Sequence) or 11110000 or 10101010

The sync word is transmitted as the major part of the access code. For this purpose the LAP (lower address part) of the BD address will be expanded to 64 bit by adding the BCH code and baker.

sync word 64 bits		
BCH code 34 bits	LAP 24 bits	Barker 6 bits

The LAP (lower address part) of the BD address serves as a basis for the sync word.

BD – address 48 bits		
NAP 16 bits	UAP 8 bits	LAP 24 bits

1.2 Functional Scope of the Bluetooth Analyzer Option

1.2.1 Supported Tests

The Bluetooth Analyzer Option R&S FS-K8 supports measurements according to the Bluetooth RF Test Specification (Bluetooth SIG) , Revision 0.91, July 2001, on FSP and FSU spectrum analyzers.

The following tests are currently implemented according to this specification:

Test cases taken from the RF Test Specification

5.1.3	Output Power
5.1.8	TX Output Spectrum - Adjacent Channel Power
5.1.9	Modulation Characteristics
5.1.10	Initial Carrier Frequency Tolerance (ICFT)
5.1.11	Carrier Frequency Drift

1.2.2 Overview of Transmitter Tests with settings according to the RF Test Specification

	Hop	Trigger	Synchroni- zation	Packet Type	Payload	Test Mode	Operating Mode	RBW	VBW	Power	Sweep Time	Sweep Count	Trace Mode	Detec- tor	Frequency in MHz	Span	Test cond	Results
Output Power	ON	Extern	yes (p0) however, also possible without synchroni- zation	Longest supported	PRBS 9	Loop back	FM+RF Power	3MHz	3MHz	Supported maximum	One complete packet	-	Maxh	Peak	Low / middle / high	-	Norm / Ext	Peak and average power 1) $P_{AV} < 100$ mW (20 dBm) 2) $P_{PK} < 200$ mW (23 dBm) 3) $P_{max} > P_{AV} > P_{min}$ at maximum power step
TX Output Spectrum – Adjacent Channel Power	OFF	-	no	DH1	PRBS 9	Loop back	Analyzer Time Domain	100kHz	300kHz	Supported maximum	79s pro sweep (= 100ms * 10 * 79)	10	Maxh	Aver	2402-2480 – 450kHz $\pm n * 1$ MHz mit $n = 0..9$ bzw. France 2454-2476	-	Norm / Ext	Channel power of all channels 1) $P_{TX}(f) \leq -20$ dBm for $ M-N = 2$ 2) $P_{TX}(f) \leq -40$ dBm for $ M-N \geq 3$
Modulation Characteristics	OFF	-	yes (p0)	Longest supported	11110000 10101010	Loop back	FM+RF Power	-	-	Supported maximum	One complete packet	10 (extern)	-	-	Low / middle / high	-	Norm / Ext	All 8 bit peak deviations and average deviations
Initial Carrier Frequency Tolerance	ON / OFF	-	yes (p0)	DH1	PRBS 9	Loop back	FM+RF Power	-	-	Supported maximum	-	10	-	-	Low / middle / high	-	Norm / Ext	Carrier offset within the 4 preamble bits
Carrier Frequency Drift	ON / OFF	-	yes (p0)	All supported packets (DH1/3/5)	10101010	Loop back	FM+RF Power	-	-	Not specified	One complete packet	10	-	-	Low / middle / high	-	Norm / Ext	Carrier offsets of the 4 bit preamble, of all 10 bit payload sequences, and the maximum drift rate of all 10 bit payload sequences at 50 μ s offset.

1.3 Functional Description - Block Diagram

The Adjacent Channel Power measurement is performed in the spectrum analyzer operating mode of the analyzer. For this test case the complete frequency band is scanned using a sequence of zero span measurements.

All other test cases are based on a digital I/Q demodulator which determines the temporal characteristics of power and frequency. The output data of the demodulator are the basis for calculation of all relevant measurement results like modulation characteristics or output power. The demodulator reaches a maximum in accuracy and temperature stability by sampling the IF signal and converting it digitally down into the base band (I/Q area).

The measurements are performed by passing the following signal processing steps:

- LAP (Lower Address Part) trigger detection
- Resampling
- Channel filtering
- Automated packet and bit pattern detection
- Limit check
- Parallel display of measurement curves and numeric results on the screen

Fig. 1 shows the analyzer hardware from the IF to the processor. The analog IF filter is the resolution filter of the spectrum analyzer, which can be selected in a range from 300 kHz to 10 MHz. The A/D converter samples the 20.4 MHz IF signal with a sampling frequency of 32 MHz.

Low pass filtering is performed after the signal has been down-converted into the complex base band and the data rate is reduced in the sequence. The amount of decimation depends on the selected oversampling factor = points / symbol. The default setting is 4, resulting in a 4 MHz sampling rate.

The resulting I/Q data are stored in a memory of 128 k words (FSU 512 k words) for I and Q respectively. The hardware trigger (external or IF power) controls the memory access.

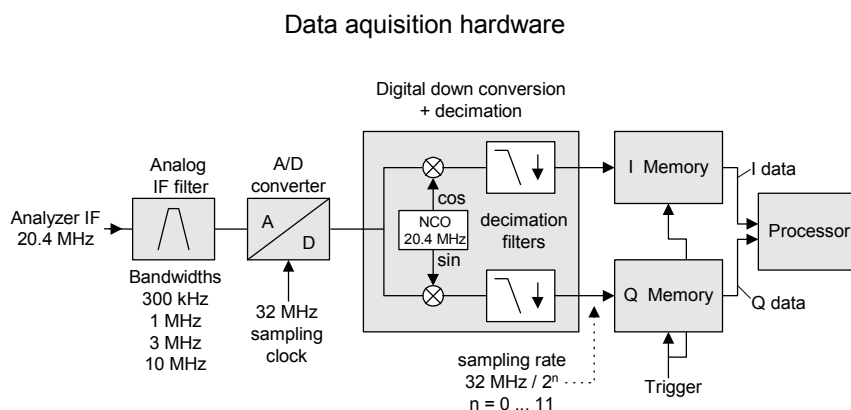


Fig. 1 Block diagram of the signal processing architecture of the analyzer

1.4 Further Characteristics

1.4.1 Bandwidths

The Bluetooth RF Specification defines a minimal bandwidth of 3 MHz. This requirement is related to the standard gaussian filters as normally used by spectrum analyzers. As the amplitude characteristics of these filters is not flat a bandwidth must be selected that is significantly higher than the bandwidth of the signal under test. The 3 MHz filter causes an error in frequency deviation of about 4% as soon as a 0101 symbol sequence is used. Therefore an IF bandwidth of 10 MHz is highly recommended for this measurement and set up as the default value. The digital bandwidth is smaller and depends on the selected oversampling factor = points / symbol. With the default setting of 4 the digital bandwidth is 3 MHz. This digital filter has a flat amplitude characteristics and does not affect the frequency deviation of the signal.

1.4.2 Optional Measurement Filter (Meas Filter On)

The RF Specification allows high distortion power in the first adjacent channels. The 3 MHz filter does not suppress this kind of distortion, which leads to a high interference in modulation. Therefore a precise measurement of the frequency deviation is not possible.

In order to obtain correct deviation results the analyzer supplies an optional filter whose pass band is only appropriate for the channel to measure. The Bluetooth spectrum has a bandwidth of 1 MHz. The filter is flat within 1.04 MHz (ripple: only 0.02 dB) and has steep edges. This measurement filter is not dependent on the selection of the points / symbol value. As a result the displayed deviation value will increase by 3.2%, but without the filter the displayed deviation value can increase dramatically due to interference from adjacent channels. Generally the result will be more precise, if the displayed deviation is lower with filtering than without filtering. In these cases the inaccuracy caused by the adjacent channel interference is higher than the systematic inaccuracy caused by the filter.

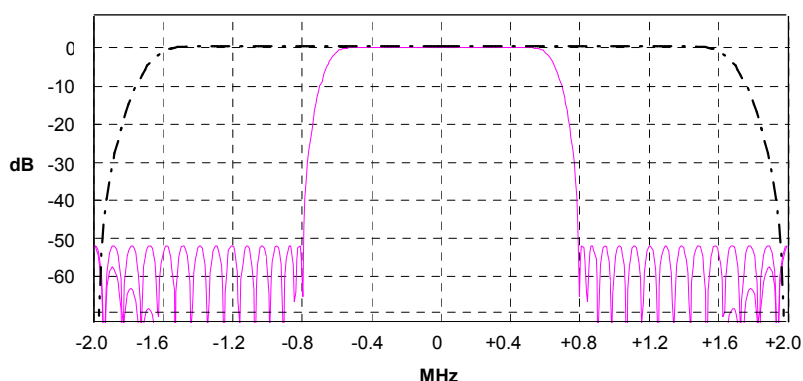


Fig. 2 Selection of digital filters

Dashed-dotted curve: Standard filter with 4 points / symbol

Solid curve: Optional measurement filter, independent of the points / symbol setting

1.4.3 Oversampling

The number of samples per symbol is equivalent to the sampling rate in MHz (due to the symbol length of 1 μ s)

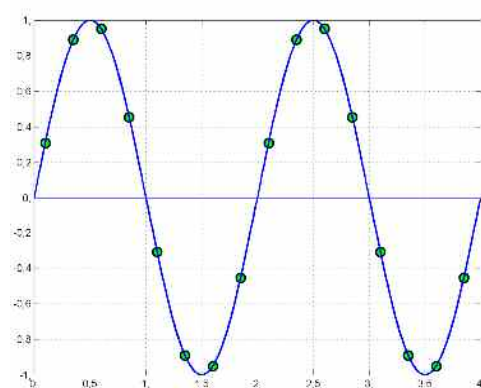
Digital bandwidth (flat area)	Points per Symbol	Sampling rate
10 MHz	32	32 MHz
8 MHz	16	16 MHz
5 MHz	8	8 MHz
2.8 MHz	4	4 MHz
1.6 MHz	2	2 MHz

According to the RF Test Specification an oversampling factor of 4 is required at minimum. On the analyzer this oversampling factor can be selected as "Points per Symbol" in a range from 2 to 32. The default value is 4.

Although possible a value > 4 is not recommended. It increases the measurement time due to the extended calculation effort. Additionally the resulting bandwidth will be larger than required, which leads to lower measurement accuracy, unless the optional measurement filter (Meas Filter On) is used as described in chapter "Bandwidths".

The analyzer uses a phase shifter in order to move the samples to the zero trespassing points. As a result there is one sample per symbol time, which is especially important for a 0101 symbol sequence in order to obtain the precise value for the peak frequency deviation.

Sampling times before Phase Shifter



Sampling times after Phase Shifter

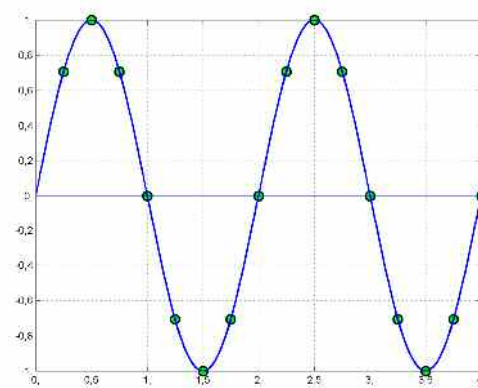


Fig. 3 Operation of the Phase Shifter

Advantages of the Phase Shifter:

- No jitter with low sampling rates
- With one sample per zero trespassing point there is always a sample in the middle of the bit length. Therefore the maximum values in the frequency deviation of 0101 bit patterns can be detected precisely also with low sampling rates.
- The immunity to interference when determining the data bits is improved.
- Higher suppression of the distortion during peak detection.

1.4.4 Determining Average or Max/Min Values during several Sweeps (= Bursts)

These functions are very useful in order to obtain more stable results or to find sporadic spurious signals not included in every burst. In many cases the RF Test Specification defines measurements over a 10 burst period.

The number of measurements can be selected using function **Sweep Count**, thus adapting the measurement to the individual requirements.

When using function **Single Sweep** the calculation of average or maximum / minimum values is performed over a well-defined number of sweeps (= Sweep Count).

Continuous Sweep hingegen liefert eine fortlaufende Mittelwertbildung und Extremwertbildung über die gesamte Messzeit.

Modulation measurements are performed using trace mode **Clear Write**.

In contrast to this **Continuous Sweep** yields continuous averaging and calculation of maximum / minimum values over the whole measurement time.

With Continuous Sweep a "live" display is obtained, which allows e.g. an instant view of changes during alignment of a DUT.

Power measurements are performed using trace mode **Maxhold** in relation with the defined measurement time. The measurement time is selected in a way that makes sure that always one complete burst is acquired. In this case several sweeps are combined to one trace, before this result trace is evaluated.

1.4.4.1 Impact of the Sweep Counter on the Measurement Results

	Continuous Sweep	Single Sweep & Sweep Count
Trace Mode = Clear Write	All measurement results (min., max., average) will be updated with every sweep. The corresponding values will be calculated based on the current curve.	Starts a measurement with n sweeps (n = Sweepcount). All measurement results (min., max., average) will be calculated based on these n sweeps.
Trace Mode = AVG, MaxHold, MinHold	All measurement results (min., max., average) will be updated with every sweep. The corresponding values will be calculated based on the current curve. The trace is the continuous average value (AVG) or the extreme value (MaxHold, MinHold) since the start of the measurement.	Starts a measurement with n sweeps (n = Sweepcount). n defines the number of sweeps that will be taken into account for the trace math functions (AVG, MaxHold, MinHold). The n sweeps will result in one trace and the measurement results (Min, Max, Average) will be calculated based on this summarized trace.

Please note that the above functions may not be mixed up with the detectors of the instrument:

- Detectors combine the measurement data obtained by oversampling to **one pixel** on the screen. The kind of combination (Max Peak, Min Peak, Average, RMS) can be selected.

- The trace functions affect complete measurement curves: A resulting curve is calculated from **several subsequent sweeps**. The method of calculation (Average, Maxhold, Minhold) can be selected here as well.

Thus the detector is the arithmetic rule for how sample data collected with a high data rate are combined to the pixel data of one individual measurement curve, whereas the trace mode is the rule of how samples taken from several measurement curves are to be combined to a new resulting curve.

For the ACP measurement the Average detector is fixed.

1.4.5 Trigger Concepts

As the DUT (Device Under Test) uses frequency hopping, a trigger method is necessary for two reasons:

1. a measurement is only possible during the period of time, when there is a Tx signal (burst) at the frequency under request.
2. In order to determine the modulation characteristics correctly a synchronization with the preamble of the signal must be supplied.

With selection *Find Sync = On* the synchronization is supplied towards the 64 bit sync word. For this purpose in a first step a burst is searched automatically within the RF signal, or, if selected, the external trigger or the IF power trigger will be used in order to determine the burst position.

In a second step the sync word position is searched by correlation of the signal with the sync word defined in the initialization phase. The correlation is performed directly with the FM signal, not with the data bits, which are only available after the phase shifter has been processed. The find burst process will be continued as long as no sync word has been found.

After the position of the sync word has been determined the position of the p0 bit will be calculated from the average value of all zero trespassing points, as defined in the RF test specification. Finally the samples will be moved in a way that each sample matches one zero trespassing point (phase shifting).

The only measurement possible without synchronization is the Output Power Measurement. The specified measurement time is 20% to 80% of the burst length. Without synchronization the burst length is defined via the -3dB points of the power curve. With synchronization the burst starts with the p0 bit. Therefore varying measurement results are possible if the power of the EUT is not constant within the burst.

In order to supply stable synchronization the EUT must be operated in reduced hopping mode. The EUT is only allowed to toggle between two frequencies, because otherwise the repetition time for the same frequency would become higher than the record length.

If the test environment supplies an external trigger which marks the channel to be measured a synchronization is also possible with normal hopping operation.

2 Getting Started - Introduction to the Bluetooth Operation

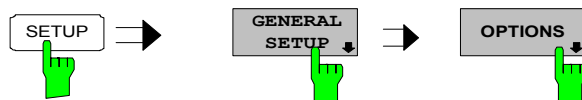
2.1 Enabling the Bluetooth Option

In order to activate the Bluetooth option on your spectrum analyzer a license key is necessary. This license key is included in the option package.

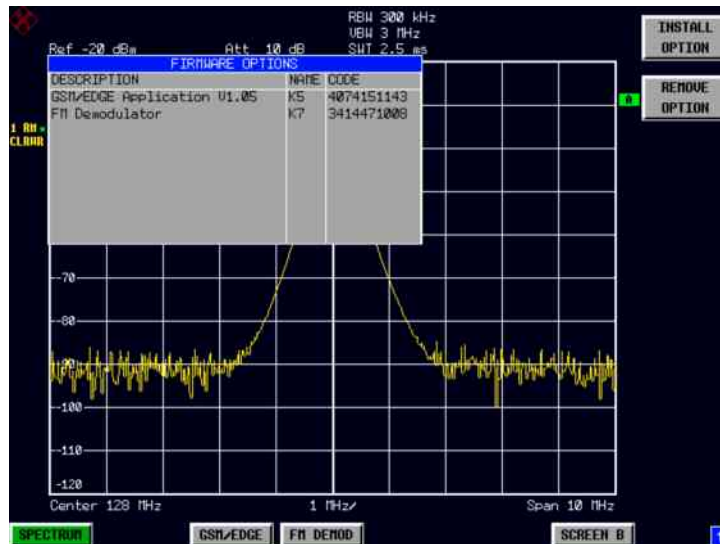


If the option is installed in the factory the license key will be entered before delivery. Entering the license key as described below is **not** necessary in this case.

In order to open the editor for the license key please use the following frontpanel key sequence:



Softkey *OPTIONS* opens a submenu prepared for entering the license key for the Bluetooth option. Any option already installed in the instrument will be displayed in a table opened on entering the submenu.



INSTALL OPTION

Softkey *INSTALL OPTION* opens the data entry for the license keycode of a firmware option. On entry of a valid license key the message *OPTION KEY OK* is displayed in the status line and the firmware option appears in table *FIRMWARE OPTIONS*. On entry of an invalid license key the message *OPTION KEY INVALID* is displayed in the status line.

Remote: --

2.2 First Operating Steps

Before measurements according to the RF test specification can be started the settings of the analyzer must be adapted to the characteristics of the DUT (device under test). Therefore the following operating sequence is recommended:

1. Set the spectrum analyzer to its default state.

- ▶ Press *PRESET*.
The analyzer will restore its default settings.

2. Select the Bluetooth operating mode.

- ▶ Press hotkey *BLUETOOTH*.
The Bluetooth measurement application will be started. The softkey menu *SETTINGS* will be selected.

3. Select a country.

- ▶ Press softkey *GEOGRAPHY*.
A list containing the available country settings will be opened.
- ▶ Press softkey *CHANNEL* and enter the desired channel number. The available channel numbers are dependent on the available frequency bands, which again depend on the selected country:
USA, Europe: 0 to 78
France: 0 to 22

4. Select the transmit channel.

- ▶ Press softkey *CHANNEL* and enter the desired channel number. The available channel numbers are dependent on the available frequency bands, which again depend on the selected country:
USA, Europe: 0 to 78
France: 0 to 22

5. Select the packet length.

- ▶ Press softkey *PACKET TYPE*.
The list of available packet type opens.
- ▶ Enter the desired packet length DH1, DH3, DH5 or AUTO (recommended) using the cursor keys. Confirm the selection with *ENTER*.
This selection defines the length of the memory area used for searching the sync information. Shorter packet types speed up the sync search process at the risk of searching an area that does not contain sync information.

6. Select the power class of the DUT.

- ▶ Press softkey *POWER CLASS* and select power class 1 to 3.

7. Configure the sync settings (LAP).

- ▶ Press hotkey *FIND SYNC*.
The softkey menu for configuration of the sync information will be opened.
- ▶ Press softkey *LAP* and enter the Lower Address Part of the Bluetooth Device Address of the DUT. The sync word used for the sync search will be calculated.

