Software Manual

GSM/EDGE Mobile and Base Station Test for Spectrum Analyzers

Applications Firmware
R&S® FS-K5

1141.1496.02

ROHDE&SCHWARZ

Test and Measurement

This Software Manual describes GSM/EDGE Mobile and Base Station Test for the following models:

R&S®FMU

R&S®FSG

R&S®FSP

R&S®FSQ

R&S®FSU

R&S®FSUP

Dear Customer,

throughout this manual, FS-K5 is generally used as an abbreviation for the software option R&S FS-K5. The Spectrum Analyzers R&S FSP and R&S FSU are abbreviated as FSP and FSU, respectively.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Symbols and safety labels

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

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

Tags and their meaning

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

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

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

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

NOTICE indicates the possibility of incorrect operation which can result in damage to the product.
In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of ±10 % shall apply to the nominal voltage and ±5 % to the nominal frequency.

2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or death.

3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.

2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.

3. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.

5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

6. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).

7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.

8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.

11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

12. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.

13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.

14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.

15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.

16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.

17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.

2. Before you move or transport the product, read and observe the section titled "Transport".

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.

4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.

5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.

6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

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

1. Cells must not be taken apart or crushed.

2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.

3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.

4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.

5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.

6. If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.

7. Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.

8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

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

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

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

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

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

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

Símbolos y definiciones de seguridad

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

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

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de ±10 % sobre el voltaje nominal y de ±5 % sobre la frecuencia nominal.

2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, pueden causarse lesiones o incluso la muerte.

3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.

2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.

3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.

5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).

7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.

8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.

9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.

11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.

12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.

14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.

15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.

16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.

17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.

18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.

2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.

4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.

5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.

6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.

7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.

2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

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

1. No deben desmontarse, abrirse ni triturarse las celdas.

2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.

3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.

4. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.

5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.

6. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.

7. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).

8. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.

3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.

2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Qualitätszertifikat
Certificate of quality
Certificat de qualité

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 ISO 9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet
▪ Energie-effiziente, RoHS-konforme Produkte
▪ Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
▪ ISO 14001-zertifiziertes Umweltmanagementsystem

Dear Customer,

You have decided to buy a Rohde&Schwarz product. 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 ISO 9001 and ISO 14001.

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 ISO 9001 et ISO 14001.

Engagement écologique
▪ Produits à efficience énergétique
▪ Amélioration continue de la durabilité environnementale
▪ Système de gestion de l'environnement certifié selon ISO 14001

1171.0200.11 V 04.01

ROHDE&SCHWARZ

Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

USA & Canada	Monday to Friday 8:00 AM – 8:00 PM	(except US public holidays) Eastern Standard Time (EST)
	Tel. from USA From outside USA Fax	888-test-rsa (888-837-8772) (opt 2) +1 410 910 7800 (opt 2) +1 410 910 7801
	E-mail	CustomerSupport@rohde-schwarz.com
East Asia	Monday to Friday 8:30 AM – 6:00 PM	(except Singaporean public holidays) Singapore Time (SGT)
	Tel. Fax	+65 6 513 0488 +65 6 846 1090
	E-mail	CustomerSupport@rohde-schwarz.com
Rest of the World	Monday to Friday 08:00 – 17:00	(except German public holidays) Central European Time (CET)
	Tel. Fax	+49 89 4129 13774 +49 (0) 89 41 29 637 78
	E-mail	CustomerSupport@rohde-schwarz.com

ROHDE & SCHWARZ

Address List

Headquarters, Plants and Subsidiaries

Headquarters

ROHDE&SCHWARZ GmbH & Co. KG
Mühldorfstraße 15 · D-81671 München
P.O.Box 80 14 69 · D-81614 München

Phone +49 (89) 41 29-0
Fax +49 (89) 41 29-121 64
info.rs@rohde-schwarz.com

Plants

ROHDE&SCHWARZ Messgerätebau GmbH
Riedbachstraße 58 · D-87700 Memmingen
P.O.Box 16 52 · D-87686 Memmingen

Phone +49 (83 31) 1 08-0
+49 (83 31) 1 08-1124
info.rsmb@rohde-schwarz.com

ROHDE&SCHWARZ GmbH & Co. KG
Werk Teisnach
Kaikenrieder Straße 27 · D-94244 Teisnach
P.O.Box 11 49 · D-94240 Teisnach