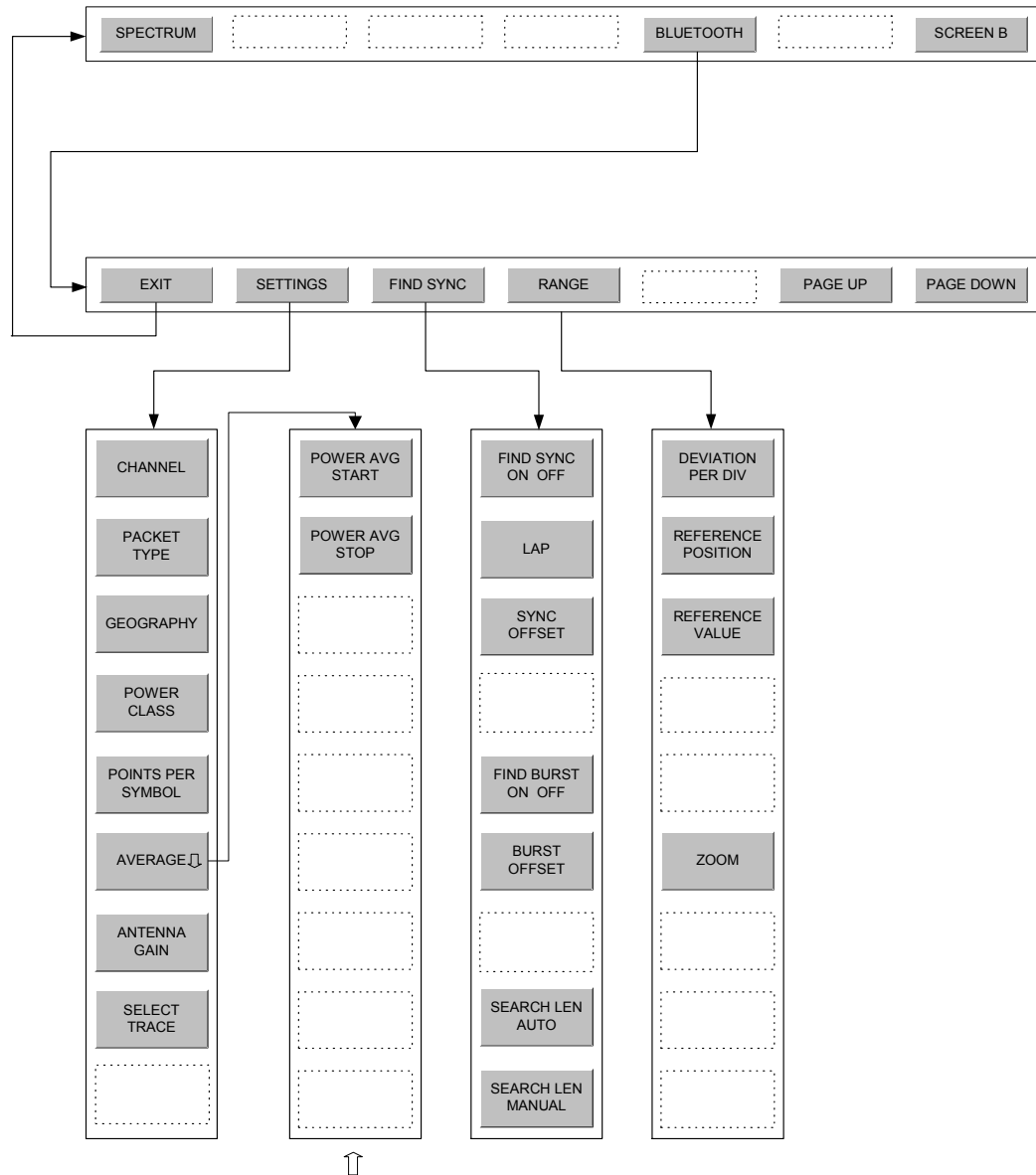
8. Select a measurement.

- ▶ Press the *MEAS* key and select the desired measurement in the softkey menu.
- ▶ Configure measurement time, measurement control (*CONTINUOUS* or *SINGLE*) and the number of measurement cycles (*SWEEP COUNT*) by pressing the corresponding softkeys.

Settings exceeding the functions described in the above setup sequence are included in the reference part of the operating manual in the next chapter.

3 Settings of the Bluetooth Option

3.1 Bluetooth Menu Overview



3.1.1 Hotkey BLUETOOTH

BLUETOOTH

The hotkey *BLUETOOTH* in the menu bar below the LCD screen serves to activate the Bluetooth option and to switch the measurement demodulator on. At the same time the main softkey menu of the Bluetooth option is opened.

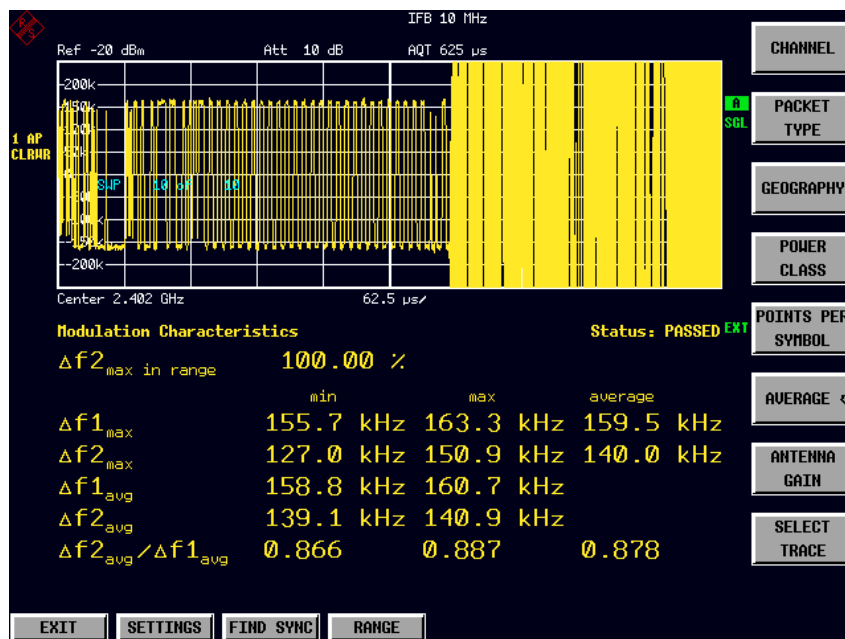


Fig. 4 Bluetooth main menu

The Bluetooth main menu contains the entry points for the essential configurations of the Bluetooth demodulator:

- **SETTINGS:**
This softkey menu contains general settings common to all measurements of the measurement demodulator.
- **FIND SYNC:**
This softkey menu defines the synchronization parameters for the Bluetooth signal under request.
- **RANGE:**
This softkey menu allows the adaption of the scaling of x- and y-axis of the diagram during the measurement of *Modulation Characteristics*, *Initial Carrier Frequency Tolerance* and *Carrier Frequency Drift*.

Hotkey **EXIT** is used to leave the Bluetooth Option. The hotkeys **PAGE UP / PAGE DOWN** are used to scroll the result lists of the individual measurements.

```
Remote: INST:SEL BTO
        INST:NSEL 12
```

3.1.2 Bluetooth Main Hotkey Menu

EXIT

Hotkey *EXIT* leaves the Bluetooth option and re-activates the Spectrum mode of the instrument. The Bluetooth demodulator is switched off on leaving the option.

```
Remote: INST:SEL SAN
        INST:NSEL 1
```

SETTINGS

Hotkey *SETTINGS* opens the softkey menu containing the basic settings for the Bluetooth option, which are common to all tests. These settings include:

- Channel number
- Packet type
- Packet bytes SCO
- Geographical settings
- Power class
- Number of points / symbol
- Averaging
- Antenna gain

```
Remote: --
```

FIND SYNC

Hotkey *FIND SYNC* opens the softkey menu containing the settings for searching the sync word and the Bluetooth burst. This includes both the settings of the lower address part (LAP) and the settings of the timing parameters (*SYNC OFFSET*, *BURST OFFSET*).

```
Remote: --
```

RANGE

Hotkey *RANGE* opens the softkey menu containing the settings for the scaling of x- and y-axis for the measurement of the *Modulation Characteristics*, *Initial Carrier Frequency Tolerance* or *Carrier Frequency Drift*. This hotkey is not available for other measurement types.

```
Remote: --
```

PAGE UP / PAGE DOWN

These hotkeys scroll the list of measurement results. These hotkeys are only visible if the number of measurement results exceeds one screen.

```
Remote: --
```

3.2 General Settings - *SETTINGS* Menu

CHANNEL

The softkey *CHANNEL* opens the editor for the index of the Tx channel. The range of valid values is dependent on the locally available frequency band.

Editing the channel number is in principle equal to changing the center frequency. The major difference is that the center frequency editor does not limit frequency values to the available frequency band, which means that values outside the frequency band and between the discrete channels can be selected.

As soon as the channel number editor is opened after the center frequency has been changed, the center frequency will be rounded to the nearest channel number.

The channel number determines the center frequency for the following measurements:

- Output Power
- Modulation Characteristics
- Initial Carrier Frequency Tolerance
- Carrier Frequency Drift
- Relative Transmit Power (EDR)
- Carrier Frequency Stability and Modulation Accuracy (EDR)
- Differential Phase Encoding (EDR)

The center frequencies of the other measurements are independent of the active frequency channel (see menu *FREQ*).

The available value range for the channel number is dependent on the selected country. It is defined as follows:

USA, Europe (outside France): 0..78
 France: 0..22

The formula for calculating the center frequencies is as follows:

USA, Europe (outside France): $f = 2402 + k \text{ MHz}$ with $k = 0..78$
 France: $f = 2454 + k \text{ MHz}$ with $k = 0..22$

The default setting is channel number 0.

Remote: CONF:BTO:CHAN 0

PACKET BYPE SCO

Opens an edit dialog box to set the number of payload bytes that are transmitted in a packet. For SCO packets, the payload length must be adjusted because those packets have no payload header.

Remote: CONF:BTO:PBSC 50

PACKET TYPE

The softkey *PACKET TYPE* opens a list with available packet types, which allows you to chose the one to be measured. The list contains the following packet types:

PACKET TYPE
<input checked="" type="checkbox"/> DH1 (1 slot packet)
<input type="checkbox"/> DH3 (3 slot packet)
<input type="checkbox"/> DH5 (5 slot packet)
<input type="checkbox"/> AUTO

The selected packet type will be used for the automatic calculation of the sweep time (*SWEEP TIME AUTO*) and the search length of the sync word (*SEARCH LEN AUTO*). The number of occupied slots is the other decisive factor in both calculations.

The actually transmitted packet type will be determined automatically by the Bluetooth demodulator (which means that the selected packet type need not necessarily correspond to the really transmitted packet type; it will only affect the settings for sweep time and search length as described above).

The default value is packet type DH1.

Remote: CONF:BTO:PTYP DH1 | DH3 | DH5 | AUTO

GEOGRAPHY

The softkey *GEOGRAPHY* opens a list with geographical regions that have different frequency bands:

GEOGRAPHY
<input checked="" type="checkbox"/> Europe
<input type="checkbox"/> USA
<input type="checkbox"/> France

The default setting is *EUROPE*.

Remote: CONF:BTO:GEOG EUR | USA | FRAN

POWER CLASS

The softkey *POWER CLASS* opens the editor for the Bluetooth power classes 1 to 3. The selection of the power class determines the limits for the output power measurement.

The default setting is power class 1.

Remote: CONF:BTO:POW:PCL 1

POINTS PER SYMBO

The softkey *POINTS PER SYMBOL* allows changing the number of measurement samples per symbol.

The RF Test Specification requests an oversampling factor of at least 4 (default settings). With this oversampling factor a DH5 packet corresponds to 12500 measurement samples (= 2500 samples / slot).

Remote: CONF:BTO:PRAT 2 | 4 | 8 | 16 | 32

AVERAGE

The softkey *AVERAGE* opens the submenu containing the settings for the calculation of the average power. These settings will be used for the measurement of the output power.

Remote: --

ANTENNA GAIN

The softkey *ANTENNA GAIN* allows the input of a level offset in order to take the gain of an antenna into account for displaying power values .
The default setting is 0 dB.



Offset values \neq 0 dB will activate the enhancement label "TDF" at the right diagram border.

```
Remote: SENS:CORR:EGA:INP[:MAGN] 0 DB
```

SELECT TRACE

The softkey *SELECT TRACE* selects the measurement curve whose numeric results will be displayed in the lower half of the screen.
The default curve selected is trace 1.

```
Remote: CONF:BTO:TRAC<1...3>:SEL
```

3.3 Configuring the Averaging Method - Submenu AVERAGE

In order to determine the average power of a Bluetooth burst the corresponding area of the burst must be selected according to the RF Test Specification. In order to define this averaging area the start position and stop position must be entered in percent of the burst length.

The RF Test Specification allows different methods to determine the position of a Bluetooth burst:

- With *FIND SYNC ON* the burst is defined by the p0 bit and the automatically determined packet length.
- With *FIND SYNC OFF* and *FIND BURST ON* the burst is defined by the two 3dB points. The search of the 3dB points is defined in the RF Test Specification as the alternative method compared with the p0 bit method.

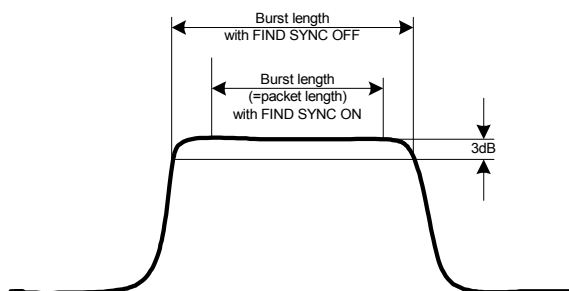


Fig. 5 Definition des Bluetooth-Bursts

With these definitions and dependent on the selected method for determining the burst there are different areas for the calculation of the average power:

AVERAGE START

The softkey *AVERAGE START* activates the editor for the start position of the evaluation area for the average burst power.

The valid value range is 0 to 100%, the default setting is 20%.

Remote: CONF:BTO:POW:AVER:STAR 20PCT

AVERAGE STOP

The softkey *AVERAGE STOP* activates the editor for the stop position of the evaluation area for the average burst power.

The valid value range is 0 to 100%, the default setting is 80%.

Remote: CONF:BTO:POW:AVER:STOP 80PCT

3.4 Setting of the Synchronization Parameters - Menu FIND SYNC

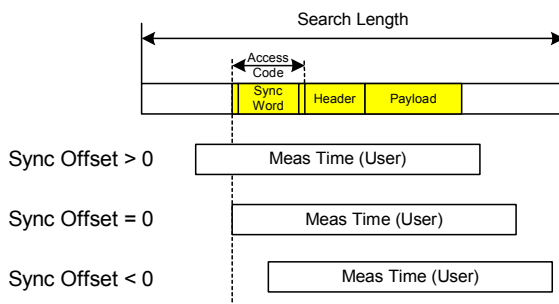
With active function *FIND SYNC* the signal processing functions of the analyzer determine the position of the first preamble bit p0 by correlation with the sync word. For this purpose a sufficient record length of the FM demodulated signal is necessary..

The record length can be defined using the softkeys *SEARCH LEN AUTO* and *SEARCH LEN MANUAL*. If the sync word cannot be found in the signal, the message "SYNC NOT FOUND" will be displayed on the screen, and the corresponding bit in the STATus:QUESTionable:SYNC register will be set during remote operation.

The function *FIND SYNC* is active only during the following measurements:

- Output Power
- Modulation Characteristics
- Initial Carrier Frequency Tolerance
- Carrier Frequency Drift
- Relative Transmit Power (EDR)
- Carrier Frequency Stability and Modulation Accuracy (EDR)
- Differential Phase Encoding (EDR)

The softkey *SYNC OFFSET* defines the number of bits to be displayed in front of the access code (p0 bit).



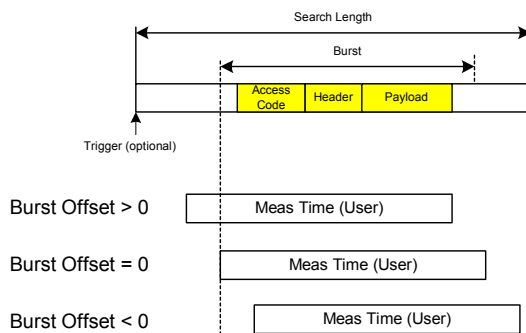
If both functions *FIND SYNC* and *FIND BURST* are active, the sync word will be

Setting of the Synchronization Parameters - Menu FIND SYNC

determined in an identified burst. If function *FIND BURST* is not active or no burst is identified, the total record length (*Search Length*) will be investigated.

Function *FIND BURST* can be activated without active sync search. If no burst is identified in this case, the message "BURST NOT FOUND" will be displayed on the screen, and the corresponding bit in the STATus:QUESTIONable:SYNC register will be set during remote operation.

The softkey *BURST OFFSET* defines the time to be displayed in front of the identified burst.



The results of the modulation measurements

- Modulation Characteristics
- Initial Carrier Frequency Tolerance
- Carrier Frequency Drift

can only be calculated with active function *FIND SYNC*.

The measurement of output power can be performed with either of the functions *FIND SYNC* or *FIND BURST* active.

FIND SYNC ON/OFF

The softkey *FIND SYNC ON/OFF* toggles the search of the sync word.

The default setting is *FIND SYNC ON*.

Remote: SENS:DDEM:SEAR:SYNC:STAT ON

LAP

The softkey *LAP* allows the input of the lower 24 bit (Lower Address Part, LAP) of the 'Bluetooth Device Address' (BD_ADDR) of the equipment under test (EUT). The LAP is used to calculate the 64-bit 'sync word'. The 'sync word' in return is used to determine the start of a packet by correlation and to determine the position of the first preamble bit p0 using the method described in the RF Test Specification. The valid value range for the lower address part is 000000h - FFFFFFFh, its default setting is 000000h.

Remote: SENS:DDEM:SEAR:SYNC:LAP <hex>

SYNC OFFSET

The softkey *SYNC OFFSET* activates the input of the number of bits to be displayed in front of the first preamble bit p0. If the sync word is identified, but the selected measurement time cannot be displayed due to the selected sync offset, the message "SYNC OFFSET INVALID" will be displayed on the screen.

The valid value range comprises of -10000 bits to + 100000 bits, with negative values moving the preamble to the left, positive values to the right. The default setting for the sync offset is = 0.

Remote: SENS:DDEM:SEAR:SYNC:OFFS 0

FIND BURST ON/OFF

The softkey *FIND BURST ON/OFF* toggles the search for a burst for the output power measurement between on and off. If both functions *FIND BURST* and *FIND SYNC* are active the search area for the sync word will be limited to the area of the detected burst.

The default setting is *FIND BURST ON*.

Remote: SENS:DDEM:SEAR:PULS:STAT ON | OFF

BURST OFFSET

The softkey *BURST OFFSET* opens the editor for the time to be displayed in front of the identified burst. If the burst is identified, but the selected measurement time cannot be displayed due to the selected burst offset, the message "BURST OFFSET INVALID" will be displayed on the screen.

The valid value range comprises of -10 ms to + 10 ms, with negative values moving the burst to the left, positive values to the right. The default setting for the burst offset is = 0.

Remote: SENS:DDEM:SEAR:PULS:OFFS 0

SEARCH LEN AUTO

The softkey *SEARCH LEN AUTO* activates the automatic selection of the search length for the search of the sync word or the burst, depending on the selected packet type.

The automatic search length is determined as follows:

- Trigger free Run:
search length = 3 * packet length + | sync offset or burst offset |
- a all other trigger modes:
search length = 1 * packet length + 1 Slot + | sync offset or burst offset |

If the selected measurement time is higher than the packet length, the difference measurement time - packet length is added to the search length.

The default setting for the automatic calculation of the search length is ON.

Remote: SENS:DDEM:SEAR:TIME:AUTO ON | OFF

SEARCH LEN MANUAL

The softkey *SEARCH LEN MANUAL* switches the automatic selection of the search length off and opens the editor for the search length used for determining the sync word or the burst.

The input of the search length is done in seconds; the valid value range is 100 μ s to (130560 μ s / points per symbol).

There is a relation between the selected # of points / symbol and the maximum search length (in # of slots):

Points per Symbol	max search length
2	104,4 Slots
4	52,2 Slots
8	26,1 Slots
16	13,1 Slots
32	6,5 Slots



Measurements without trigger require at least 3 times the record length as a value for the search length in loop back operation (see *SEARCH LEN AUTO*). With this condition the packet types that can be identified with an oversampling factor of 16 are restricted to DH1 and DH3. With an oversampling factor of 32 only DH1 packets can be identified reliably.

The default setting is 1875 μ s. This is the value used by *SEARCH LEN AUTO* (= 3 * DH1 packet length = 3 * 625 μ s).

Remote: SENS:DDEM:SEAR:TIME 1875US

3.5 Modifying the Diagram Scales - Menu *RANGE*

The hotkey *RANGE* is only available, if a test with display of the FM modulated signal is selected. This menu allows adaption of both the scaling of the y-axis and activation of the zoom function for the x-axis.

DEVIATION PER DIV

The softkey *DEVIATION PER DIV* allows the selection of the FM deviation to be displayed. The valid value range is 1 Hz / Div to 1 MHz / Div; the default setting is kHz.

Remote: DISP:WIND:TRAC:Y:PDIV 50kHz

REFERENCE POSITION

The softkey *REFERENCE POSITION* defines the position of the reference line for the 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.

The input is performed in % of the diagram height, with 100% corresponding to the upper diagram border. The default setting is 50% (vertical middle of the diagram).

Remote: DISP:WIND:TRAC:Y:RPOS 50PCT

REFERENCE VALUE

The softkey *REFERENCE VALUE* defines the FM deviation at the reference line on the y-axis. This allows individual frequency offsets to be taken into account for the display of the measurement curves.

The valid value range is 0 to ± 10 MHz; the default setting is 0 Hz.

```
Remote: DISP:WIND:TRAC:Y:RVAL 0HZ
```

ZOOM

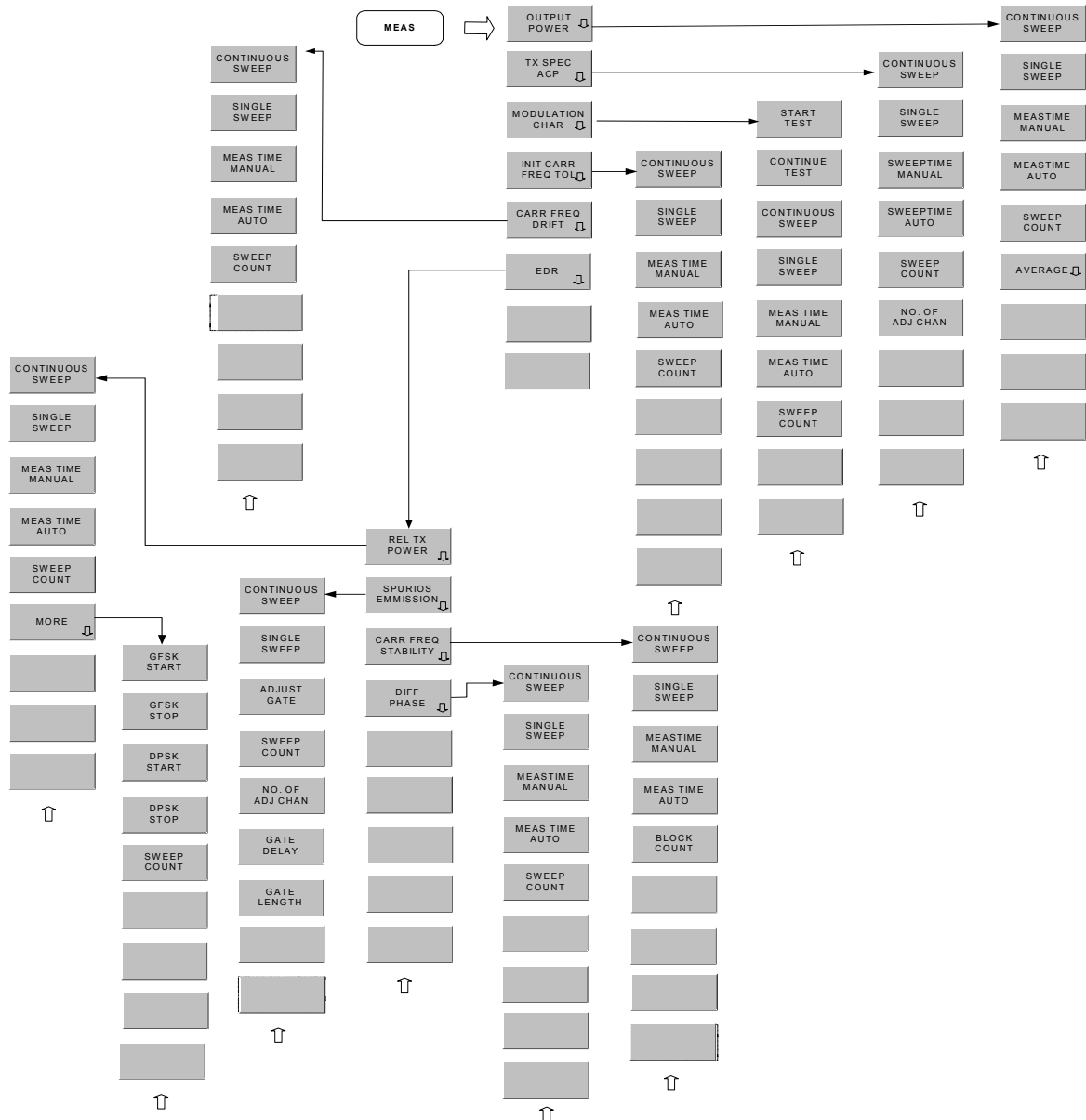
The softkey *ZOOM* activates the zoom function and opens the editor for the zoom start position. With active zoom function an area of only 501 samples is displayed.

The valid value range for the zoom start position is 0 to (meas time - 500 / sampling rate). The default setting for the zoom function is *OFF*.

```
Remote: SENS:ADEM:ZOOM ON  
SENS:ADEM:ZOOM:STAR 30US
```

3.6 Selection of Measurements - Hardkey MEAS

The hardkey *MEAS* selects the menu containing the Bluetooth measurements:



The following settings can be configured individually for each of the measurements:

- RBW (the IF bandwidth set up for modulation measurements is valid for all measurements)
- VBW
- RBW auto mode
- VBW auto mode
- Trace mode
- Detector
- Sweep count

- Sweep time auto mode
- Sweep time

The settings which are specific for each measurement become active as soon as the corresponding measurement is selected. Changes to the above settings performed using the menus for the hardkeys BW, TRACE and SWEEP are always related to the selected measurement.

The settings defined in the RF Test Specification can thus be modified individually for development or production.

By using the function *STARTUP RECALL* the individual configuration of the various tests can be preserved over a preset.

Remote: CONF:BTO:MEAS <measurement>

with <measurement> =

OPOW Output Power
 ACLR TX Output Spectrum-Adjacent Channel Power
 MCH Modulation Characteristics
 IFCT Initial Carrier Frequency Tolerance
 CFDR Carrier Frequency Drift

3.6.1 Measuring the Output Power - Softkey *OUTPUT POWER*

The output power measurement determines the maximum and average output power during a burst of the equipment under test (EUT). For this purpose a complete packet is recorded in the time domain.

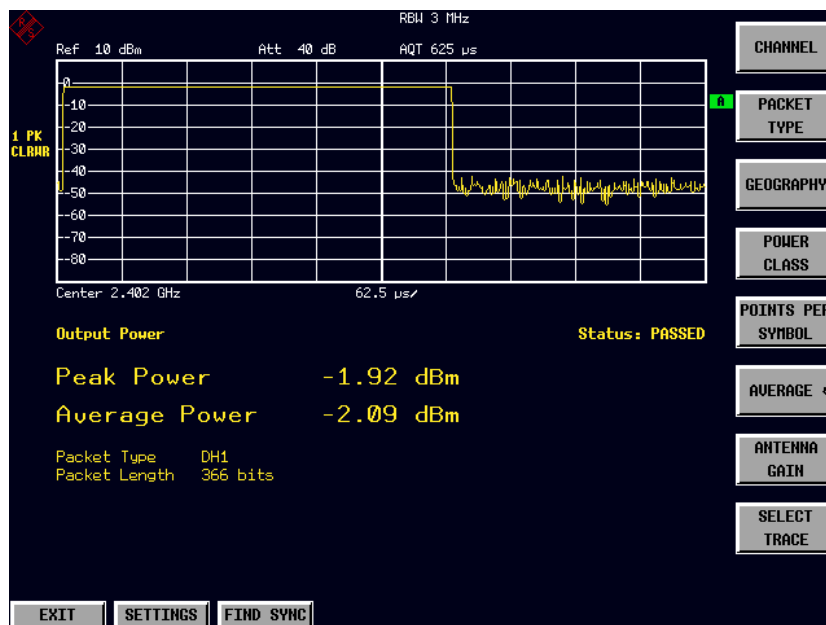


Fig. 6 Output power measurement

The peak value is determined from the complete contents of the measurement curve, whereas the average power is calculated from an area of at least 20% to 80% of the burst.

During the output power measurement the Bluetooth demodulator is active in order to determine the sync word within the signal, which is later-on used as the trigger basis. The Bluetooth demodulator is placed in a signal path without video filter. This is why the video filter cannot be activated with the output power measurement.

The EUT must keep the following limits according to the RF Test Specification:

- $P_{AV} < 100 \text{ mW}$ (20 dBm) EIRP
- $P_{PK} < 200 \text{ mW}$ (23 dBm) EIRP
- If the EUT is conforming to power class 1: $P_{AV} > 1 \text{ mW}$ (0 dBm)
- If the EUT is conforming to power class 2: 0.25 mW (-6 dBm) $< P_{AV} < 2.5 \text{ mW}$ (4 dBm)
- If the EUT is conforming to power class 3: $P_{AV} < 1 \text{ mW}$ (0 dBm)

A violation of these limits is marked on the screen in red letters.

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT OFF
```

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the output power measurement.

The valid value range is 1 μs to (130560 μs / points per symbol). The default setting is 625 μs .

```
Remote: CONF:BTO:SWE:TIME 625us
```

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the sweep time for the output power measurement. For the output power measurement the automatically calculated sweep time corresponds to the length of a packet.

Examples:

```
DH1 625us
DH3 1875us
DH5 3125us
```

As a default setting the automatic sweeptime calculation is switched on.

```
Remote: CONF:BTO:SWE:TIME:AUTO ON
```

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP*.

The valid value range is 0 to 32767, the default setting is 0.



The maximum and minimum value calculated from the individual sweeps for the P_{AV} - value will be displayed only for sweep count values $\neq 0$.

With sweep count = 0 only the P_{AV} - value of the current measurement will be displayed.

Remote: CONF:BTO:SWE:COUN 0

AVERAGE

The softkey *AVERAGE* opens the submenu for the settings required for calculation of the average power with output power measurement (see menu *SETTINGS*).

Remote: --

3.6.2 Adjacent Channel Power Measurement - Softkey TX SPEC ACP

The measurement of the TX Output Spectrum - Adjacent Channel Power measurement measures the power of all adjacent channels.

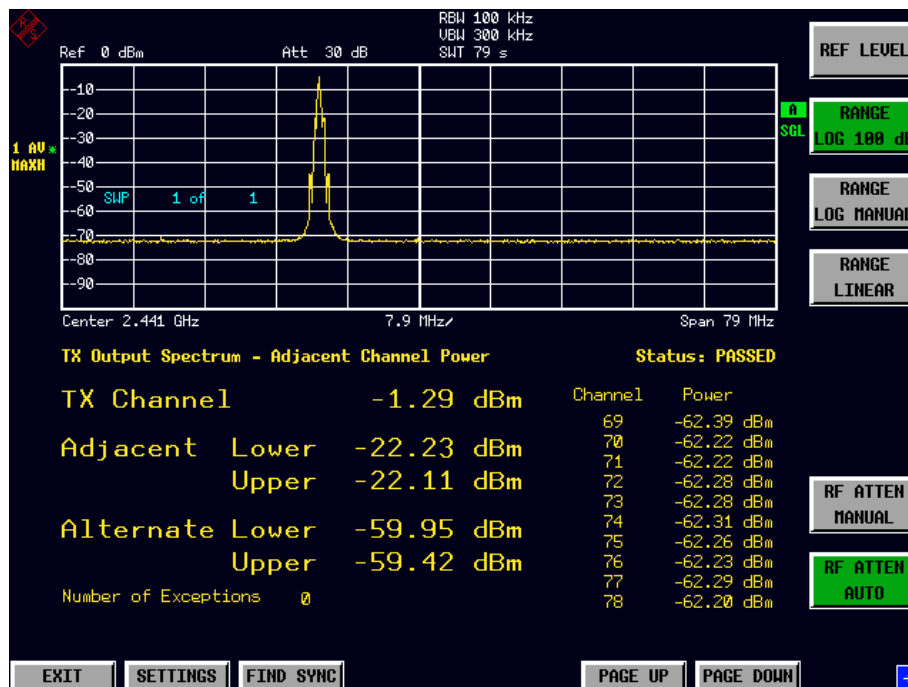


Fig. 7 - TX Spectrum ACP measurement

The following limits are given by the RF Test Specification:

$$1) P_{TX}(f) \leq -20 \text{ dBm for } |M-N| = 2$$

2) $P_{TX}(f) \leq -40$ dBm for $|M-N| \geq 3$

with

M = Transmit channel of the equipment under test

N = adjacent channel to be measured

A violation of these limits will be marked by red color and an asterisk (*).

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT OFF
```

SWEPTIME MANUAL

The softkey *SWEPTIME MANUAL* opens the editor for the sweep time of the output power measurement.

The valid value range is 10 μ s (minimum meas time for one channel) to 16000 s. The default setting is 79 s.

```
Remote: CONF:BTO:SWE:TIME 79s
```

SWEPTIME AUTO

The softkey *SWEPTIME AUTO* activates the automatic calculation of the sweeptime for the TX Output Spectrum - Adjacent Channel Power measurement. The automatic sweeptime corresponds to the settings defined in the RF Test Specification.

The default state of this function is ON.

```
Remote: CONF:BTO:SWE:TIME:AUTO ON
```

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the TX Output Spectrum - Adjacent Channel Power measurement.

The valid value range is 0 to 32767, the default setting is 10.

```
Remote: CONF:BTO:SWE:COUN 10
```

NO. OF ACP CHAN

The softkey *NO. OF ACP CHAN* opens the editor for the number of adjacent channels, whose power is to be measured.

As with the ACP measurement of the basic instrument firmware this value refers to the number of adjacent channels on one side of the Tx channel. This means that with a selected value of 10 the analyzer will measure in total 21 channels (10 lower channels + TX channel + 10 upper channels).

The frequency range required for the measurement is set up automatically. The center frequency will also be adapted automatically dependent on the selected TX channel.

The measurement of the adjacent channels is limited to the available Bluetooth frequency band, which means that at maximum 79 channels (23 channels in France) will be measured.

Value range: 0 to 78 (Europe/USA), 0 to 22 (France).

The default setting is 78

Remote: CONF:BT0:ACLR:ACPairs 78

3.6.3 Measuring the Modulation Characteristics - Softkey MODULATION CHAR

The measurement of the modulation characteristics determines the maximum frequency deviation of all 8 bit sequences of the payload.

Additionally the average value of the maximum frequency deviation of a packet will be calculated. For this purpose the equipment under test is configured in a way that packets with bit pattern "11110000" and "10101010" are transmitted alternately. According to the RF Test Specification this sequence has to be repeated 10 times.

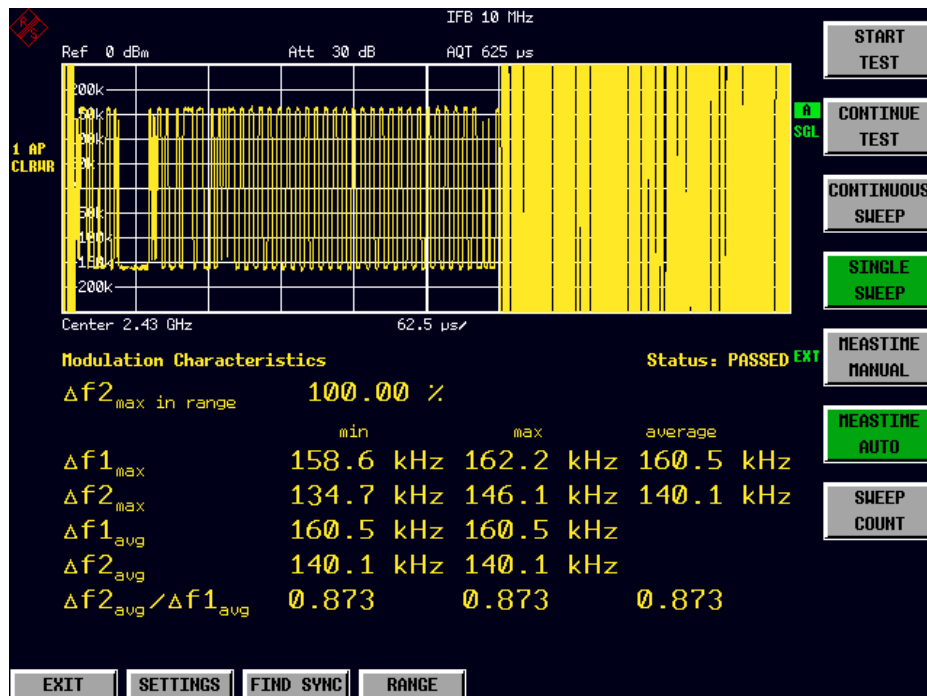


Fig. 8 Modulation Characteristics measurement

START TEST

The softkey *START TEST* initiates a new measurement. All frequency deviation values obtained earlier are discarded.

The bit pattern in the payload will be detected automatically. The frequency deviation of a packet is determined according to the procedure defined in the RF Test Specification.

```
Remote: INIT;*WAI
```

CONTINUE TEST

After the bit pattern has been toggled at the EUT the softkey *CONTINUE TEST* measures the frequency deviation of further packets, just like softkey *START TEST* did for the first bit pattern type. The results of the preceding measurement are preserved and will be taken into account during the new measurements.

```
Remote: INIT:CONM
```

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument. The number of displayed measurement results depends on the detected bit pattern.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle. The number of displayed measurement results depends on the detected bit pattern.

```
Remote:          INIT:CONT OFF
                INIT;*WAI
```

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the modulation characteristics measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 625 μ s.

```
Remote: CONF:BTO:SWE:TIME 625us
```

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the measurement time for the modulation characteristics measurement. The automatic sweep time corresponds to the settings defined in the RF Test Specification.

The default state of this function is ON.

```
Remote: CONF:BTO:SWE:TIME:AUTO ON
```

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the modulation characteristics measurement.

The valid value range is 0 to 32767, the default setting is 0.

Remote: CONF:BT0:SWE:COUN 0

3.6.4 Measuring the Initial Carrier Frequency Tolerance - Softkey *INIT CARR FREQ TOL*

The measurement of the Initial Carrier Frequency Tolerance determines the carrier offset of the four preamble bits. According to the RF Test Specification the calculation of the carrier offset is performed from the middle of the first preamble bit to the middle of the bit following the preamble.

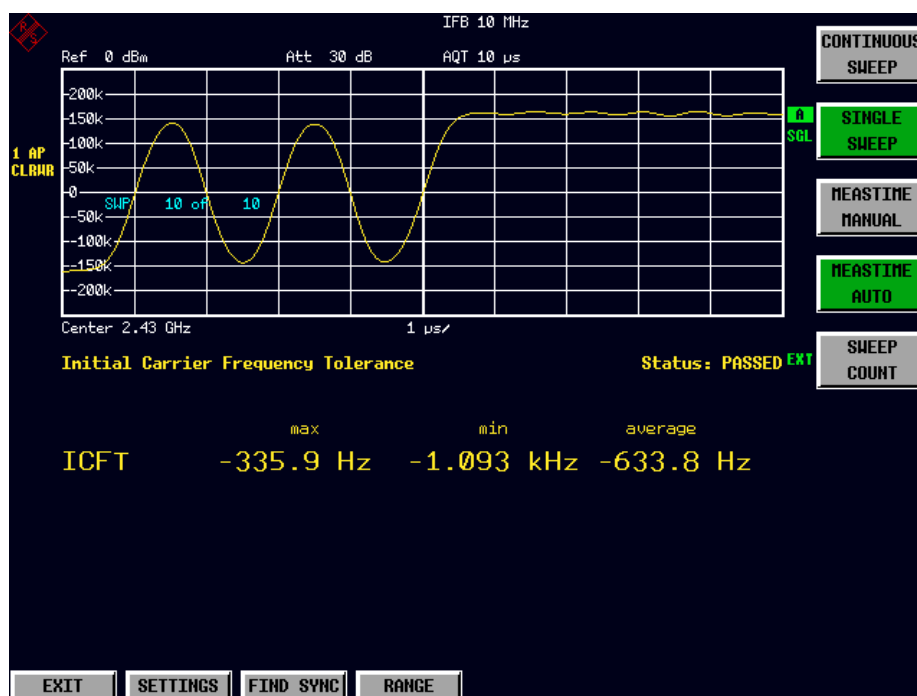


Fig. 9 Initial Carrier Frequency Tolerance measurement

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

Remote: INIT:CONT ON

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT OFF
        INIT;*WAI
```

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the initial carrier frequency tolerance measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 10 μ s.

```
Remote: CONF:BTO:SWE:TIME 625us
```

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the measurement time for the modulation characteristics measurement. The automatic sweep time corresponds to the settings defined in the RF Test Specification.

The default state of this function is ON.