Phone +49 (99 23) 8 50-0
Fax +49 (99 23) 8 50-174
info.rsdts@rohde-schwarz.com

ROHDE&SCHWARZ závod
Vimperk, s.r.o.
Location Spidrova 49
CZ-38501 Vimperk

Phone +420 (388) 45 21 09
Fax +420 (388) 45 21 13

ROHDE&SCHWARZ GmbH & Co. KG
Dienstleistungszentrum Köln
Graf-Zeppelin-Straße 18 · D-51147 Köln
P.O.Box 98 02 60 · D-51130 Köln

Phone +49 (22 03) 49-0
Fax +49 (22 03) 49 51-229
info.rsdc@rohde-schwarz.com
service.rsdc@rohde-schwarz.com

Subsidiaries

R&S BICK Mobilfunk GmbH
Fritz-Hahne-Str. 7 · D-31848 Bad Münder
P.O.Box 20 02 · D-31844 Bad Münder

Phone +49 (50 42) 9 98-0
Fax +49 (50 42) 9 98-105
info.bick@rohde-schwarz.com

ROHDE&SCHWARZ FTK GmbH
Wendenschloßstraße 168, Haus 28
D-12557 Berlin

Phone +49 (30) 658 91-122
Fax +49 (30) 655 50-221
info.ftk@rohde-schwarz.com

ROHDE&SCHWARZ SIT GmbH
Am Studio 3
D-12489 Berlin

Phone +49 (30) 658 84-0
Fax +49 (30) 658 84-183
info.sit@rohde-schwarz.com

R&S Systems GmbH
Graf-Zeppelin-Straße 18
D-51147 Köln

Phone +49 (22 03) 49-5 23 25
Fax +49 (22 03) 49-5 23 36
info.rssys@rohde-schwarz.com

GEDIS GmbH
Sophienblatt 100
D-24114 Kiel

Phone +49 (431) 600 51-0
Fax +49 (431) 600 51-11
sales@gedis-online.de

HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen

Phone +49 (61 82) 800-0
Fax +49 (61 82) 800-100
info@hameg.de

Locations Worldwide

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

◆ Sales Locations
◆ Service Locations
◆ National Websites

Table of Contents – Chapter 1 "General Information"

Figures

Tables

1 General Information on Application Firmware FS-K5, GSM/EDGE Mobile and Base Station Tests

A brief explanation of GSM (GMSK and EDGE)

The GSM (Global System for Mobile Communication) standard describes the GSM mobile radio network that is in widespread use today. To enhance this network the 8PSK modulation has been defined in addition to the existing GMSK modulation. With 8PSK the mobile or base station operates in the EDGE (Enhanced Data rates for GSM Evolution) mode.

This means that GSM includes two different modes: GMSK and EDGE. The term EDGE is used only wherever there are significant differences between the two modes. In all other cases, the term GSM will be used.

There are two different standards, distinguished primarily by their frequency bands: ETSI (for GSM900, GSM1800) and J-STD-007 (PCS 1900 , primarily in the USA).
The physical layer – the layer of the GSM network on which modulation, transmission of RF signals, reception of RF signals, and demodulation take place – is defined in the standards

GSM 05.04	Modulation
GSM 05.05 (ETS 300 910)	General measurement specifications and limit values
GSM 11.10 (ETS 300 607-1)	Detailed measurement specifications and limit values for mobiles
GSM 11.21 (ETS 300 609-1) and	Detailed measurement specifications and limit values for base stations
J-STD 007	Detailed measurement specifications and limit values for mobiles and base stations in the 1900 MHz band

As technological development progresses, J-STD 007 is now being integrated into the other GSM standards.

A T&FDMA method is used to transfer data in the GSM network. This means that the digital information is transmitted discretely in the time domain as well as in the frequency domain.

The time domain is divided logically into frames of different length, the smallest unit being known as a timeslot. A multiframe consists of 26 frames, and a frame has 8 timeslots (see GSM 05.01 for details).

A mobile, therefore, does not communicate continuously with the base station; instead, it communicates discretely in individual timeslots. In the simplest case, 8 mobiles share the 8 timeslots of a frame (TDMA - Time Division Multiple Access).