```
Remote: CONF:BTO:SWE:TIME:AUTO ON
```

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the initial carrier frequency tolerance measurement.

The valid value range is 0 to 32767, the default setting is 10.



With trace mode CLEAR/WRITE and single sweep operation the selected number of sweeps will be processed and according to the RF Test Specification the results of all sweeps will be compared with the defined tolerance.

If a different trace mode is selected, the analyzer can alternatively combine several traces and determine the measurement results from the resulting trace.

```
Remote: CONF:BTO:SWE:COUN 10
```

3.6.5 Measuring the Carrier Frequency Drift - Softkey *CARRIER FREQ DRIFT*

The measurement of the Carrier Frequency Drift determines the maximum frequency drift between the average value of the preamble bits and any 10 bit group of the payload. Additionally the maximum drift rate between all 10 bit groups in the payload is determined every 50 μ s.

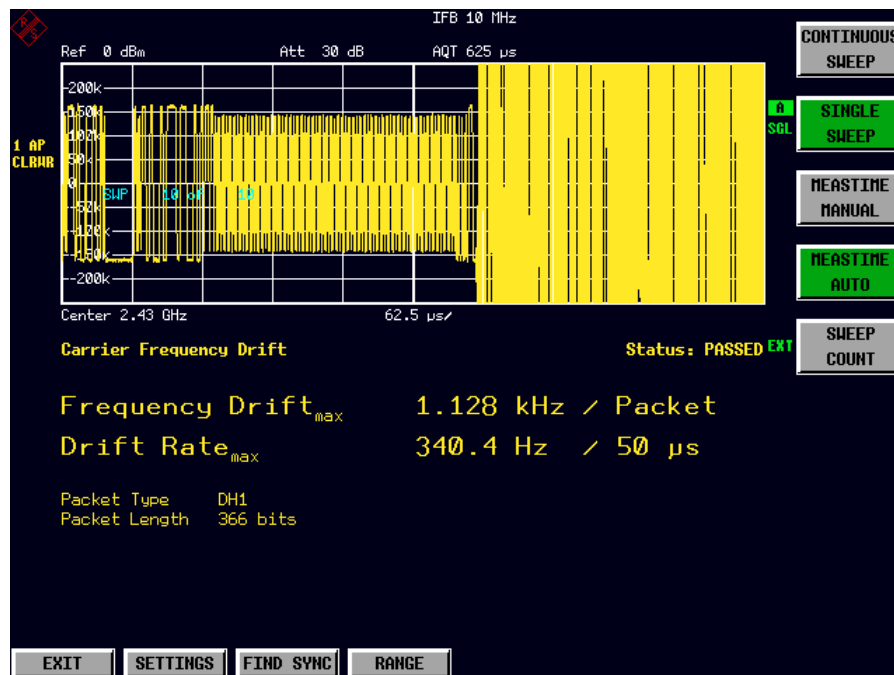


Fig. 10 Carrier Frequency Drift measurement

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

Remote: INIT:CONT ON

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

Remote: INIT:CONT OFF
INIT;*WAI

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the sweep time. The automatically calculated sweep time corresponds to the length of a packet.

Examples:

DH1	625us
DH3	1875us
DH5	3125us

As a default setting the automatic sweeptime calculation is switched on.

```
Remote: CONF:BTO:SWE:TIME:AUTO ON
```

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the Carrier Frequency Drift measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 625 μ s.

```
Remote: CONF:BTO:SWE:TIME 625us
```

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the initial carrier frequency tolerance measurement. The valid value range is 0 to 32767, the default setting is 10.



With trace mode CLEAR/WRITE and single sweep operation the selected number of sweeps will be processed and according to the RF Test Specification the results of all sweeps will be compared with the defined tolerance.

If a different trace mode is selected, the analyzer can alternatively combine several traces and determine the measurement results from the resulting trace.

```
Remote: CONF:BTO:SWE:COUN 10
```

3.6.6 Measuring the Enhanced Data rate - Softkey *EDR*

The softkey *EDR* opens a submenu with all available enhanced data rate measurements.

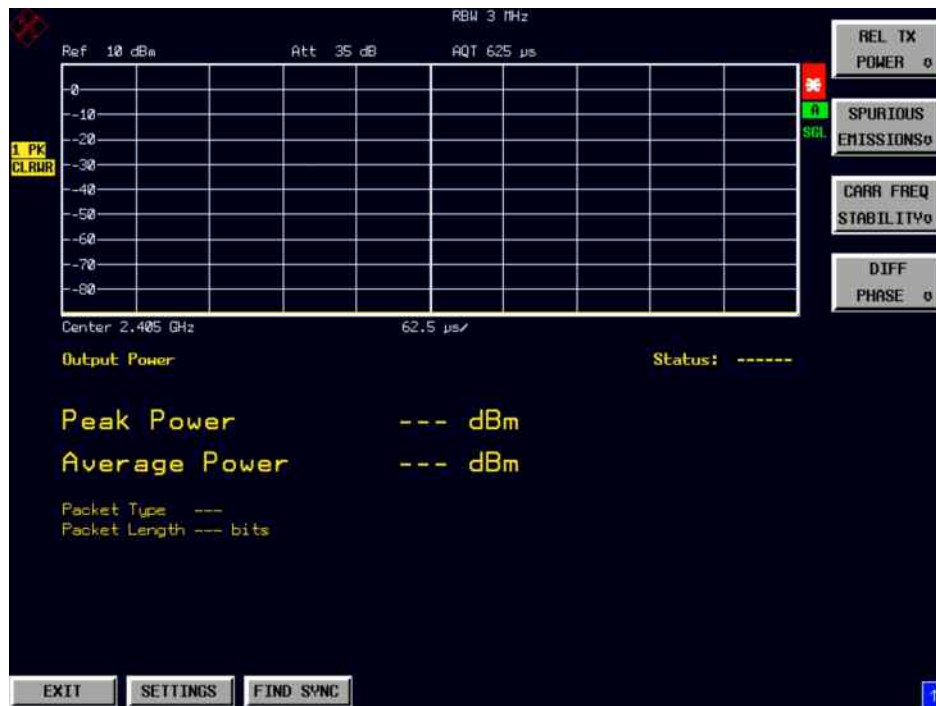


Fig. 11 Measuring the Enhanced Data rate

3.6.6.1 Relative Transmit Power (EDR) measurement

REL TX POWER

Opens a submenu to configure the Rel TX Power measurement. The measurement of the Relative Transmit Power (is an enhanced data rate measurement (EDR). It determines the average transmission power of the GFSK and DPSK modulated parts of the signal and calculates the ratio of those values.

The measurement results must conform to the requirement:

- $(P_{\text{GFSK}} - 4\text{dB}) < P_{\text{DPSK}} < (P_{\text{GFSK}} + 1\text{dB})$

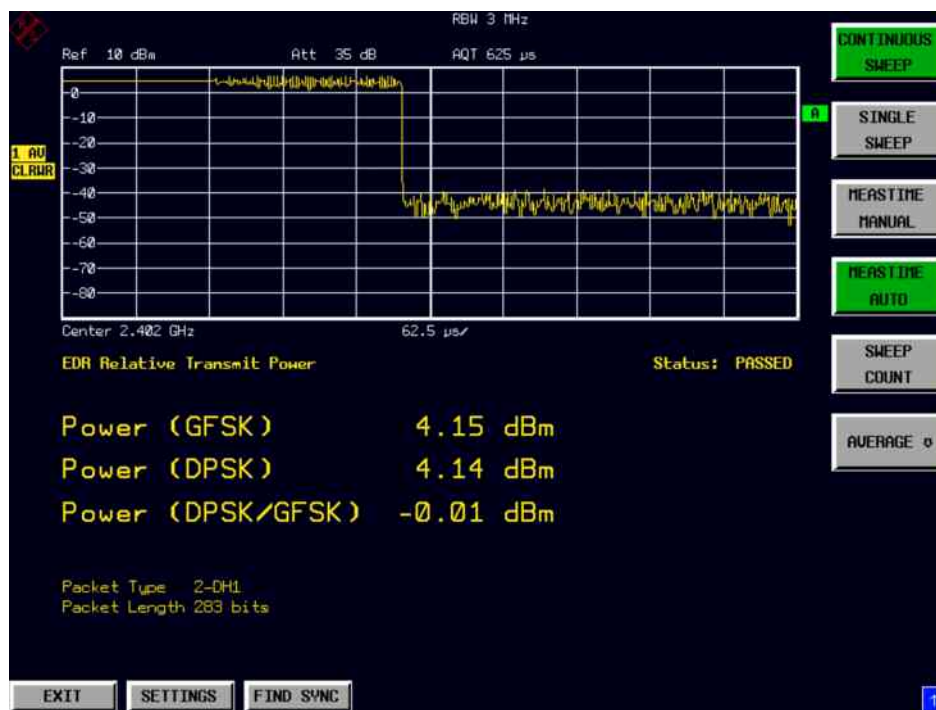


Fig. 12 Relative Transmit Power (EDR) measurement

```
Remote: CONF:BTO:MEAS RTP
        CALC:BTO:RTP? MIN
        CALC:BTO:RTP:GFSK? MIN
        CALC:BTO:RTP:RAT? MIN
```

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT OFF
        INIT;*WAI
```

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the Carrier Frequency Drift measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 625 μ s.

```
Remote: CONF:BTO:SWE:TIME 625us
```


MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the sweep time. The automatically calculated sweep time corresponds to the length of a packet.

Examples:

DH1	625us
DH3	1875us
DH5	3125us

As a default setting the automatic sweeptime calculation is switched on.

Remote: CONF:BTO:SWE:TIME:AUTO ON

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the initial carrier frequency tolerance measurement.

The valid value range is 0 to 32767, the default setting is 10.



With trace mode CLEAR/WRITE and single sweep operation the selected number of sweeps will be processed and according to the RF Test Specification the results of all sweeps will be compared with the defined tolerance.

If a different trace mode is selected, the analyzer can alternatively combine several traces and determine the measurement results from the resulting trace.

Remote: CONF:BTO:SWE:COUN 10

AVERAGE

The softkey *AVERAGE* opens the submenu for the settings required for calculation of the average power with Relative Transmit Power (EDR) measurement.

Remote: --

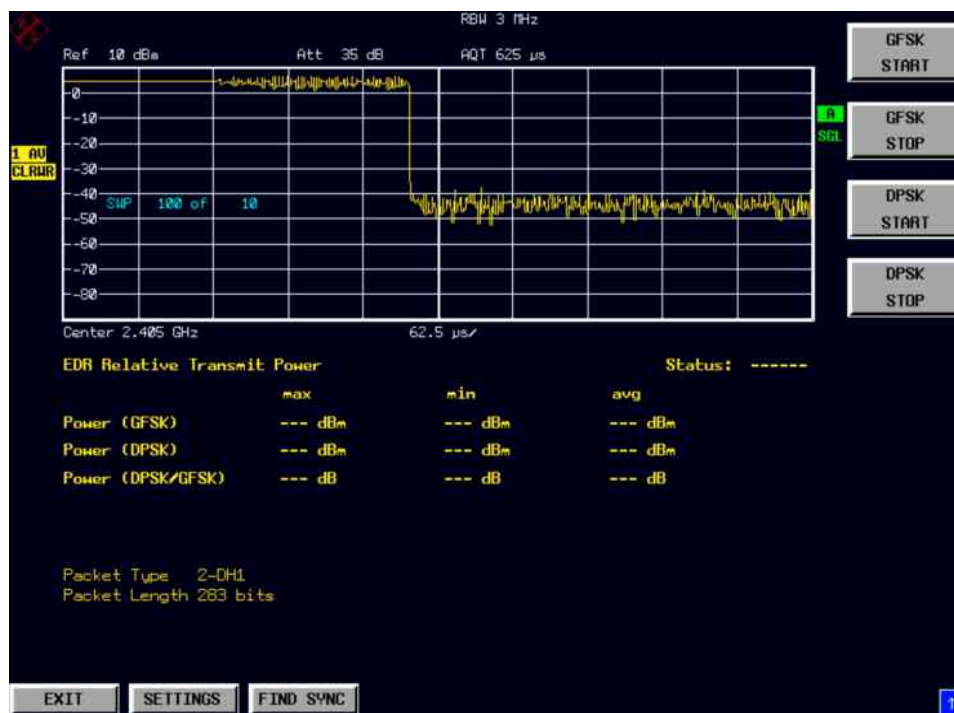


Fig. 13 Settings required for calculation - submenu Relative Transmit Power (EDR) measurement

GFSK START

Opens an edit dialog box to enter the start time for the power measurement of the GFSK sections of the packet. The default value is 10%.
The abbreviation GFSK stands for Gaussian Frequency Shift Keying.

Remote: CONF:BT0:RTP:GAV:STAR 20

GFSK STOP

Opens an edit dialog box to enter the stop time for the power measurement of the GFSK sections of the packet. The default value is 90%.
The abbreviation GFSK stands for Gaussian Frequency Shift Keying.

Remote: CONF:BT0:RTP:GAV:STOP 80

DPSK START

Opens an edit dialog box to enter the start time for the power measurement of the DPSK sections of the packet. The default value is 10%.
The abbreviation DPSK stands for Differential Phase Shift Keying.

Remote: CONF:BT0:RTP:DAV:STAR 20

DPSK STOP

Opens an edit dialog box to enter the stop time for the power measurement of the DPSK sections of the packet. The default value is 90%.
The abbreviation DPSK stands for Differential Phase Shift Keying.

Remote: CONF:BT0:RTP:DAV:STOP 80

3.6.6.2 In-band Spurious Emissions (EDR) measurement

SPURIOUS EMISSIONS

Opens a submenu to configure the Spurious Emissions measurement.

The measurement of the In-band Spurious Emissions is an enhanced data rate measurement (EDR). It verifies whether the level of unwanted signals within the used frequency band lies below the required level. The analyzer records the signal only in those parts of the signal in which the device transmits DPSK-modulated data. The signal must meet the following conditions:

- $P_{TX}(f) \leq -20$ dBm for $|M-N| = 2$
- $P_{TX}(f) \leq -40$ dBm for $|M-N| \geq 3$
with M = transmit channel of the equipment under test, N = adjacent channel to be measured
- The adjacent channel power between 1 MHz and 1.5 MHz from the carrier (Adj500kHz Lower/Upper) shall be at least 26 dB below the maximum power of the carrier (TX Channel (Ref)).

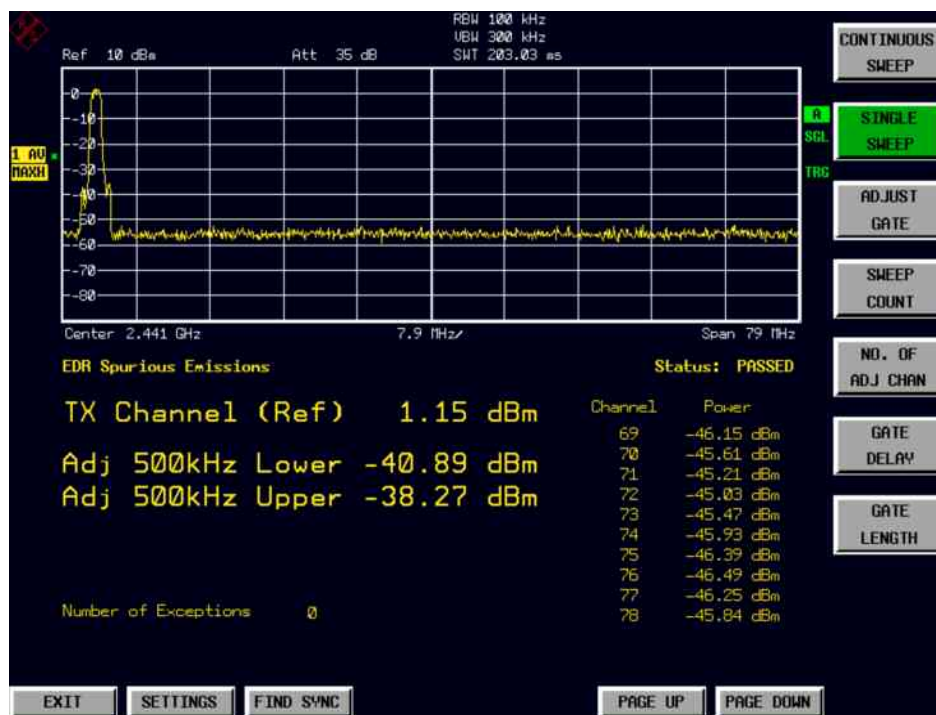


Fig. 14 In-band Spurious Emissions (EDR)

```
Remote: CONF:BTO:MEAS IBS
        CALC:BTO:IBS?
        CALC:BTO:IBS:EXC?
        CALC:BTO:IBS:HADJ? LOW
```

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote:  INIT:CONT OFF
         INIT;*WAI
```

ADJUST GATE

Adjusts the gate settings according to the pre-measurement results.

```
Remote:  CONF:BTO:IBS:GATE:AUTO ONCE
```

SWEEP COUNT

Opens an edit dialog box to enter the number of sweeps to be initiated by Single Sweep softkey. The valid value range is 0 to 32767.

```
Remote:  CONF:BTO:SWE:COUN 20
```

NO. OF ADJ CHAN

Opens an edit dialog box to enter the number of adjacent channels, for which the power is to be measured. The values range from 0 to 78. A minimum value of 3 is recommended. The default setting is 78 (all channels).

As with the ACP measurement of the basic instrument firmware this value refers to the number of adjacent channels on one side of the TX channel. This means that with a selected value of 10 the analyzer will measure in total 21 channels (10 lower channels + TX channel + 10 upper channels).

The frequency range required for the measurement is set up automatically. The center frequency will also be adapted automatically dependent on the selected TX channel. The measurement of the adjacent channels is limited to the available Bluetooth frequency band, which means that at maximum 79 channels (23 channels in France) will be measured.

```
Remote:  CONF:BTO:IBS:ACP 20
```

GATE DELAY

Opens an edit dialog box to enter the time between trigger event and start of the DPSK packet.

That is the measurement start time.

```
Remote:  SWE:EGAT:HOLD 1US
```

GATE LENGTH

Opens an edit dialog box to enter the sweep time in seconds. Usually, this is the length of the DPSK section including the power down ramp.