The frequency domain absolute frequency channel number is divided into frequency bands, and each band, in turn, is subdivided into channels.

Each frequency channel is identified by its center frequency and a number, known as the ARFCN, which is a non-band-specific identifier (ARFCN - absolute radio frequency channel number). A bandwidth of 200 kHz is defined for each frequency channel.

Communication between a mobile and the base station can be either frequency-continuous or frequency-discrete – distributed across various frequency channels (FDMA – Frequency Division Multiple Access). In the standards, the abbreviation "SFH" (slow frequency hopping) is used to designate this mode of communication.

Mobiles transmitting simultaneously on different frequencies: FDMA
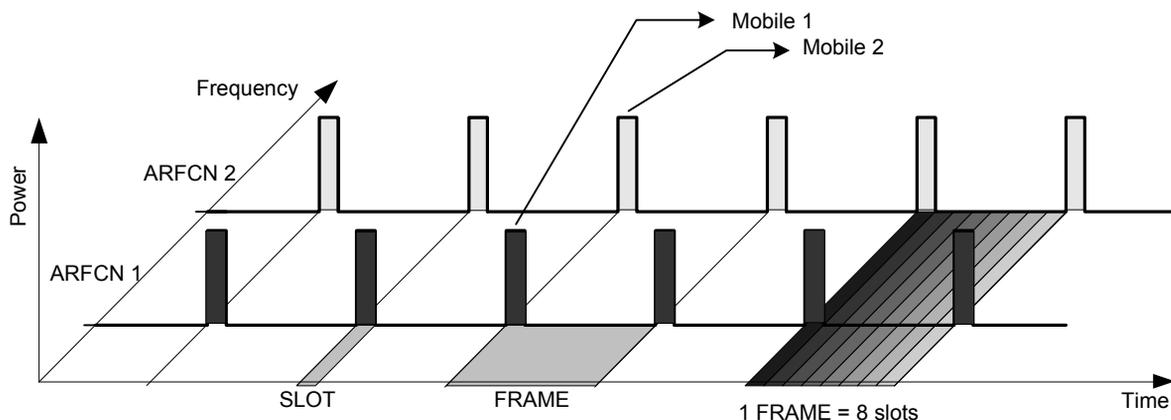
Mobiles transmitting on the same frequency at different times: TDMA
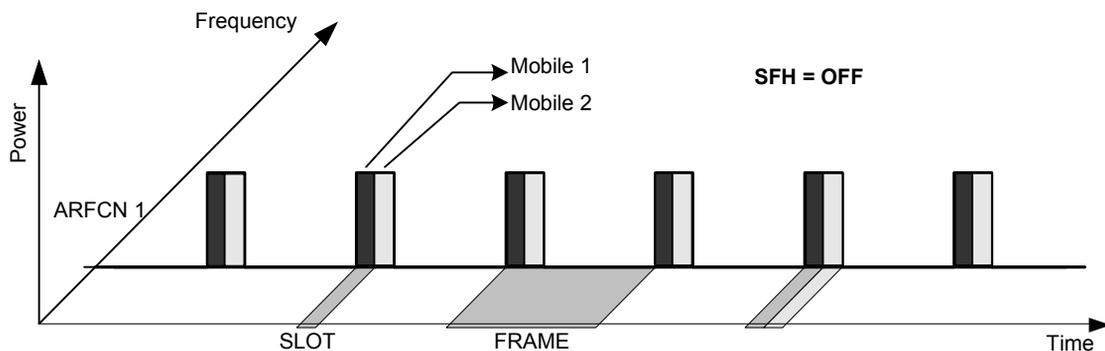
Mobile 1 transmitting on same frequency,   mobile 2 transmitting on different frequencies
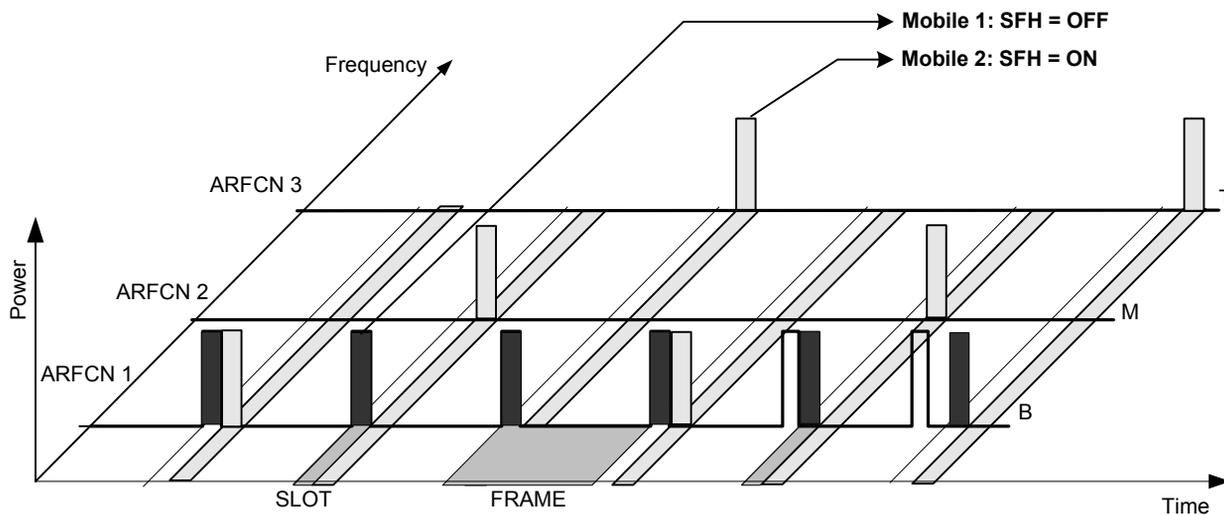
Figure 1-1 Data transmission in GSM network - T&FDMA communication

Base station and mobile communicate in different frequency ranges. The mobile sends in the "uplink", and the base station in the "downlink".

The frequencies specified in the standards plus their channel numbers are listed in the tables below.

Table 1-1   Downlink – base station transmitting to mobile

P-GSM 900	935.2MHz				959.8MHz	FREQ
	1				124	ARFCN
E-GSM 900	925.2MHz	934.8	935	935.2	959.8MHz	FREQ
	975	1023	0	1	124	ARFCN
R-GSM 900	921.2MHz	934.8	935	935.2	959.8MHz	FREQ
	955	1023	0	1	124	ARFCN
DCS 1800	1805.2MHz				1879.8MHz	FREQ
	512				885	ARFCN
PCS 1900	1930.2MHz				1989.8MHz	FREQ
	512				810	ARFCN
GSM 450				460.6MHz	467.4MHz	FREQ
				259	293	ARFCN
GSM 480				489MHz	495.8MHz	FREQ
				306	340	ARFCN
GSM 850			867.2MHz		893.8MHz	FREQ
			128		251	ARFCN

Table 1-2   Uplink – mobile transmitting to base station

P-GSM 900	890.2MHz				914.8MHz	FREQ
	1				124	ARFCN
E-GSM 900	880.2MHz	889.8	890	890.2	914.8MHz	FREQ
	975	1023	0	1	124	ARFCN
R-GSM 900	876.2MHz	889.8	890	890.2	914.8MHz	FREQ
	955	1023	0	1	124	ARFCN
DCS 1800	1710.2MHz				1784.8MHz	FREQ
	512				885	ARFCN
PCS 1900	1850.2MHz				1909.8MHz	FREQ
	512				810	ARFCN
GSM 450				450.6MHz	457.4MHz	FREQ
				259	293	ARFCN
GSM 480				479MHz	485.8MHz	FREQ
				306	340	ARFCN
GSM 850			824.2MHz		848.8MHz	FREQ
			128		251	ARFCN

At this time, two different modes of modulation are used in the GSM mobile radio network. The original GMSK method has now been joined by an 8PSK method (EDGE).

The GMSK symbol rate is $1/T$ = 1625/6 ksymb/s (in other words, approx. 270.833 ksymb/s). This corresponds to 1625/6 kbit/s (in other words approx. 270.833 kbit/s). In this method, a bit change represents a symbol. The details are laid down in ETSI standard GSM 05.04.