```
Remote:  SWE:EGAT:LENG 100US
```

3.6.6.3 Messung der Trägerfrequenzstabilität und Modulationsgenauigkeit (EDR)

CARR FREQ STABILITY

Opens a submenu to configure the Carr Freq Stability measurement.

The measurement of the Carrier Frequency Stability and Modulation Accuracy (EDR) is an enhanced data rate measurement (EDR). It verifies that the modulation accuracy and the frequency stability are working within the required limits. According to the RF Test Specification, the software records 200 blocks, each with a length of 50 μ s for the evaluation.

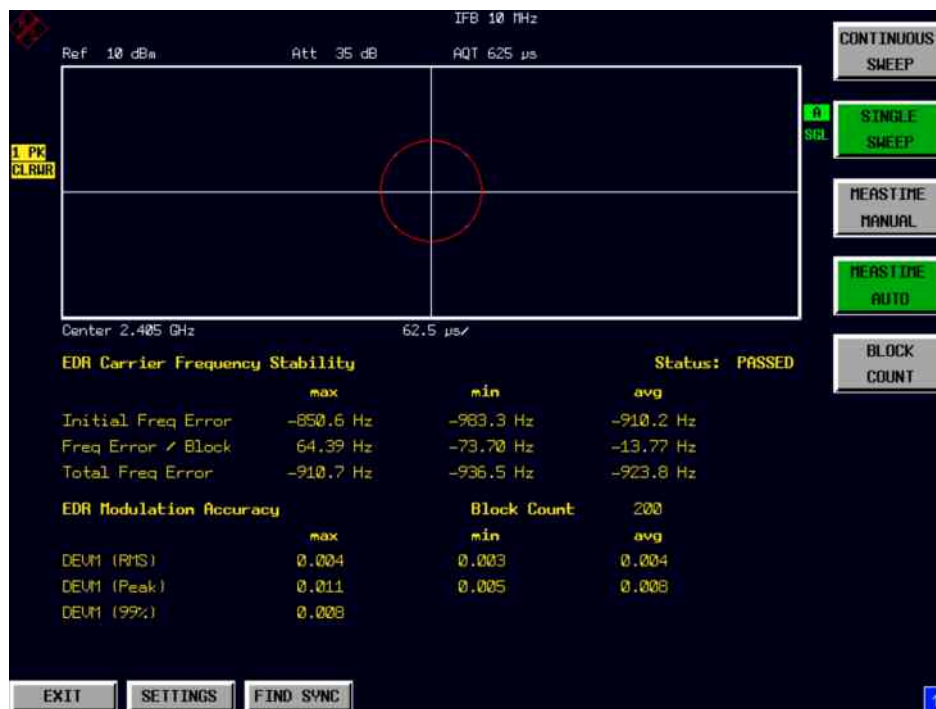


Fig. 15 Carrier Frequency Stability and Modulation Accuracy (EDR) measurement

Remote:

```

CALC:BTO:CFST:FERR? MIN
CALC:BTO:CFST:FERR;BLOC? AVER
CALC:BTO:CFST:FERR;INIT? MAX
CALC:BTO:CFST:DEVM? AVER
CALC:BTO:CFST:DEVM:PEAK?
CALC:BTO:CFST:DEVM:D99Pct?
ALC:BTO:CFST:COUN?

```

CONTINUOUS SWEEP

The softkey *CONTINUOUS SWEEP* selects continuous measurement operation. This is the default setting of the instrument.

Remote: INIT:CONT ON

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

Remote: INIT:CONT OFF
INIT;*WAI

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the Carrier Frequency Drift measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 625 μ s.

Remote: CONF:BTO:SWE:TIME 625us

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the sweep time. The automatically calculated sweep time corresponds to the length of a packet.

Examples:

DH1	625us
DH3	1875us
DH5	3125us

As a default setting the automatic sweeptime calculation is switched on.

Remote: CONF:BTO:SWE:TIME:AUTO ON

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the initial carrier frequency tolerance measurement. The valid value range is 0 to 32767, the default setting is 10.



With trace mode CLEAR/WRITE and single sweep operation the selected number of sweeps will be processed and according to the RF Test Specification the results of all sweeps will be compared with the defined tolerance.

If a different trace mode is selected, the analyzer can alternatively combine several traces and determine the measurement results from the resulting trace.

Remote: CONF:BTO:SWE:COUN 10

3.6.6.4 Differential Phase Encoding (EDR) measurement

DIFF PHASE

Opens a submenu to configure the Differential Phase Encoding measurement. The measurement of the Differential Phase Encoding (softkey) is an enhanced data rate measurement (EDR). It checks in the time range of the DPSK modulation whether the device modulates the data correctly.



Fig. 1 Differential Phase Encoding (EDR) measurement

```
Remote: CONF:BTO:MEAS DPEN
        CALC:BTO:DPEN:NERR?
        CALC:BTO:DPEN?
        CALC:BTO:DPEN:BER?
```

CONTINUOUS SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT ON
```

SINGLE SWEEP

The softkey *SINGLE SWEEP* selects single measurement operation and starts a measurement cycle.

```
Remote: INIT:CONT OFF
        INIT;*WAI
```

MEASTIME AUTO

The softkey *MEASTIME AUTO* activates the automatic calculation of the sweep time. The automatically calculated sweep time corresponds to the length of a packet

Examples:

DH1	625us
DH3	1875us
DH5	3125us

As a default setting the automatic sweeptime calculation is switched on.

Remote: CONF:BTO:SWE:TIME:AUTO ON

MEASTIME MANUAL

The softkey *MEASTIME MANUAL* opens the editor for the sweep time of the Carrier Frequency Drift measurement.

The valid value range is 1 μ s to (130560 μ s / points per symbol). The default setting is 625 μ s.

Remote: CONF:BTO:SWE:TIME 625us

SWEEP COUNT

The softkey *SWEEP COUNT* opens the editor for the number of sweeps to be initiated by softkey *SINGLE SWEEP* for the initial carrier frequency tolerance measurement.

The valid value range is 0 to 32767, the default setting is 10.

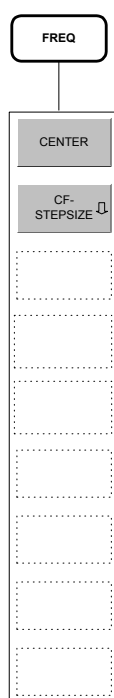


With trace mode CLEAR/WRITE and single sweep operation the selected number of sweeps will be processed and according to the RF Test Specification the results of all sweeps will be compared with the defined tolerance.

If a different trace mode is selected, the analyzer can alternatively combine several traces and determine the measurement results from the resulting trace.

Remote: CONF:BTO:SWE:COUN 10

3.7 Setting the Center Frequency - Hardkey *FREQ*



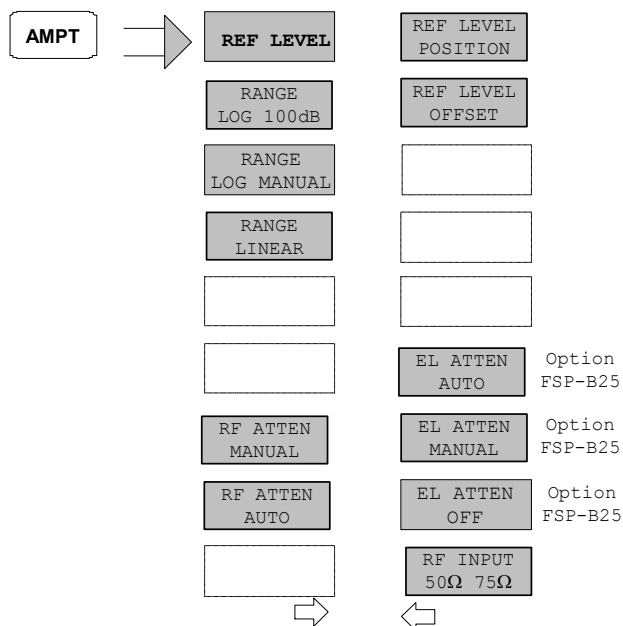
For all measurements the selection of a frequency channel via softkey *CHANNEL* in menu *SETTINGS* is necessary in order to provide correct function according to the RF Test Specification. A change of the center frequency via menu *FREQ* is possible for these measurements, but the relation to the frequency channel will be lost, which means that the value range for the center frequency is not limited to frequencies within valid frequency channels.

The return to the fixed relation between center frequency and Bluetooth frequency channels is performed at the moment when softkey *CHANNEL* is pressed or another measurement is selected. The center frequency will be rounded to the nearest frequency channel.

3.8 Setting the Frequency Range - Hardkey *SPAN*

The hardkey *SPAN* is not available in the *BLUETOOTH* operating mode.

3.9 Power Settings - Hardkey *AMPT*



The functions of menu *AMPT* are identical to those of the basic instrument.

The functions

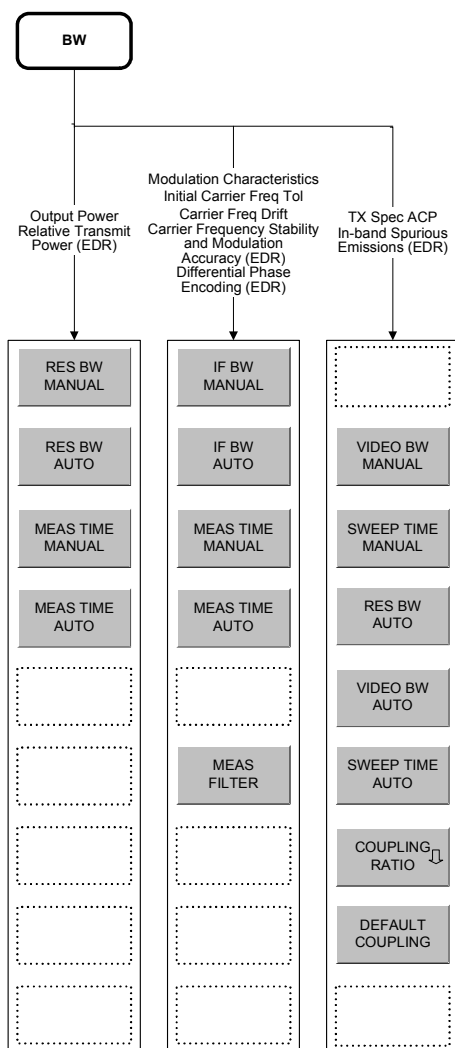
- RANGE LOG 100 dB,
- RANGE LOG MANUAL und
- RANGE LINEAR

are only available with measurements *OUTPUT POWER* and *TX SPECTRUM ACP*



The *REF LEVEL* value defines the maximum input power of the A/D converter. It must therefore be equal or higher than the maximum power of the signal under test.

3.10 Bandwidth Settings - Hardkey BW



The configuration of the bandwidths is distinguished between 3 groups of measurements:

1. Output Power, Relative Transmit Power (EDR)
Here only the setting of the resolution bandwidth (*RES BW*) and measurement time (*MEAS TIME*) is possible.
2. Modulation Characteristics, Initial Carrier Frequency Tolerance, Carrier Frequency Drift, Carrier Frequency Stability and Modulation Accuracy (EDR), Differential Phase Encoding (EDR):
In addition to the IF bandwidth (*IF BW*, is equal to the resolution bandwidth of the analyzer) and measurement time a measurement filter (*MEAS FILTER*) can be switched on or off.
Please note that the settings selected here affect all of the above measurements.
3. TX Spectrum ACP, In-band Spurious Emissions (EDR):
The video bandwidth (*VIDEO BW*) and the corresponding couplings can be selected. Resolution bandwidth and filter type cannot be modified with this

measurement function.

The following statement is equally valid for all groups of measurement functions:

The softkeys *RES BW AUTO* or *IF BW AUTO* select the bandwidths according to the values defined in the RF Test Specification.

Value range and default settings of measurement time / sweep time are described in chapter "Hardkey: MEAS" together with the corresponding softkeys *MEAS TIME / SWEEP TIME*.

The function of the softkeys *VIDEO BW MANUAL / AUTO*, *COUPLING RATIO* and *DEFAULT COUPLING* is identical to the basic instrument. Please refer to the corresponding chapters of the basic instrument operating manual.

Please note that the corresponding GPIB commands are placed in the CONF:BTO subsystem.

MEAS FILTER

The softkey *MEAS FILTER* activates a filter that limits the bandwidth for the modulation measurements.

The filter is flat within 1.04 MHz (ripple: only 0.02 dB) and has steep slopes outside this area. Minimum attenuation in the transition band. The filter has the following characteristics:

- Passband Ripple up to ± 550 kHz < 0.5 dB (peak to peak)
- Minimum attenuation in the transition band
 - ± 650 kHz: ≥ 3 dB
 - ± 1 MHz: ≥ 14 dB
 - ± 2 MHz: ≥ 44 dB

Remote: SENS:DDEM:FILT:MEAS OFF | BTO



The MEAS FILTER softkey is only available if one of the following measurements has been selected: MODULATION CARR, INIT CARR FREQ TOL, CARR FREQ DRIFT.

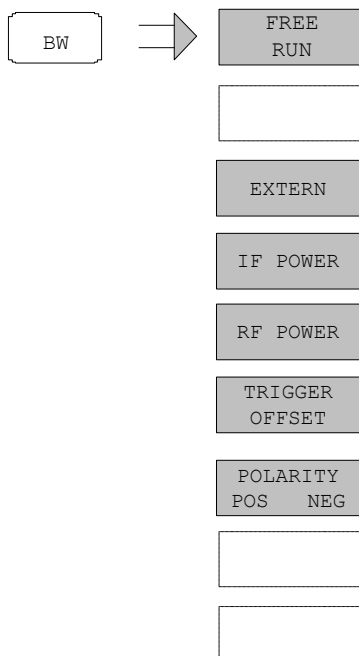
3.11 Starting Measurements - Hardkey SWEEP

In the *BLUETOOTH* operating mode the hardkey *SWEEP* is used for direct entry into the measurement menu of the currently selected measurement.. The "deviation" via the key sequence *MEAS + submenu selection* is not necessary in this case.

The functions of the individual softkeys are described in the corresponding chapter of the submenu of hardkey *MEAS*.

Please note that the corresponding GPIB commands are placed in the CONF:BTO subsystem.

3.12 Trigger Settings - Hardkey *TRIG*



The hardkey *TRIG* opens a menu to set up the various trigger sources and to select the polarity of the trigger signal. The active trigger mode is signaled by coloring the corresponding softkey.

A trigger mode different from *FREE RUN* is indicated on the screen by the enhancement label **TRG**.

The softkey *RF POWER* is only available with the R&S FSP with Option R&S FSP-B6 (TV- and RF-Trigger).

FREE RUN

The softkey *FREE RUN* activates a continuous measurement sequence, which means that there is no explicit trigger of the measurement start. At the end of one measurement the next one is started immediately.

FREE RUN is the default setting.

```
Remote: TRIG: SOUR IMM
```

EXTERN

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

```
Remote: TRIG: SOUR EXT
```

IF POWER

The *IF POWER* softkey activates triggering of the measurement via signals which are outside the measurement channel.

For this purpose, the R&S FSP uses a level detector at the second intermediate frequency. The trigger level can be selected in a range between -30 dBm and -10 dBm at the input mixer.

The R&S FSU also uses a level detector at the second intermediate frequency. The trigger level in this case can be selected in a range between -50 dBm and -10 dBm at the input mixer.

The resulting trigger level at the RF input is calculated via the following formula:

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

The bandwidth at the intermediate frequency is 10 MHz for the FSP and 50 MHz for the FSU. The analyzer is triggered as soon as the trigger threshold is exceeded within a 5 MHz range (FSU: 25 MHz range) around the selected frequency (= start frequency in the frequency sweep).. Thus, the measurement of spurious emissions, e.g. for pulsed carriers, is possible even when the carrier lies outside the selected frequency span.

Remote: TRIG:SOUR IFP

RF POWER

The *RF POWER* softkey activates triggering of the measurement via signals which are outside the measurement channel.

For this purpose, the analyzer uses a level detector at the second intermediate frequency. The trigger level can be selected in a range between -50 dBm and -10 dBm at the input mixer.

The resulting trigger level at the RF input is calculated via the following formula:

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

The bandwidth at the intermediate frequency is 80 MHz. The analyzer is triggered as soon as the trigger threshold is exceeded within a 40 MHz range around the selected frequency (= start frequency in the frequency sweep).. Thus, the measurement of spurious emissions, e.g. for pulsed carriers, is possible even when the carrier lies outside the selected frequency span.



This function is only available with the R&S FSP and only with option TV- und RF-Trigger R&S FSP-B6.

Remote: TRIG:SOUR RFP

TRIGGER OFFSET

The *TRIGGER OFFSET* softkey activates the window for entering the time offset between the trigger signal and the start of the sweep.

Triggering is delayed by the entered time with respect to the trigger signal (time entered > 0) or is started earlier (time entered < 0).

The default setting is 0 s.

Remote: TRIG:HOLD 10US

POLARITY POS/NEG

The *POLARITY POS/NEG* softkey selects the polarity of the trigger source.

The sweep starts after a positive or negative edge of the trigger signal. The selected setting is highlighted.

The selection is valid for all trigger modes with the exception of *FREE RUN*; in the gate mode, it also applies to the gate polarity.

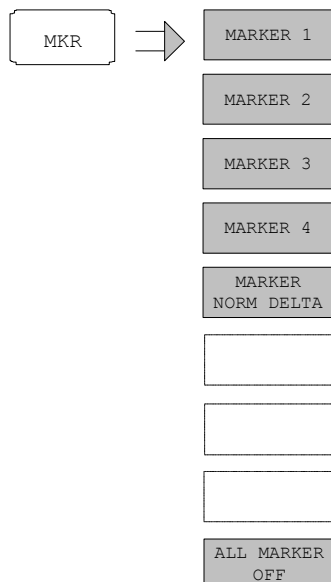
The default setting is *POLARITY POS*.



This function is only available with detector boards with model index ≥ 3 . With older boards the setting will be ignored.

Remote: TRIG:SLOP POS

3.12.2 Measurement Display - Hardkey MKR



The functions of menu *MKR* are identical to the basic instrument.

The only difference is that the display of the measurement result is coupled to the active result display.

- Output Power

- Relative Transmit Power (EDR)
- TX Spectrum ACP
- In-band Spurious Emission (EDR)

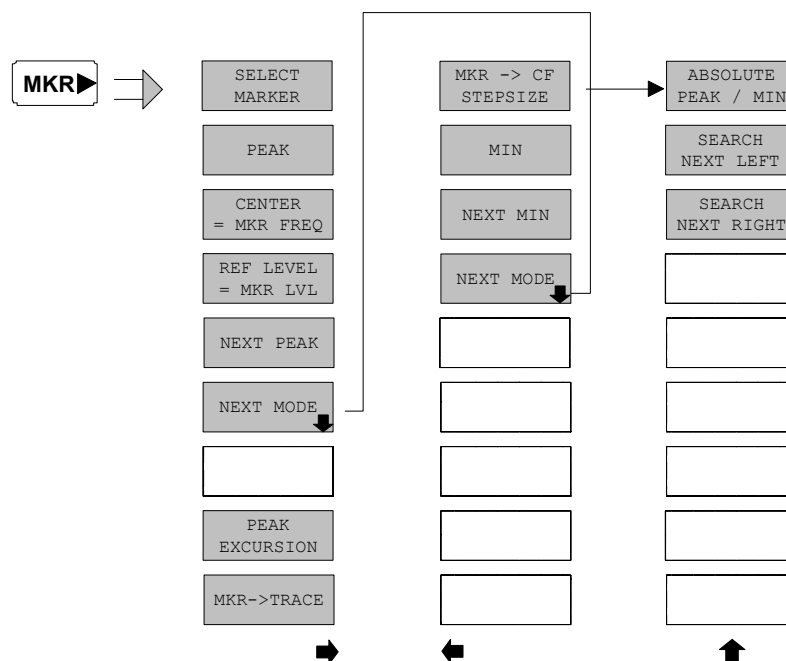
the result is displayed in dBm or dB.

For the measurements

- Modulation Characteristics
- Initial Carrier Frequency Tolerance
- Carrier Frequency Drift

the result is displayed in Hz.

3.13 Marker Search Functions - Hardkey *MKR* ⇒



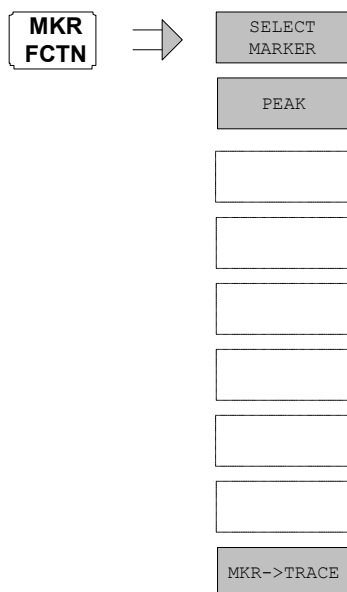
The functions of menu *MKR* ⇒ are identical to those of the basic instrument.

The functions.

- CENTER = MKR FREQ
- REF LEVEL = MKR LVL

are only available in the power measurements.

3.14 Marker Functions - Hardkey *MKR FCTN*



The available functions of menu *MKR FCTN* are identical to those of the basic instrument.

3.15 Other Hardkeys

The functions of the other hardkeys are identical to those of the basic instrument. Please refer to the corresponding chapters of the basic instrument operating manual.

Please note that some of the corresponding GPIB commands are placed in the CONF:BTO subsystem.

4 Remote Control - Description of commands

The following sections are to complete and update Chapters 5 and 6 of the R&S FSP / R&S FSU manual.

The "Description of commands" section includes the new commands valid especially for the R&S FS-K8 application, as well as modified commands of the basic instrument, as far as they are used by the R&S FS-K8 option. commands which are used equally in basic instrument and option K8 are marked accordingly in the operating manual of the basic instrument.

In the description of measurements in Chapter 3, the corresponding IEC/IEEE-bus commands are stated for each softkey.



Measurements for operating mode BLUETOOTH are always performed in screen A. Therefore all commands which use the numeric suffix for selection of the screen must be supplied with either the numeric suffix 1 (e.g. CALCulate1) or without numeric suffix (e.g. CALCulate).