The 8PSK (EDGE) symbol rate is $1/T$ = 1625/6 ksymb/s (in other words, approx. 270.833 ksymb/s). This corresponds to 3 x 1625/6 kbit/s (in other words approx. 812.5 kbit/s).
in this method, three bits represent a symbol. The details are laid down in ETSI standard GSM 05.04.

In both cases, however, the channel bandwidth is restricted to 200 kHz. As these figures show, the EDGE bit rate is approx. three times higher than that of the GMSK method.

The customers' demand for higher telecommunication speeds increases the demand for bandwidth. Therefore the GSM standard has to evolve constantly. An example of this development is the recently introduced EDGE specification and the GPRS and HSCSD modes.

Until now, each mobile could use only one timeslot per frame, but the new HSCSD and GPRS methods will allow permanent assignment of more than one timeslot per mobile, plus dynamic utilization of multiple timeslots.

The concept behind GPRS (General Packet Radio Service) is dynamic assignment of up to 8 timeslots to each mobile for data transmission, depending on demand (and availability in the network).

HSCSD (High Speed Circuit Switched Data) allows permanent assignment of up to 4 timeslots to a mobile.

The two modulation modes GMSK and EDGE can be used.

Of significance for the FS-K5 application firmware in this respect is that the mobile can send power on a frequency in more than one timeslot.

Note: In this manual, the functions described are illustrated by means of an FSP.

Firmware application FS-K5

The characteristics of the GSM system as outlined above have to be measured in development and production and checked against limit values. The characteristics belonging to the physical layer that have to be checked include:

The characteristics of GMSK modulation: Phase/frequency error

The characteristics of 8PSK modulation: Modulation accuracy

Carrier power versus time   Power, time characteristic of power, and timing offset of power within a timeslot/several timeslots are checked.

The spectral characteristics   The spectral distribution of the energy is measured in the frequency channel, in the transmit band and outside the transmit band.

                                                 A distinction is made between two causes for the form of spectral distribution:

                                                 1) The spectrum caused by GMSK or 8PSK (EDGE) modulation (measurement is performed only in that part of the timeslot in which power is virtually constant, in other words the switching ramps are ignored).

                                                 2) The spectrum caused by switching of the power in a timeslot.

In accordance with these requirements, the standards define the six measurements supported in this firmware application.

The GSM/EDGE, FS-K5 application provides a convenient means of performing the measurements listed below for GSM900 (P-GSM, E-GSM and R-GSM), DCS1800 or PCS1900 mobiles or base stations (by analogy with the standards GSM 11.10, GSM 11.10-DCS, GSM11.10-1 and J-STD-007 Air Interface):

Characteristics of GMSK modulation:

- PFE   Phase/frequency error   Measurement of phase and frequency error with synchronization to midamble, IQ offset and IQ imbalance

Characteristics of GMSK modulation:

- MAC   Modulation Accuracy   Measurement of EVM, of 95:th percentile value, of origin offset suppression, of frequency error, of IQ offset and IQ imbalance with synchronization to midamble

Carrier power versus time

- CPW   Carrier power   Measurement of carrier power
- PVT   Power versus time   Measurement of carrier power versus time with synchronization to midamble

Spectral characteristics

- MOD   Spectrum due to modulation   Measurement of spectrum due to modulation
- TRA   Spectrum due to transients   Measurement of spectrum due to transients
- SPU   Spurious   Measurement of spurious

Measurements are available for one slot per frame or for the adjustable multislot mode.
Limit values can be defined for each individual measurement. Some basic limit values are predefined and can be changed or supplemented by other limit values.

The limit lines of GSM and EDGE signals are denoted by the extensions _G or _E, respectively . Single-slot and multislot limit lines (PVT) are distinguished by means of a digit appended to the letter _G or _E.

In the PVT, MOD and TRA (only BTS) measurement modes, the limit values depend on the measured power of the device. An arbitrary midamble can be defined for GMSK and EDGE (8-PSK). These measurements are preceded by reference measurements to furnish the correct level setting as required by the standard.

The PFE and PVT measurement modes require a time reference to the midamble (TSC 0 to 7). The IF signal is digitized, demodulated and processed (IQ mode) for these measurements.
The sections below contain basic information on the main procedures, settings and messages of the device. The descriptions of the measurements in Chapter 2 contain more detailed information specific to the various modes of measurement. The background information in the sections entitled "Additional information" in Chapter 2 is supplementary in nature and not necessary for normal operation. This information merely explains in more detail the internal settings and procedures. Chapter 3 describes the application's remote-control commands. The relevant commands also accompany each description of a softkey.

Installing the FS-K5 firmware application

When shipped ex works, the FS-K5 firmware application is preinstalled and enabled and can be used right away.
When shipped separately, the FS-K5 firmware application is accompanied by the latest version of the instructions for installation and enabling. Notes e.g. on compatibility between firmware and other applications are provided in the release notes for each firmware version.

Starting the application

Press the *GSM/EDGE* hotkey to start the GSM/EDGE, FS-K5 application. The GSM/EDGE mode is now active, the *GSM/EDGE* hotkey has a green background.

Set triggering by switching to the GSM trigger mode (See "*Trigger options*"); the level versus time over approx. 9 slots is displayed. No measurement is active.
In order to simplify the procedure for working alternately with the analyzer and GSM/EDGE modes, the principal parameters are maintained each time you change from one mode to the other:

- Center frequency (CENTER)
- Frequency offset (FREQUENCY OFFSET)
- Reference level (REF LEVEL)
- Reference level offset (REF LEVEL OFFSET)
- Attenuation value (RF ATTEN)[1]
- Mode of attenuation (RF ATTEN AUTO/MANUAL)
- Attenuation value of electronic attenuator (EL ATTEN)
- Electronic attenuator on/off (EL ATTEN OFF)[1]
- Setting of electronic attenuator (EL ATTEN AUTO/MANUAL)
- Input impedance (RF INPUT 50 Ω/75 Ω)
- Sweep counter (SWEEP COUNT = NO. OF BURSTS)
- Trigger (TRIGGER; see "*Trigger options*")

[1]) only with *RF ATTEN AUTO*: If the GSM/EDGE application is activated, the attenuation is automatically reduced so that the mixer level is at the maximum (-10dBm for FSP, -5dBm for FSU/FSQ). When the GSM/EDGE application is exited, this modification is cancelled (mixer level maximum -30 dBm for FSP, -25dBm for FSU/FSQ).
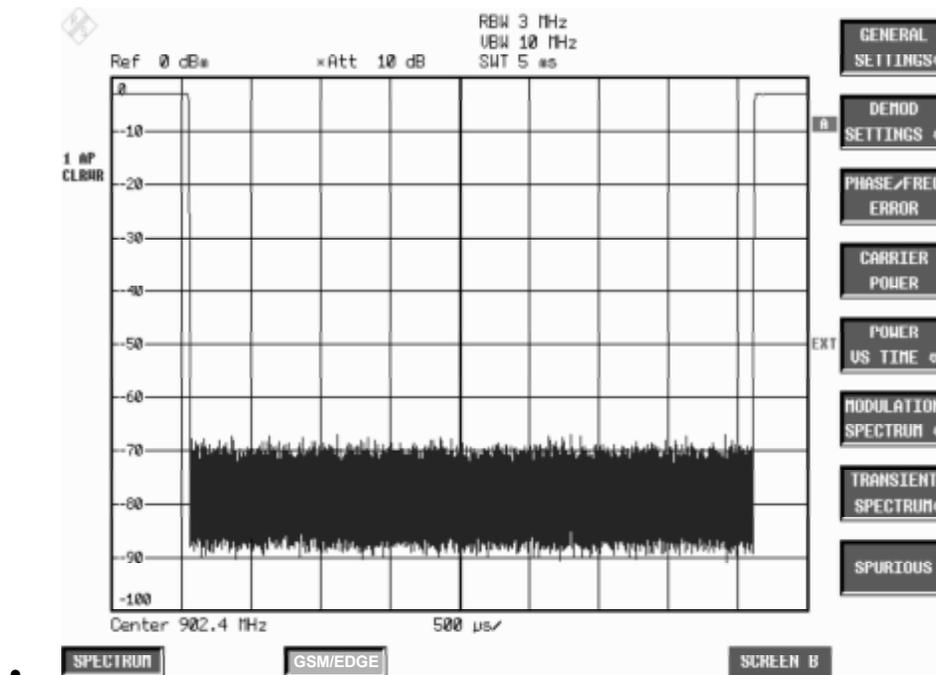
Figure 1-2 Start screen in GSM/EDGE mode

If the display does not update when you activate the GSM/EDGE mode (screen frozen), check the frequency, reduce external or internal attenuation or increase the level, or switch to an external trigger.