4.1 Overview of the Status Registers

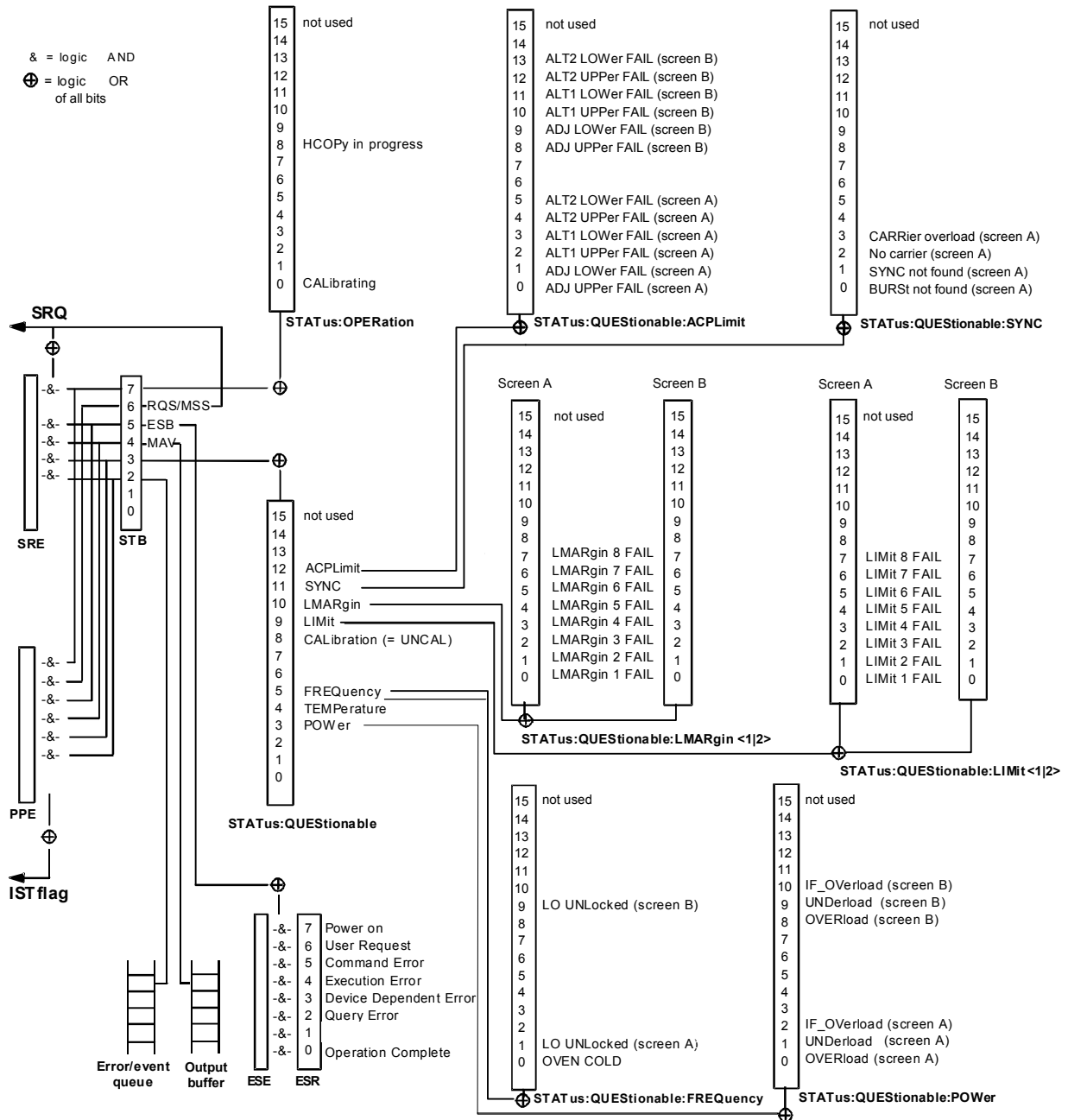


Fig. 16 Overview of the status registers



This command is only available with active Adjacent Channel Power measurement (command CONF:BTO:MEAS ACLR). With all other measurements this command will lead to a query error.

Examples:

```
INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:MEAS ACLR
'activate the Adjacent Channel Power measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:ACLR?
'query the power list
CALC:BTO:ACLR:EXC?
'query the number of exceptions
```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BTOoth:ACLR[:LIST]?

This command determines the power of the selected adjacent channels. The number of adjacent channel pairs is defined with command CONF:BTO:ACLR:ACP. The results are returned as a list of power values. The structure of the list is as follows:

<TX channel – n>...<TX channel – 1> <TX channel> <TX channel + 1>...<TX channel + n>

The number of adjacent channels is limited at the Bluetooth band limits.



This command is only available with active Adjacent Channel Power measurement (command CONF:BTO:MEAS ACLR). With all other measurements this command will lead to a query error.

Examples:

```
INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:MEAS ACLR
'activate the Adjacent Channel Power measurement
INIT;*WAI
start the measurement with synchronization
CALC:BTO:ACLR?
'query the power list
```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BTOoth:CFDRift[:MAXimum]?

This command determines the maximum Carrier Frequency Drift.



This command is only available with active Carrier Frequency Drift measurement (command CONF:BTO:MEAS CFDR). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS CFDR
'activate the CFDR measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:CFDR?
'query the result

```

Characteristics:

*RST value:
SCPI: device-specific

CALCulate:BTOoth:CFDRift:RATE?

This command determines the maximum Carrier Frequency Drift per 50 μ s.



This command is only available with active Carrier Frequency Drift measurement (command CONF:BTO:MEAS CFDR). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS CFDR
'activate the CFDR measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:CFDR:RATE?
'query the result

```

Characteristics:

*RST value:-
 SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:DEVM:DPCT?

This command reads 99% of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.
The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
'Activates the Carrier Frequency Stability and Modulation
Accuracy measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:CFST:DEVM:DPct?
'Reads 99% of the differential error vector magnitude.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:DEVM:PEAK?

This command reads the peak of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.
The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
'Activates the Carrier Frequency Stability and Modulation
Accuracy measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:CFST:DEVM:PEAK?
'Reads the peak of the differential error vector magnitude.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:DEVM[:RMS]? MINimum | MAXimum | AVERage

This command reads the root mean square (RMS) of the differential error vector magnitude (DEVM) in the Carrier Frequency Stability and Modulation Accuracy measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
```

'Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT;*WAI
```

'Starts the measurement with synchronization.

```
CALC:BTO:CFST:DEVM? AVER
```

'Reads the root mean square of the average differential error vector magnitude.

Characteristics:

*RST value: –

SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:FERRor:BLOCK? MINimum | MAXimum | AVERage

This command reads the maximum frequency deviation of all blocks in the Carrier Frequency Stability and Modulation Accuracy measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
```

'Activates the Carrier Frequency Stability and Modulation Accuracy measurement.

```
INIT;*WAI
```

'Starts the measurement with synchronization.

```
CALC:BTO:CFST:FERR:BLOC? AVER
```

'Reads the maximum average frequency deviation of all blocks.

Characteristics:

*RST value: –

SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:FERRor:INITial? MINimum | MAXimum | AVERAge

This command reads the combined frequency deviation of all packets and all blocks in the Carrier Frequency Stability and Modulation Accuracy measurement. The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
'Activates the Carrier Frequency Stability and Modulation
Accuracy measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:CFST:FERR:INIT? MAX
'Reads the combined maximum frequency deviation of all
packets and all blocks.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:CFSTability:FERRor[:TOTal]? MINimum | MAXimum | AVERAge

This command reads the carrier frequency deviation of all packets in the Carrier Frequency Stability and Modulation Accuracy measurement. The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Carrier Frequency Stability and Modulation Accuracy measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS CFST
'Activates the Carrier Frequency Stability and Modulation
Accuracy measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:CFST:FERR? MIN
'Reads the minimum carrier frequency deviation of all
packets.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:DPENcoding:BER?

This command reads the bit error rate (BER) in the Differential Phase Encoding measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Differential Phase Encoding measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS DPEN
'Activates the Differential Phase Encoding measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:DPEN:BER?
'Reads the bit error rate.
```

Characteristics:

*RST value:–
SCPI: device-specific

CALCulate<1|2>:BTOoth:DPENcoding:NERRor?

This command reads the number of passed packets in the Differential Phase Encoding measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Differential Phase Encoding measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS DPEN
'Activates the Differential Phase Encoding measurement.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:DPEN:NERR?
'Reads the number of passed packets.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:DPENcoding[:TOTal]?

This command reads the number of tested packets in the Differential Phase Encoding measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Differential Phase Encoding measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS DPEN
'Activates the Differential Phase Encoding measurement.

INIT;*WA
'Starts the measurement with synchronization.

CALC:BTO:DPEN?
'Reads the number of tested packets.
```

Characteristics:

*RST value: -
SCPI: device-specific

CALCulate<1|2>:BTOoth:IBSemissions:EXCeptions?

This command reads the number of results that exceeded the specified limits in the In-band Spurious Emissions measurement.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active In-band Spurious Emissions measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS IBS
'Activates the In-band Spurious Emissions measurement.

CONF:BTO:CHAN 7
'Adjust the TX channel number.

INIT;*WAI
'Starts the measurement with synchronization.

CALC:BTO:IBS:EXC?
'Reads the number of results that exceeded the specified
limits.
```

Characteristics:

*RST value: -
SCPI: device-specific

CALCulate<1|2>:BTOoth:IBSemiissions:HADJacent? UPPer | LOWer

This command reads the maximum power of the upper or lower frequency band (500 kHz) of the TX channel in the In-band Spurious Emissions measurement. The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active In-band Spurious Emissions measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS IBS
'Activates the In-band Spurious Emissions measurement.
CONF:BTO:CHAN 7
'Adjust the TX channel number.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:IBS:HADJ? LOW
'Reads the maximum power of the lower frequency band.
```

Characteristics:

*RST value: -
SCPI: device-specific

CALCulate<1|2>:BTOoth:IBSemiissions[:List]?

This command reads the power of all adjacent channels in the In-band Spurious Emissions measurement. The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active In-band Spurious Emissions measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS IBS
'Activates the In-band Spurious Emissions measurement.
CONF:BTO:CHAN 7
'Adjust the TX channel number.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:IBS?
'Reads the results of the In-band Spurious Emissions
measurement.
```

Characteristics:

*RST value: -
SCPI: device-specific

CALCulate<1|2>:BTOoth:IBSemiissions:TXReference?

This command reads the TX channel reference power.
The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active In-band Spurious Emissions measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS IBS
'Activates the In-band Spurious Emissions measurement.
CONF:BTO:CHAN 7
'Adjust the TX channel number.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:IBS:TXR?
'Reads the TX channel reference power.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate:BTOoth:ICFTolerance? MINimum | MAXimum | AVERage

This command determines the Initial Carrier Frequency Tolerance.
With a sweep count value of ≥ 1 (*CONF:BTO:SWE:COUN*) and trace mode clear/write (*DISP:WIND:TRAC:MODE WRIT*) several measurements will be performed with one single command (*INIT:IMM* or *INIT:CONM*). In this case all the measurements will be taken into account for calculation of the minimum / maximum / average value. Minimum, maximum and average value will be equal if only one measurement was executed.



The commands are only available with active Modulation Characteristics measurement (command *CONF:BTO:MEAS MCH*). With all other measurements this command will lead to a query error.

Examples:

```
INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
```

```

'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0'
set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS ICFT
'activate the ICFT Measurement
CONF:BTO:SWE:COUN 20
'init the sweep counter with 20
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:ICFT? MIN
'query the minimum value
CALC:BTO:ICFT? MAX
'query the maximum value
CALC:BTO:ICFT? AVER
'query the average value

```

Characteristics:

*RST value:-
 SCPI: device-specific

CALCulate:BTOoth:MCHar:DF<1|2>:AVERage? MINimum | MAXimum

This command determines the average frequency deviation for varying bit patterns of the payload. The assignment of command to frequency deviation and bit pattern is as follows:

Frequency deviation	$\Delta f_{1\text{avg}}$	$\Delta f_{2\text{avg}}$
Bit pattern	11110000"10101010"	
Minimum value	CALC:BTO:MCH:DF1:AVER? MIN	CALC:BTO:MCH:DF2:AVER? MIN
Maximum value	CALC:BTO:MCH:DF1:AVER? MAX	CALC:BTO:MCH:DF2:AVER? MAX

The command INIT:IMM starts a new measurement and erases the previous results. Further measurements can be performed using the command INIT:CONM, which allows calculation of minimum and maximum values over several measurements. Minimum and maximum value will be equal if only one measurement was executed.

With a sweep count value of ≥ 1 (CONF:BTO:SWE:COUN) and trace mode clear/write (DISP:WIND:TRAC:MODE WRIT) several measurements will be performed with one single command (INIT:IMM or INIT:CONM). In this case all the measurements will be taken into account for calculation of the minimum / maximum value.



The commands are only available with active Modulation Characteristics measurement (command CONF:BTO:MEAS MCH). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS MCH
'activate the Modulation Characteristics measurement
CONF:BTO:SWE:COUN 20
'init the sweep counter with 20 EUT emits bit pattern 1111000
INIT:IMM;*WAI
'start the measurement with
synchronization and erase previous
'measurement results
CALC:BTO:MCH:DF1:MAX? MIN
'query minimum value 11110000
CALC:BTO:MCH:DF1:MAX? MAX
'query maximum value 11110000
CALC:BTO:MCH:DF1:MAX? AVER
'query average value 11110000 EUT emits bit pattern 10101010

```

Characteristics:

*RST value:-
 SCPI: device-specific

CALCulate:BTOoth:MCHar:DF2:PERCent?

This command determines the percentage of measurements of the frequency deviation, for which the value of $\Delta f_{2_{\max}}$ is within the allowed range.



The numeric suffix 1 (...:DF1:Percent?) is not allowed for this command.

The command is only available with active Modulation Characteristics measurement (command CONF:BTO:MEAS MCH). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS MCH
'activate the Modulation Characteristics 'measurement
CONF:BTO:SWE:COUN 20
'init the sweep counter with 20.. EUT emits bit pattern
10101010
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:MCH:DF2:PERC?
'query the percentage of in range 'measurements

```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BTOoth:MCHar:RATio? MINimum | MAXimum | AVERage

This command determines the ratio of the average frequency deviations for varying bit patterns of the payload. The assignment of command to frequency deviation and bit pattern is as follows:

Frequency deviation $\Delta f_{2_{avg}}/\Delta f_{1_{avg}}$

Minimum value CALC:BTO:MCH:RAT? MIN

Maximum value CALC:BTO:MCH:RAT? MAX

Average value CALC:BTO:MCH:RAT? AVER

The command INIT:IMM starts a new measurement and erases the previous results. Further measurements can be performed using the command INIT:CONM, which allows calculation of minimum and maximum values over several measurements. Minimum, maximum and average value will be equal if only one measurement was executed.

With a sweep count value of ≥ 1 (CONF:BTO:SWE:COUN) and trace mode clear/write (DISP:WIND:TRAC:MODE WRIT) several measurements will be performed with one single command (INIT:IMM or INIT:CONM). In this case all the measurements will be taken into account for calculation of the minimum / maximum / average value.



The commands are only available with active Modulation Characteristics measurement (command CONF:BTO:MEAS MCH). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS MCH
'activate the Modulation Characteristics 'measurement
CONF:BTO:SWE:COUN 20
'init the sweep counter with 20 ... EUT emits bit pattern
1111000
INIT:IMM;*WAI
'start the measurement with synchronization and erase
previous measurement results ... EUT emits bit pattern
10101010
INIT:CONM;*WAI
'start additional measurement with synchronization
CALC:BTO:MCH:RAT? MIN
'query the minimum value
CALC:BTO:MCH:RAT? MAX
'query the maximum value
CALC:BTO:MCH:RAT? AVER
'query the average value

```

Characteristics:

*RST value:-
 SCPI: device-specific

CALCulate:BTOoth:OPOwer:AVERage? MINimum | MAXimum

This command reads the average value of the Output Power measurement according to the Bluetooth standard.

With a sweep count value of ≥ 1 (*CONF:BTO:SWE:COUN*) and trace mode clear/write (*DISP:WIND :TRAC:MODE WRIT*) the selected number of measurements is performed when a single sweep is started (*INIT:IMM*). During these measurements the minimum and maximum values are determined.

If only a single measurement is performed, the minimum and maximum value will be identical.



This command is only available with active Output Power measurement (command *CONF:BTO:MEAS OPOW*). With all other measurements this command will lead to a query error.

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:CHAN 10
'select channel 10
CONF:BTO:GEOG EUR
'select geographical region Europe
CONF:BTO:PCL 1
'select power class 1
CONF:BTO:PRAT 4
'select 4 points per symbol
CONF:BTO:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:PULS:OFFS 0s
'set burst offset = 0
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BTO:MEAS OPOW
'activate the Output Power Measurement
CONF:BTO:SWE:COUN 20
'activate measurement over 20 sweeps
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:OPOW:AVER? MAX
'query the maximum average value of the Output Power measurement

```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BT0oth:OPower[:PEAK]?

This command reads the peak value of the Output Power Measurement according to the BLUETOOTH standard.



This command is only available with active Output Power Measurement (command CONF:BT0:MEAS OPOW). With all other measurements it will lead to a query error.

Examples:

```
NST:SEL BTO
'activates the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BT0:CHAN 10
'select channel 10
CONF:BT0:GEOG EUR
'select geographical region Europe
CONF:BT0:PCL 1
'select power class 1
CONF:BT0:PRAT 4
'select 4 points per symbol
CONF:BT0:PTYP DH1
'select 1 slot packet
DDEM:SEAR:PULS ON
'activate the FIND BURST function
DDEM:SEAR:PULS:OFFS 0s
'set burst offset = 0
DDEM:SEAR:SYNC ON
'activate the FIND SYNC function
DDEM:SEAR:SYNC:OFFS 0
'set the sync offset = 0
DDEM:SEAR:SYNC:LAP #H0
'set the lower address part = 0
DDEM:SEAR:TIME:AUTO ON
'select automatic search length
CONF:BT0:MEAS OPOW
'activate the Output Power Measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BT0:OPower?
'query the output power result
```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BT0oth:PLENght?

This command reads the length of the packet analyzed by the preceding measurement.



This command is only available, if a measurement was started via INIT:IMMEDIATE before and if this measurement is completed. With a missing or incomplete measurement the command will cause a query error.

This command is only available with measurement of Output Power ((CONF:BT0:MEAS OPOW), Modulation Characteristics (CONF:BT0:MEAS MCH), Initial Carrier Frequency Tolerance (CONF:BT0:MEAS ICFT) and Carrier Frequency Drift (CONF:BT0:MEAS CFDR).

Examples:

```
INST:SEL BT0
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BT0:MEAS OPOW
'activate the Output Power Measurement
INIT;*WAI
'tart the measurement with synchronization
CALC:BT0:PLEN?
'query the packet length
```

Characteristics:

*RST value:-
SCPI: device-specific

CALCulate:BT0oth:PTYPe?

This command determines the type of the packet analyzed by a preceding measurement.



This command is only available, if a measurement was started via INIT:IMMEDIATE before and if this measurement is completed. With a missing or incomplete measurement the command will cause a query error.

This command is only available with measurement of Output Power ((CONF:BT0:MEAS OPOW), Modulation Characteristics (CONF:BT0:MEAS MCH), Initial Carrier Frequency Tolerance (CONF:BT0:MEAS ICFT) and Carrier Frequency Drift (CONF:BT0:MEAS CFDR).

Response:

The following packet types are **identified** and returned as character data
AUX1, DH1, DH3, DH5, DM1, DM3, DM5, FHS, HV1, HV2, HV3, DV, NULL,
POLL, UNDEF

Examples:

```

INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:MEAS OPOW
'activate the Output Power Measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:PTYP?
'query the packet type

```

Characteristics:

*RST value:-
 SCPI: device-specific

CALCulate<1|2>:BTOoth:RTPower[:DPSK]? MINimum | MAXimum | AVERage

This command reads the transmission power for the GFSK sections of the packet in the Relative Transmission Power measurement. With a sweep count ≤ 1 , the command returns the current value, irrespective of the parameter.

The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Relative Transmit Power measurement. With all other measurements this command will lead to a query error.

Examples:

```

CONF:BTO:MEAS RTP
'Activates the Relative Transmit Power measurement.
CONF:BTO:SWE:COUN 10
'Initiates the sweep counter with 10.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:RTP? MIN
'Reads the highest recorded average power of the GFSK section
of all packets.

```

Characteristics:

*RST value: –
 SCPI: device-specific

CALCulate<1|2>:BTOoth:RTPower:GFSK? MINimum | MAXimum | AVERAge

This command reads the transmission power for the GFSK sections of the packet in the Relative Transmission Power measurement. With a sweep count ≤ 1 , the command returns the current value, irrespective of the parameter. The numeric suffixes <1|2> are irrelevant for this command.



This command is only available with active Relative Transmit Power measurement. With all other measurements this command will lead to a query error.