The application's general settings

The *GENERAL SETTINGS* menu contains the functions for setting the basic parameters needed in order to perform measurements.
All the parameters you cannot change in this menu can be controlled by means of the keys on the basic unit.
You cannot always change all the parameters for specific measurements. Availability is detailed in the descriptions of the individual measurements.

Measuring with the application

Once you exit the *GENERAL SETTINGS* menu (**PREV** or **GSM/EDGE**), you can start all measurements by pressing the appropriate softkey in the GSM/EDGE menu.
The PVT, MOD and TRA measurements offer a choice of modes: you can start and parameterize these modes in the submenu of the measurement you select.

The measurements of the FS-K5 may be divided into 2 classes:
Measurements with and without preceding reference measurements.

The purpose of the reference measurement – depending on the measurement selected – is to ascertain the current signal level as a reference for the subsequent (main) measurement.
This applies to all relative measurements (PVT and MOD) that require a reference value. A warning and the reference level to be set for a correctly adjusted measurement is issued at the end of the main measurement if the measured signal level is below a minimum value or above a maximum value.
Reference measurement is not automatic: it must be started manually (*START REF MEAS*).

Aborting a measurement

In manual mode you can always abort a measurement in progress.
You can do so either by pressing the softkey with which you start the measurement, or in a special dialog box where you are prompted for confirmation of your intention.
To start another measurement you always have to abort the measurement in progress.

Aborts take place without further warning.

In remote-control mode the ABORt command can be sent to stop a measurement in progress (see the manual on IEC/IEEE bus control).

Results of measurements

Table 1-3   Results of measurements

Measurement	Result	Limit Line	Table	Curve
PFE	Phase error 'peak' and 'RMS'; frequency error in 'Hz'. IQ offset and IQ imbalance in '%'.	None	None	X Phase error
MAC	EVM 'Peak' and 'RMS'; Origin Offset Suppression 95:th percentile frequency error in 'Hz'. IQ offset and IQ imbalance in '%'.	None	None	X EVM per symbol
CPW	PASSED / MARGIN / FAILED	Upper & lower limit lines	None	X Carrier power
PVT	PASSED / MARGIN / FAILED Carrier Power Time Trig to Sync Start	Upper & lower limit lines	None	X Carrier power
MOD Frequency sweep	PASSED / MARGIN / FAILED	Upper limit line		X Frequency sweep
MOD List	PASSED / MARGIN / FAILED	Upper limit line	One level value and one limit value per frequency value	Compressed frequency sweep while measurement is in progress
TRA Frequency sweep	PASSED / MARGIN / FAILED	Upper limit line		X
TRA List	PASSED / MARGIN / FAILED	Upper limit line	One level value and one limit value per frequency value	Compressed frequency sweep while measurement is in progress
SPU	PASSED / MARGIN / FAILED	Upper limit line		X Frequency sweep

Each measured value is assigned to one of the following quality classes:

- PASSED   Best quality level   Measured values inside the tolerance window
- MARGIN   :   Values inside the limit, but above the tolerance margin (= MARGIN, user-definable)
- FAILED   poorest quality level   Values outside limit

Overall assessment of the measurement is shown along with the assessments of the individual measured values. The worst evaluation is dominant.

Exiting the application

You exit the FS-K5 application by pressing a hotkey to call another operating mode, for example by pressing the *SPECTRUM* hotkey to call the ANALYZER mode. The GSM/EDGE mode is no longer active, the **GSM/EDGE** hotkey has a grey background, the newly selected mode is active and its hotkey has a green background.