Examples:

```
CONF:BTO:MEAS RTP
'Activates the Relative Transmit Power measurement.
CONF:BTO:SWE:COUN 10
'Initiates the sweep counter with 10.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:RTP:GFSK? MIN
'Reads the highest recorded average power of the GFSK section
of all packets.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate<1|2>:BTOoth:RTPower:RATio? MINimum | MAXimum | AVERAge

This command reads the transmission power ratio for the GFSK and DPSK modulations when measuring the relative transmission power (P_{DPSK}/P_{GFSK}). Using a sweep count ≤ 1 , the command resets the actual value regardless of the parameter. The numeric suffix <1|2> is irrelevant for this command.



This command is only available when the relative transmission power measurement is switched on. With all other measurements, this command results in a query error.

Examples:

```
CONF:BTO:MEAS RTP
'Switches the relative transmission power on.
CONF:BTO:SWE:COUN 10
'Begins the sweep count at 10.
INIT;*WAI
'Starts the measurement with synchronization.
CALC:BTO:RTP:RAT? MIN
'Determines the minimum value.
```

Characteristics:

*RST value: –
SCPI: device-specific

CALCulate:BT00th:STATus?

This command queries the status of a preceding measurement.

Results: 0: PASS
1: FAIL.



This command is only available, if a measurement was started via INIT:IMMEDIATE before and if this measurement is completed. With a missing or incomplete measurement the command will cause a query error.

Examples:

```
INST:SEL BTO
'activate the Bluetooth option
INIT:CONT OFF
'select single sweep operation
CONF:BTO:MEAS OBW
'activate the OBW measurement
INIT;*WAI
'start the measurement with synchronization
CALC:BTO:STAT?
'query the status
```

Characteristics:

*RST value:-
SCPI: device-specific

4.3.2 CALCulate:DELTaMarker - Subsystem

The CALCulate:DELTaMarker subsystem controls the delta-marker functions in the instrument. The measurement windows are selected via CALCulate1 (screen A) or 2 (screen B).

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 or to the reference position (reference fixed active).

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 unit defined with CALC:UNIT or on the activated measuring functions, the query result is output in the units below:

- DBM | DBPW | DBUV | DBMV | DBUA: Output unit DB
- WATT | VOLT | AMPere: Output unit W | V | A
- Statistic function (APD or CCDF) on: Dimensionless output

Result Displays:

- FM (FS-K7):	Hz
- RF POWER (FS-K7):	dB
- SPECTRUM (FS-K7):	dB
- OUTPUT POWER:	dB
- TX SPECTRUM ACP:	dB
- MODULATION CHARACTERISTICS:	Hz
- INITIAL CARR FREQ TOL:	Hz
- CARRIER FREQ DRIFT:	Hz

Examples:

```
INIT:CONT OFF
'Switches to single-sweep mode.
CALC:DELT2 ON
'Switches on delta marker 2 in screen A.
INIT;*WAI
'Starts a sweep and waits for its end.
CALC:DELT2:Y?
'Outputs measurement value of delta marker 2 in 'screen A.
```

Characteristics:

*RST value:
SCPI: device-specific

4.3.3 CALCulate:MARKer - Subsystem

The CALCulate:MARKer subsystem checks the marker functions in the instrument. The measurement windows are assigned to CALCulate 1 (screen A) or 2 (screen B).

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

This command defines the peak excursion., i.e. the spacing below a trace maximum which must be attained before a new maximum is recognized, or the spacing above a trace minimum which must be attained before a new minimum is recognized. The set value is valid for all markers and delta markers. The unit depends on the selected operating mode. The numeric suffix in MARKer<1 to 4> is irrelevant.

Examples:

```
CALC:MARK:PEXC 10dB
'Defines peak excursion 10 dB in SPECTRUM mode
CALC:MARK:PEXC 100 Hz
'Defines peak excursion 100 Hz in FM DEMOD + BLUETOOTH
```

Characteristics:

*RST value:6dB
SCPI: device-specific

The numeric suffix in MARKer<1 to 4> 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.

The query result is output in the unit determined with `CALCulate:UNIT`.

In the default setting, the output is made depending on the unit determined with `CALC:UNIT`; only with linear level scaling is the output in %.

If the FM Demodulator (R&S FS-K7) is activated, the query result is output in the following units:

- Result display FM: Hz
- Result display RF POWER LOG: dBm
- Result display RF POWER LIN: %
- Result display SPECTRUM LOG: dBm
- Result display SPECTRUM LIN: %

If the BLUETOOTH Demodulator (R&S FS-K8) is activated, the query result is output in the following units:

- OUTPUT POWER: dBm
- TX SPECTRUM ACP: dBm
- MODULATION CHARACTERISTICS: Hz
- INITIAL CARR FREQ TOL: Hz
- CARRIER FREQ DRIFT: Hz

Examples:

```
INIT:CONT OFF
'Switches to single-sweep mode.
CALC:MARK2 ON
'Switches marker 2 in screen A.
INIT;*WAI
'Starts a sweep and waits for the end.
CALC:MARK2:Y?
'Outputs the measured value of marker 2 in screen A.
```

Characteristics:

*RST value: -
SCPI: device-specific

4.4 CONFigure – Subsystem

4.4.1 CONFigure:BT0oth – Subsystem

The following commands are used for configuration of the BLUETOOTH analyzer operating mode.

CONFigure:BT0oth:ACLR:ACPairs <numeric value>

This command selects the number of adjacent channel pairs during the measurement of the adjacent channel power. The number of adjacent channels will be limited as soon as the border of the Bluetooth frequency band is reached.



This command is only available with active Adjacent Channel Power Measurement (command: CONF:BT0:MEAS ACLR).

Examples:

```
CONF:BT0:ACLR:ACP 10
'selects 10 adjacent channel pairs
```

Characteristics:

*RST value:78
SCPI: device-specific

CONFigure:BT0oth:BANDwidth|BWIDTH[:RESolution] <numeric_value>

This command sets the resolution bandwidth of the analyzer for the currently selected Bluetooth measurement (see command [SENSe:]BAND:RES). For the measurements of Modulation Characteristics (CONF:BT0:MEAS MCH), Initial Carrier Frequency Tolerance (CONF:BT0:MEAS ICFT) and Carrier Frequency Drift (CONF:BT0:MEAS CFDR) the resolution bandwidth corresponds to the IF bandwidth of the signal.

Setting range::	300kHz ...10MHz	Output Power; Modulation Characteristics, Initial Carrier Frequency Tolerance, Carrier Frequency Drift
	100kHz	TX Output Spectrum Adjacent Channel Power

A change to the resolution bandwidth will stop its link to the settings of the RF Test Specification.



The settings for the measurements of Modulation Characteristics (CONF:BT0:MEAS MCH), Initial Carrier Frequency Tolerance (CONF:BT0:MEAS ICFT) and Carrier Frequency Drift (CONF:BT0:MEAS CFDR) is common to all three measurements. For all other Bluetooth measurements the setting is only valid for the currently active measurement (see command CONF:BT0:MEAS). This command is not available with active adjacent channel power measurement (command: CONF:BT0:MEAS ACLR).

Examples:

```

INST:SEL BTO
'Activates the Bluetooth option
CONF:BTO:MEAS OBW
'Activates the TX Output Spectrum 20dB Bandwidth measurement
CONF:BTO:BAND 1KHZ
'Sets the resolution bandwidth to 1kHz

```

Characteristics:

*RST value:- (AUTO is set to ON)
 SCPI: device-specific

CONFigure:BTOoth:BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF

This command links the resolution bandwidth to the settings according to the RF Test Specification.



The settings for the measurements of Modulation Characteristics (*CONF:BTO:MEAS MCH*), Initial Carrier Frequency Tolerance (*CONF:BTO:MEAS ICFT*) and Carrier Frequency Drift (*CONF:BTO:MEAS CFDR*) is common to all three measurements. For all other Bluetooth measurements the setting is only valid for the currently active measurement (see command [CONF:BTO:MEAS](#)).

Examples:

```

INST:SEL BTO
'activates the Bluetooth option
CONF:BTO:MEAS OPOW
'activates the Output Power measurement
CONF:BTO:BAND:AUTO ON
'activates the RBW coupling

```

Characteristics:

*RST value: ON
 SCPI: device-specific

CONFigure:BTOoth:BANDwidth|BWIDth:VIDeo 1 Hz ... 10 MHz

This command sets the video bandwidth for the currently selected Bluetooth measurement. It is only available for the measurement of TX Output Spectrum Adjacent Channel Power (*CONF:BTO:MEAS ACLR*). The available filters have a bandwidth range of 1 Hz to 10 MHz. On a change in video bandwidth its link according to the RF Test Specification is switched off.



This setting is valid only for the currently active measurement (see command *CONF:BTO:MEAS*) and it is independent of other Bluetooth measurements.

Examples:

```

INST:SEL BTO
'activates the Bluetooth option
CONF:BTO:MEAS ACLR
'activates the Output Power measurement
CONF:BTO:BAND:VID 100HZ
'sets the video bandwidth to 100 Hz

```

Characteristics:

*RST value:(AUTO is set to ON)
 SCPI: device-specific

CONFigure:BT0oth:BANDwidth|BWIDth:VIDeo:AUTO ON | OFF

This command links the video bandwidth to the settings according to the RF Test Specification. It is only available for the measurement of TX Output Spectrum Adjacent Channel Power (*CONF:BTO:MEAS ACLR*).



This setting is only valid for the currently active measurement (see command [CONF:BTO:MEAS](#)) and it is independent for the other Bluetooth measurements.

Examples:

```

INST:SEL BTO
'activates the Bluetooth option
CONF:BTO:MEAS OPOW
'activates the Output Power measurement
CONF:BTO:BAND:VID:AUTO ON
'switches the VBW coupling on

```

Characteristics:

*RST value: ON
 SCPI: device-specific

CONFigure:BT0oth:CHANnel 0...78

This command selects the frequency channel for the measurements according to the Bluetooth standard.



The value range depends on the selected geographical region ([SENS:]BTO:GEOG):
 EUROpe, USA: 0...78
 FRANce: 0...22

Examples:

```

CONF:BTO:CHAN 20
'select channel 20

```

Characteristics:

*RST value:0
 SCPI: device-specific

CONFigure:BT0oth:DETEctor<1...3> APEak | NEGative | POSitive | SAMPlE | RMS | AVERAge

This command selects the detector for the currently selected Bluetooth measurement. The numeric suffix assigns the detector to a trace (1 to 3).



The RMS detector is not available for the measurements Modulation Characteristics (*CONF:BT0:MEAS MCH*), Initial Carrier Frequency Tolerance (*CONF:BT0:MEAS ICFT*) and Carrier Frequency Drift (*CONF:BT0:MEAS CFDR*). The setting is valid for the currently selected measurement (see command *CONF:BT0:MEAS*) and independent of other Bluetooth measurements.

Examples:

```
INST:SEL BTO
'activates the Bluetooth option
CONF:BT0:MEAS OPOW
'activates the Output power measurement
CONF:BT0:DET2 RMS
'sets the detector for trace 2 to RMS
```

Characteristics:

**RST value: PEAK Output Power; ,
 AVER TX Output Spectrum Adjacent Channel Power,
 APEAK Modulation Characteristics,
 Initial Carrier Frequency Tolerance,
 Carrier Frequency Drift
 SCPI: device-specific

CONFigure:BT0oth:GEOGraphy EURope | USA | FRANce

This command selects the geographical region for the measurements:

```
EURope: Europe outside France
USA:    USA
FRANce: France
```

The region determines the number of available frequency channels (command: [SENSe:]BT0oth:CHANnel). Additionally the standard for the measurement of spurious emissions will be selected: ETS 300 328 (Europe incl. France) or FCC Part 15.247,c (USA).

Examples:

```
CONF:BT0:GEOG USA
'selects region USA
```

Characteristics:

*RST value: EURope
 SCPI: device-specific

CONFigure:BT0oth:IBSemiissions:ACPairs 1 to 78

This command selects the number of adjacent channel pairs during the In-band Spurious Emissions measurement. The number of adjacent channels will be limited as soon as the border of the Bluetooth frequency band is reached.



This command is only available with active In-band Spurious Emissions measurement.

Examples:

```
CONF:BT0:IBS:ACP 20
'Selects 20 adjacent channel pairs.
```

Characteristics:

*RST value: 78
SCPI: device-specific

CONFigure:BT0oth:IBSemiissions:GATE:AUTO ONCE

This command adjusts the gate settings for the In-band Spurious Emissions automatically.



This command is only available with active In-band Spurious Emissions measurement.

Examples:

```
CONF:BT0:IBS:GATE:AUTO ONCE
'Adjusts the gate automatically once.
```

Characteristics:

*RST value: ONCE
SCPI: device-specific

CONFigure:BT0oth:MEASurementOPOWER | ACLR | MCHar | CFTolerance | CFDRift | RTPower | IBSEmissions | DPENcoding | CFSTability

This command selects the current measurement according to the Bluetooth standard.

OPOWER	Output Power measurement
ACLR	Adjacent Channel Power measurement
MCHar	Modulation Characteristics measurement
ICFTolerance	Initial Carrier Frequency Tolerance measurement
CFDRift	Carrier Frequency Drift measurement
RTPower	Relative Transmit Power (EDR) measurement
IBSEmissions	Spurious Emissions (EDR) measurement
DPENcoding	Differential Phase Encoding (EDR) measurement
CFSTability	Carrier Frequency Stability and Modulation Accuracy (EDR) measurement

Examples:

```
CONF:BT0:MEAS ACLR
'Selects the measurement of the adjacent channel power.
```

Characteristics:

```
*RST value: OPOWER
SCPI: device-specific
```

CONFigure:BT0oth:PBSCo 1 ... 1000

This command selects the number of payload bytes that are transmitted in a packet.

Examples:

```
CONF:BT0:PBSC 50
'Selects the number of payload bytes.
```

Characteristics:

```
*RST value: 1
SCPI: device-specific
```

CONFigure:BT0oth:PCLass 1...3

This command selects the power class for the Output Power measurement. The power class defines the limits for the Output Power measurement.

Examples:

```
CONF:BT0:PCL 3
'selects power class 3
```

Characteristics:

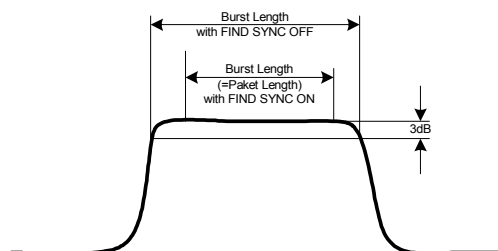
```
*RST value:1
SCPI: device-specific
```

CONFigure:BT0oth:POWer:AVERage:STARt 0...100PCT

This command defines the start position for the calculation of the average power of a burst.



Depending on the setting FIND SYNC ON or OFF (command SENS:DDEM:SEAR:SYNC:STAT ON/ OFF) the burst is either defined by the p0 bit and the packet length or the 3 dB points according to the RF Test Specification. As a result there are different areas within the burst for calculating the average power:

**Examples:**

```
CONF:BT0:POW:AVER:STAR 10PCT
'sets the starting point for the calculation to 10% of the
burst length
```

Characteristics:

*RST value:20 %
SCPI: device-specific

CONFigure:BT0oth:POWer:AVERage:STOP 0...100PCT

This command defines the end position for the calculation of the average power of a burst.



Depending on the setting FIND SYNC ON or OFF (command SENS:DDEM:SEAR:SYNC:STAT ON/ OFF) the burst is either defined by the p0 bit and the packet length or the 3 dB points according to the RF Test Specification. As a result there are different areas within the burst for calculating the average power (see command SENS:BT0:POW:AVER:STARt)

Examples:

```
CONF:BT0:POW:AVER:STAR 90PCT
'sets the end point for the calculation to 90% of the burst
length
```

Characteristics:

*RST value:80%
SCPI: device-specific

CONFigure:BT0oth:PRATe 2 | 4 | 8 | 16 | 32

This command selects the number of measurement samples (points) per symbol for the measurement.



The RF Test Specification specifies an oversampling factor of at least 4.

Examples:

```
CONF:BT0:PRAT 16  
'selects 16 points/symbol
```

Characteristics:

*RST value:4
SCPI: device-specific

CONFigure:BT0oth:PTYPE DH1 | DH3 | DH5 | AUTO

This command selects the packet type to be measured:

DH1: 1 slot packet
DH3: 3 slot packet
DH5: 5 slot packet
AUTO: automatic detection of the packet type

Examples:

```
CONF:BT0:PTYP DH5  
'selects type 5 slot packet
```

Characteristics:

*RST value:DH1
SCPI: device-specific

CONFigure:BT0oth:RTPower:DAverage:STARt 0 – 100 %

This command sets the start time for the power measurement of the DFSK sections of the packet.



This command is only available with active Relative Transmit Power measurement.

Examples:

```
CONF:BT0:RTP:DAV:STAR 20
'Sets the start time for the power measurement of the DFSK
sections of the packet.
```

Characteristics:

*RST value:10 %
SCPI: device-specific

CONFigure:BT0oth:RTPower:DAverage:STOP 0 – 100 %

This command sets the start time for the power measurement of the GFSK sections of the packet.



This command is only available with active Relative Transmit Power measurement.

Examples:

```
CONF:BT0:RTP:DAV:STOP 80
'Sets the start time for the power measurement of the GFSK
sections of the packet.
```

Characteristics:

*RST value:90 %
SCPI: device-specific

CONFigure:BT0oth:RTPower:GAverage:STARt 0 – 100 %

This command sets the start time for the power measurement of the GFSK sections of the packet.



This command is only available with active Relative Transmit Power measurement.

Examples:

```
CONF:BT0:RTP:GAV:STAR 20
'Sets the start time for the power measurement of the GFSK
sections of the packet.
```

Characteristics:

*RST value:10 %
SCPI: device-specific

CONFigure:BT0oth:RTPower:GAverage:STOP 0 – 100 %

This command sets the stop time for the power measurement of the GFSK sections of the packet.



This command is only available with active Relative Transmit Power measurement.

Examples:

```
CONF:BT0:RTP:GAV:STOP 80
'Sets the stop time for the power measurement of the GFSK
sections of the packet.
```

Characteristics:

*RST value:90 %
SCPI: device-specific

CONFigure:BT0oth:SWEep:COUNT 0 ... 32767

This command defines the number of sweeps for the currently selected Bluetooth measurement. This number will be started as a single sweep. With trace mode setting clear/write the measurement results will be calculated for each sweep and taken into account for the calculation of minimum, maximum and average values. For the remaining trace settings (AVER, MAXH, MINH) the measurement results will be calculated from the resulting trace. In average mode the value 0 defines the sliding average of the measurement data over 10 sweeps.



The setting is valid only for the currently active measurement and independent of the other Bluetooth measurements.

Examples:

```

INST:SEL BTO
'activates the Bluetooth Measurements option.
CONF:BTO:MEAS OPOW
'activates the Output Power measurement.
INIT:CONT OFF
'selects single sweep operation.
CONF:BTO:SWE:COUN 20
'sets the number of sweeps to 20.
INIT;*OPC
'starts a sweep with synchronization.

```

Characteristics:

*RST value:	0	Output Power
	10	Adjacent Channel Power Modulation Characteristics Initial Carrier Frequency Tolerance Carrier Frequency Drift EDR Relative TX Power EDR In-band Spurious Emissions
	100	Differential Phase Encoding

CONFigure:BTOoth:SWEep:TIME <numeric_value>

This command defines the duration of a sweep sequence for the active Bluetooth measurement.

Value range: (1µs...130560µs) / (points per symbol)
 Output Power; Modulation Characteristics,
 Initial Carrier Frequency Tolerance,
 Carrier Frequency Drift
 10µs... 16000s TX Output Spectrum Adjacent Channel Power

With direct programming using command `SWEep:TIME` will stop its link to the settings according to the RF Test Specification.



This setting is valid for the currently active measurement (see command `CONF:BTO:MEAS`) and is independent of other Bluetooth measurements.

Examples:

```

INST:SEL BTO
'activates the Bluetooth option
CONF:BTO:MEAS OPOW
'activates the Output Power measurement
CONF:BTO:SWE:TIME 10MS
'sets a sweep time of 10 ms

```

Characteristics:

*RST value:(AUTO is set to ON)
 SCPI: device-specific

CONFigure:BT0oth:SWEep[:TIME]:AUTO ON | OFF

This command links the sweep time to the settings according to the RF Test Specification.



This setting is valid for the currently active measurement (see command *CONF:BT0:MEAS*) and is independent of other Bluetooth measurements.

Examples:

```
INST:SEL BTO
'activates the Bluetooth option
CONF:BT0:MEAS OPOW
'activates the Output Power measurement
CONF:BT0:SWE:TIME:AUTO ON
'switches the sweep time coupling on
```

Characteristics:

*RST value: ON
SCPI: device-specific

CONFigure:BT0oth:TRACe<1...3>:MODE WRITe | VIEW | AVERAge | MAXHold | MINHold | BLANK

This command defines the way of displaying and evaluating the measurement curves for the selected Bluetooth measurement. *WRITe* corresponds to manual operating mode *Clr/Write*.

The numeric suffix selects the trace related to this setting.

The number of measurement to be executed for *AVERAge*, *MAXHold* und *MINHold* is defined with command *CONF:BT0:SWEep:COUNT*. Please note that a synchronization to the end of the indicated number of measurements is only possible during single sweep operation.



This setting is valid for the currently active measurement (see command *CONF:BT0:MEAS*) and is independent of other Bluetooth measurements.

Examples:

```
INST:SEL BTO
'activates the Bluetooth option
CONF:BT0:MEAS OPOW
'activates the Output Power measurement
INIT:CONT OFF
'selects single sweep operation
CONF:BT0:SWE:COUN 10
'sets the sweep count to 10
CONF:BT0:TRAC2:MODE AVER
'switches averaging for trace 2 on
INIT;*OPC
'starts a measurement with synchronization
```

Characteristics:

*RST value: WRITe

SCPI: device-specific

CONFigure:BT0oth:TRACe<1...3>:SElect

This command selects the measurement curve for evaluation of the modulation characteristics.

Examples:

```
INST:SEL BTO
'activates the Bluetooth option
CONF:BTO:MEAS OPOW
'activates the Output Power measurement
INIT:CONT OFF
'selects single sweep operation
CONF:BTO:TRAC2:SEL
'selects trace 2 for measurement result queries
```

Characteristics:

**RST value: --

SCPI: device-specific

4.5 DISPlay - Subsystem

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

The measurement windows are selected by WINDow1 (screen A) or WINDow2 (screen B).

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

This command defines the scaling of the y-axis in the currently selected unit.

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

Examples:

```
DISP:WIND1:TRAC:Y:PDIV 10KHz
'sets the y-scale to 10 kHz/div
```

Characteristics:

*RST value:-

SCPI: conforming

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 with TRACe<1...3> is irrelevant. With function *NORMALIZE* switched on in operating mode NETWORK (option Tracking Generator / Ext. Generator Control R&S FSP-B9/B10) the reference position marks the reference point for the normalized measurement data in the diagram. With active FM demodulator the reference position for result displays RF POWER and SPECTRUM will be kept apart from the one for result display FM. In operating mode BLUETOOTH the selected reference position is valid for all measurements.

Examples:

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

Characteristics:

**RST value: 100 PCT (mode SPECTRUM)
50 PCT (mode NETWORK and FM-DEMOM)
SCPI: conforming

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

This command is available with option Tracking Generator / Ext. Generator Control (R&S FSP-B9/B10) and function *NORMALIZE* switched on

- option FM demodulator (R&S FS-K7) and result display FM switched on
- option Bluetooth analyzer (R&S FS-K8) and measurement Modulation Characteristics, Initial Carrier Frequency Drift or Carrier Frequency Tolerance switched on.

It defines the result value assigned to the reference position on the graticule. In manual operation this corresponds to function REFERENCE VALUE. The numeric suffix with TRACe<1...3> is irrelevant.

Examples:

```
DISP:WIND1:TRAC:Y:RVAL -20dBm (Analyzer)
DISP:WIND1:TRAC:Y:RVAL +1.20 (Vector Signal Analyzer)
DISP:WIND1:TRAC:Y:RVAL 0
'sets the result value at the reference position to 0 dB
(option Tracking Generator/Ext. Generator Control) or to 0 Hz
(options FM demodulator and Bluetooth)
```

Characteristics:

*RST value: 0 dB (operating mode NETWORK)
0 Hz (operating mode FM-Demodulator and Bluetooth)
SCPI: device-specific

4.6 INSTrument - Subsystem

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

INSTrument:NSElect <numeric value>

This command selects the mode via fixed numbers.

Parameter:

- 1: mode Spectrum analyze
- 3: mode FM demodulator
- 8: mode 3G FDD BTS
- 9: mode 3G FDD UE
- 12: mode BLUETOOTH

Examples:

```
INST:NSEL 1
'selects mode SPECTRUM.
```

Characteristics:

*RST value:1
SCPI: conforming

INSTrument[:SElect] SANalyzer | ADEMod | MGSM | WCDPower | BWCDpower | MWCDpower | BTOoth

This command selects the operating mode by input of the corresponding name.

ADEMod:	mode FM-Demodulator	only available with option R&S FS-K7
SANalyzer:	mode SPECTRUM	
MGSM:	mode GSM/EDGE Analyzer	only available with option R&S FS-K5
WCDPower:	mode 3G FDD BTS	require option R&S FS-K72
BWCDpower	mode 3G FDD BTS (alias for WCDPower)	
MWCDpower	mode 3G FDD MS	requires option R&S FS-K73
BTOoth	mode BLUETOOTH	

Examples:

```
INST SAN
'selects mode SPECTRUM
```

Characteristics:

*RST value: SANalyzer
SCPI: conforming

4.7 SENSe - Subsystem

The SENSe subsystem is organized in several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.

The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, the keyword SENSe is optional for this reason, which means that it is not necessary to include the SENSe node in command sequences.

The SENSe subsystem controls the essential parameters of the receiver. In accordance with the SCPI standard, the keyword "SENSe" is optional for this reason, which means that it is not necessary to include the SENSe node in command sequences.

The measurement windows are selected by SENSe1 and SENSe2:

SENSe1 = Modification of screen A settings

SENSe2 = Modification of screen B settings.

Screen A is automatically selected if 1 or 2 is missing.

4.7.1 SENSe:DDEMod - Subsystem

This subsystem controls the parameters for digital demodulators.

[SENSe<1|2>:]DDEMod:FILTer:MEASurement OFF | BTOoth

This command selects the receive filter for the signal to measure.

Examples:

```
DDEM:FILT:MEAS BTOoth
'Bluetooth measurement filter ON
```

Characteristics:

*RST value: OFF
SCPI: device-specific

SENSe<1|2>:]DDEMod:SEARch:PULSe:OFFSet <numeric_value>

This command defines the time to be recorded before a signal burst is recognized. The valid value range is 0 to ± 10 ms.

Examples:

```
DDEM:SEAR:PULSe:OFFS 1MS
'Burst offset = 1ms before start of the burst
```

Characteristics:

*RST value:0
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARch:PULSe[:STATe] ON | OFF

This command switches the search for a signal burst on or off.

Examples:

```
DDEM:SEAR:PULS OFF
```

Characteristics:

*RST value: ON
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARch:SYNC:LAP <hex>

This command determines the 24 least significant bits (LAP) of the DUT 'Bluetooth device address'. They are used to define the synchronization pattern to determine the start of a packet. The value range is 0 to FFFFFFF hex.

Examples:

```
DDEM:SEAR:SYNC:LAP #HA3F45B
'Sets LAP A3F45B Hex
```

Characteristics:

*RST value:0
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARch:SYNC:OFFSet <numeric_value>

This command defines the number of bits to be recorded before the first preamble bit is detected.

The valid value range is 0 to ± 10000 .

Examples:

```
DDEM:SEAR:SYNC:OFFS 10
'Sync offset = 10 bits before the preamble bits
```

Characteristics:

*RST value: 0
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARch:SYNC[:STATe] ON | OFF

This command switches the search for a sync pattern on or off.

Examples:

```
DDEM:SEAR:SYNC ON
'Switches the sync pattern search on.
```

*RST value: OFF
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARCh:TIME 100µs ... 130560µs/(Points per Symbol)

This command selects manual setting of the record length and defines the record length to be used for the search of sync word and burst. The input of the record length is expected in seconds.

Value range: 100us .. 130560us / (points per symbol)

Points per Symbol	Maximum record length
2	104,4 Slots
4	52,2 Slots
8	26,1 Slots
16	13,1 Slots
32	6,5 Slots



For measurements without trigger at least 3 times the packet length is required during loop back operation. That means that with an oversampling factor of 16 only packet types DH1 and DH3 can be detected reliably; with an oversampling factor of 32 only DH1 packets can be detected.

Examples:

```
DDEM:SEAR:TIME 100US
'Sets the record length for sync word and burst search to 100µs.
```

Characteristics:

*RST value: 1875µs
SCPI: device-specific

[SENSe<1|2>:]DDEMod:SEARCh:TIME:AUTO ON | OFF

This command activates the automatic setting of the record length for the sync word and burst search, depending on the selected packet type.

The automatic record length is determined as follows:

Free Run Trigger:

search length = 3 * packet length + abs(sync offset) or

Search Length = 3 * packet length + Abs(Burst Offset)

all other trigger types:

search length = 3 * packet length + abs(sync offset) or

search length = 3 * packet length + abs(burst offset)

If the selected MEAS TIME is longer than the packet length, the difference MEAS TIME - packet length is added to the record length.

Examples:

```
DDEM:SEAR:TIME:AUTO OFF
'Selects manual input for the record length.
```

Characteristics:

**RST value: ON
SCPI: device-specific

4.7.2 SENSE:EGain - Subsystem

[SENSe<1|2>:]CORRection:EGain:INPut[:MAGNitude] -200...200dB

This command makes an external gain known to the analyzer, which will take it into account during the display of measurement results. With this function the gain of an antenna or of an external preamplifier can be taken into account for the measurement values.

Examples:

```
CORR:EGA:INP 10DB
'takes 10 dB external gain into account
```

Characteristics:

*RST value:0dB
SCPI: device-specific

4.8 TRACe - Subsystem

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

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. The associated measurement window is selected with the numeric suffix of TRACe<1|2>.



If the FM demodulator (option R&S FS-K7) is active, only the displayed trace data is read out and recalled. A portion of the measurement data that can be called by means of a marker, however, is calculated from the raw measurement data. These results are no longer available after recalling a trace; the associated queries generate a query error.

Examples:

```
TRAC TRACE1, "+A$" ($: data list in the current format)
TRAC2? TRACE1"
```

Return values:

The returned values are scaled in the current level unit. Returned FM-modulated measurement values (activated option R&S FS-K7 or R&S FS-K8) are scaled in Hz.

ASCII-Format (FORMat ASCII):

In this case a list of values separated by commas is returned (Comma Separated Values = CSV).

The number of measurement points is 501 for the R&S FSP, 625 for the R&S FSU.

Binary format(FORMat REAL,32):

In this case the command returns binary format (REAL,32). The data are transferred in block format (Definite Length Block Data according to IEEE 488.2). They are arranged in succeeding lists of I and Q data of 32 Bit IEEE 754 floating point numbers. General structure of the return string:

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

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

with

#4	digits of the subsequent number of data bytes (4 in the example)
2004	Number of the subsequent data bytes (2004 in the example)
2500	Number of subsequent data bytes (2500 in the example)
<meas value x>	4 byte floating point measurement values

Characteristics:

**RST value: -
SCPI: conforming

The trace data are 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, these data are values separated by commas. If the transfer takes place using the format real (REAL,32), the data are 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 are selected with MMEMory:SELEct[:ITEM]:ALL or MMEMory:SELEct[:ITEM]:TRACe.

Trace data in ASCII format (ASCII FILE EXPORT) are exported with the command MMEM:STORe:TRACe.

The transfer format for the trace data depends on the instrument setting:

SPECTRUM mode (span > 0 and zero span):

R&S FSP: 501 results are output in the unit selected for display.

R&S FSU: 625 results are output in the unit selected for display.



With AUTO PEAK detector, only positive peak values can be read out.
Trace data can be written into the instrument with logarithmic display only in dBm, with linear display only in volts..
FORMAT REAL,32 is to be used as format for binary transmission.

TRACe<1|2>:[DATA]? BTOBits

Reads the packet data bits.

Examples:

```
INST:SEL:BTO
'Activate Bluetooth application
CONF:BTO:MEAS MCH
'Select Modulation Characteristics
TRACe:DATA? BTOB
'Read data bits.
```

Characteristics:

*RST value: -
SCPI: device-specific

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

TRACe<1|2>:[DATA]? BTOFm

Reads the FM trace.

Examples:

```
INST:SEL:BTO
'Activate Bluetooth application
CONF:BTO:MEAS MCH
'Select Modulation Characteristics
TRAC:DATA? BTOF
'Read FM trace
```

Characteristics:

*RST value: -
SCPI: device-specific

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

4.9 Assignment Softkey / Hotkey to the Remote Commands

This chapter contains the assignment of the remote commands to the softkey menus for the menus, where the Bluetooth analyzer option differs from the basic instrument. For unchanged menus the assignment is included in the operating manual of the basic instrument.

4.9.1 Bluetooth Main Menu

BLUETOOTH	INST:SEL BTOoth INST:NSEL 12
EXIT	INST:SEL SAN INST:NSEL 1
SETTINGS	--
FIND SYNC	--
RANGE	--
PAGE UP	--
PAGE DOWN	--

4.9.1.1 Hotkey SETTINGS

CHANNEL	CONFigure:BT0oth:CHANnel 0
PACKET TYPE	CONFigure:BT0oth:PTYPE DH1 DH3 DH5 AUTO
GEOGRAPHY	CONFigure:BT0oth:GEOGraphy EUROpe USA FRANce
POWER CLASS	CONFigure:BT0oth:POWER:PClass 1
POINTS PER SYMBOL	CONFigure:BT0oth:PRATe 2 4 8 16 32
AVERAGE ↴	--
ANTENNA GAIN	[SENSe:]CORRection:EGain:INPut[:MAGNnitide] 0 DB
SELECT TRACE	CONFigure:BT0oth:TRACe<1...3>:SElect

4.9.1.2 Softkey AVERAGE

AVERAGE START	CONFigure:BT0oth:POWER:AVERAge:START <numeric_value>
AVERAGE STOP	CONFigure:BT0oth:POWER:AVERAge:STOP <numeric_value>

4.9.1.3 Hotkey *FIND SYNC*

FIND SYNC ON OFF	[SENSe:]DDEMod:SEARCh:SYNc:STATe ON OFF
LAP	[SENSe:]DDEMod:SEARCh:SYNc:LAP <hex>
SYNC OFFSET	[SENSe:]DDEMod:SEARCh:SYNc:OFFSet 0
FIND BURST ON OFF	[SENSe:]DDEMod:SEARCh:PULSe:STATe ON OFF
BURST OFFSET	[SENSe:]DDEMod:SEARCh:PULS:OFFSet <numeric value>
SEARCH LEN AUTO	[SENSe:]DDEMod:SEARCh:TIME:AUTO ON OFF
SEARCH LEN MANUAL	[SENSe:]DDEMod:SEARCh:TIME <numeric value>

4.9.1.4 Hotkey *RANGE*

DEVIATION PER DIV	DISPlay:WINDow:TRACe:Y:PDIVision <numeric_value>
REFERENCE POSITION	DISPlay:WINDow:TRACe:Y:RPOSition <numeric_value>
REFERENCE VALUE	DISlay:WINDow:TRAC:Y:RVALue <numeric_value>
ZOOM	[SENSe:]ADEMode:ZOOM ON [SENSe:]ADEMode:ZOOM:STARt <numeric_value>

4.9.2 Hardkey *MEAS*

MEAS	CONFigure:BT0oth:MEASurement <measurement>
	with <measurement> =
	OPOW Output Power
	ACLR TX Output Spectrum-Adjacent Channel Power
	MCH Modulation Characteristics
	IFCT Initial Carrier Frequency Tolerance
	CFDR Carrier Frequency Drift

4.9.2.1 Softkey *OUTPUT POWER*

CONTINUOUS SWEEP	INITiate:CONTinuous ON
SINGLE SWEEP	INITiate:CONTinuous OFF
MEASTIME MANUAL	CONFigure:BT0oth:SWEep:TIME <measurement>
MEASTIME AUTO	CONFigure:BT0oth:SWEep:TIME:AUTO ON
SWEEP COUNT	CONFigure:BT0oth:SWEep:COUNT 0
AVERAGE ↴	--

4.9.2.2 Softkey *TX SPEC ACP*

CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF
SWEEPTIME MANUAL	CONFigure:BT0oth:SWE:TIME <numeric_value>
SWEEPTIME AUTO	CONFigure:BT0oth:SWEEp:TIME:AUTO ON
SWEEP COUNT	CONFigure:BT0oth:SWEEp:COUNT <numeric_value>
NO. OF ACP CHAN	CONFigure:BT0oth:ACLR:ACPairs <numeric_value>

4.9.2.3 Softkey *MODULATION CHARACTERISTICS*

START TEST	INITiate:IMMediate
CONTINUE TEST	tinuous
CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF INITiate;*WAI

MEAS TIME MANUAL	CONFigure:BT0oth:SWE:TIME <numeric_value>
MEAS TIME AUTO	CONFigure:BT0oth:SWE:TIME:AUTO ON
SWEEP COUNT	CONFigure:BT0oth:SWE:COUN <numeric_value>

4.9.2.4 Softkey *INIT CARR FREQ TOL*

CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF INITiate;*WAI
MEASTIME MANUAL	
MEASTIME AUTO	
SWEEP COUNT	CONFigure:BT0oth:SWEep:COUN <numeric_value>

4.9.2.5 Softkey *CARRIER FREQ DRIFT*

CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF INITiate;*WAI

MEASTIME AUTO	CONFigure:BT0oth:SWEep:TIME:AUTO ON
MEASTIME MANUAL	CONFigure:BT0oth:SWEep:TIME <numeric_value>
SWEEP COUNT	CONFigure:BT0oth:SWEep:COUNT <numeric_value>

4.9.2.6 Softkey EDR

REL TX POWER ↓	CONFigure:BT0oth:MEAS RTP CALC:BT0oth:RTP? MIN CALC:BT0oth:RTP:RAT? MIN
CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF INITiate;*WAI
MEASTIME MANUAL	CONFigure:BT0oth:SWEep:TIME <numeric_value>
MEASTIME AUTO	CONFigure:BT0oth:SWEep:TIME:AUTO ON
SWEEP COUNT	CONFigure:BT0oth:SWEep:COUNT <numeric_value>
AVERAGE ↓	
GFSK START	CONFigure:BT0oth:RTPower:GAverage:START <numeric_value>

Assignment Softkey / Hotkey to the Remote Commands

GFSK STOP	CONFigure:BT0oth:RTPower:GAverage:STOP <numeric_value>
DPSK START	CONFigure:BT0oth:RTPower:DAverage:START <numeric_value>
DPSK STOP	CONFigure:BT0oth:RTPower:DAverage:STOP <numeric_value>
SPURIOUS EMISSIONS	
CONTINUOUS SWEEP	INITiate:CONTInuous ON
SINGLE SWEEP	INITiate:CONTInuous OFF INITiate;*WAI
ADJUST GATE	CONFigure:BT0oth:SWEEp:TIME <numeric_value>
SWEEP COUNT	CONFigure:BT0oth:SWEEp:COUNT <numeric_value>
NO. OF ADJ CHAN	CONFigure:BT0oth:IBSemiissions:ACP <numeric_value>
GATE DELAY	CONFigure:BT0oth:SWEEp:COUNT <numeric_value>
GATE LENGTH	SWEEp:EGAT:LENGTh <numeric_value>

CARR FREQ
STABILITY ↓

CALCulate:BT0oth:CFSTability:FERRor? MIN
 CALCulate:BT0oth:CFSTability:FERRor:BLOC? AVERAge
 CALCulate:BT0oth:CFSTability:FERRor:INIT? MAX
 CALCulate:BT0oth:CFSTability:DEVM? AVERAge
 CALCulate:BT0oth:CFSTability:DEVM:PEAK?
 CALCulate:BT0oth:CFSTability:DEVM:D99Pct?
 CALCulate:BT0oth:CFSTability:COUNT?

CONTINUOUS
SWEEP

INITiate:CONTinuous ON

SINGLE
SWEEP

INITiate:CONTinuous OFF
 INITiate;*WAI

MEASTIME
MANUAL

CONFigure:BT0oth:SWE:TIME <numeric_value>

MEASTIME
AUTO

CONFigure:BT0oth:SWEep:TIME:AUTO ON

SWEEP
COUNT

CONFigure:BT0oth:SWEep:COUNT <numeric_value>

DIFF
PHASE ↓

CONTINUOUS
SWEEP

INITiate:CONTinuous ON

SINGLE
SWEEP

INITiate:CONTinuous OFF
 INITiate;*WAI

MEASTIME
MANUAL

CONFigure:BT0oth:SWEep:TIME <numeric_value>

MEASTIME
AUTO

CONFigure:BT0oth:SWEEp:TIME:AUTO ON

SWEEP
COUNT

CONFigure:BT0oth:SWEEp:COUNT <numeric_value>

4.9.7 Hardkey *BW*

MEAS
FILTER

[SENSe:]DDEM:FILT:MEASure OFF | BTO

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