In order to simplify the procedure for working alternately with the Analyzer and GSM/EDGE modes, the principal parameters of the GSM/EDGE measurement active at the time of the changeover are maintained in the new mode:

- Center frequency (CENTER)
- Frequency offset (FREQUENCY OFFSET)
- Reference level (REF LEVEL)
- Reference level offset (REF LEVEL OFFSET)
- Attenuation value (RF ATTEN)[1]
- Mode of attenuation (RF ATTEN AUTO/MANUAL)
- Attenuation value of electronic attenuator (EL ATTEN)
- Electronic attenuator on/off (EL ATTEN OFF)[1]
- Setting of electronic attenuator (EL ATTEN AUTO/MANUAL)
- Input impedance (RF INPUT 50 Ω/75 Ω)
- Sweep counter (SWEEP COUNT = NO. OF BURSTS)
- Trigger (TRIGGER; see "*Trigger options*")
- Trigger polarity (POLARITY POS/NEG)
- Trigger offset of trigger active in GSM/EDGE (TRIGGER OFFSET)
- Resolution bandwidth [2] (RBW)
- Video bandwidth [2] (VBW)
- Sweep time [2] (SWEEP TIME)

[1]) Only with *RF ATTEN AUTO*: If the GSM/EDGE application is activated, the attenuation is automatically reduced so that the mixer level is at the maximum (max. –10 dBm for FSP, -5dBm for FSU/FSQ). When the GSM/EDGE application is exited, this modification is cancelled (mixer level max. –30 dBm for FSP, -25dBm for FSU/FSQ).

[2]) For CPW, MOD, TRA and SPU measurements only
These values cannot be transferred exactly in the case of the PFE and PVT measurements.
The values set for PFE and PVT are as follows:

	PFE	PVT
RBW:	300 kHz	300 kHz
VBW:	1 MHz	3 MHz
SWT:	542.75us	801.25us

Transducer factors

The FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Trigger options

For R&S FSP, the measurements in the GSM/EDGE mode can be triggered with the IF power trigger, the external trigger, or with free run (automatic only, cannot be selected manually).
If option FSP-B6 is installed, the RF power trigger is available in addition

For R&S FSU/FSQ, the measurements in the GSM/EDGE mode can be triggered with the IF power trigger, the external trigger, or with free run (automatic only, cannot be selected manually).
The RF power trigger is not available, but its function is provided almost completely by the FSU/FSQ's IF power trigger.

When the GSM/EDGE mode is called, the trigger changes from the currently active selection to a GSM trigger mode. This automatically selects a suitable trigger.

Table 1-4   Trigger options

Trigger setting before the GSM/EDGE mode is called	GSM trigger
IF power	IF power
RF power (R&S FSP only)	RF power (R&S FSP only)
Extern	External
Other trigger	IF power, The message: "IF Power Trigger active!" draws your attention to the change

The IF/RF power and/or external trigger settings are not always possible or useful in all measurements, so in some cases the FREE RUN trigger is selected automatically. The table below shows the triggers used for the various measurements and the GSM trigger mode selected.

Table 1-5   Trigger settings in GSM trigger mode

Measurement	Possible trigger(s)	Trigger used when trigger mode =		
		Extern	**IF Power**	**RF Power (FSP only)**
PFE	External / Free Run	External	Free Run / In access burst mode IF Power	Free Run/ In access burst mode RF Power
CPW	External / IF Power	External	IF Power	RF Power
PVT	External / Free Run	External	Free Run / In access burst mode IF Power	Free Run/ In access burst mode RF Power
MOD	External / IF Power	External	IF Power	RF Power
TRA	Free Run	Free Run	Free Run	Free Run
SPU	Free Run	Free Run	Free Run	Free Run

The level extern trigger and of the IF and RF Power trigger can be set manually.

Trigger and time references

The trigger offset for the external trigger and for the IF/RF POWER trigger can be set automatically or manually. These values are stored in the GSM/EDGE. Each time you change triggers, the relevant trigger offset value is also set.
The timeslot of the TDMA burst to be measured in the PFE, PVT, MOD and CPW measuring modes is defined in the ETSI specifications.
In the PFE and PVT measuring modes, correct timing of the timeslot is ensured by synchronization to the midamble.
In the MOD and CPW measuring modes, the timing of the timeslot has to be set precisely. The setting can be performed automatically or manually.
The manual setting is performed in the *GENERAL SETTINGS* menu by adjusting the trigger offset of the selected trigger until the TDMA burst is positioned inside the mask.
The automatic setting is performed in the *GENERAL SETTINGS* menu by means of softkey (*AUTO LEVEL & TIME*).
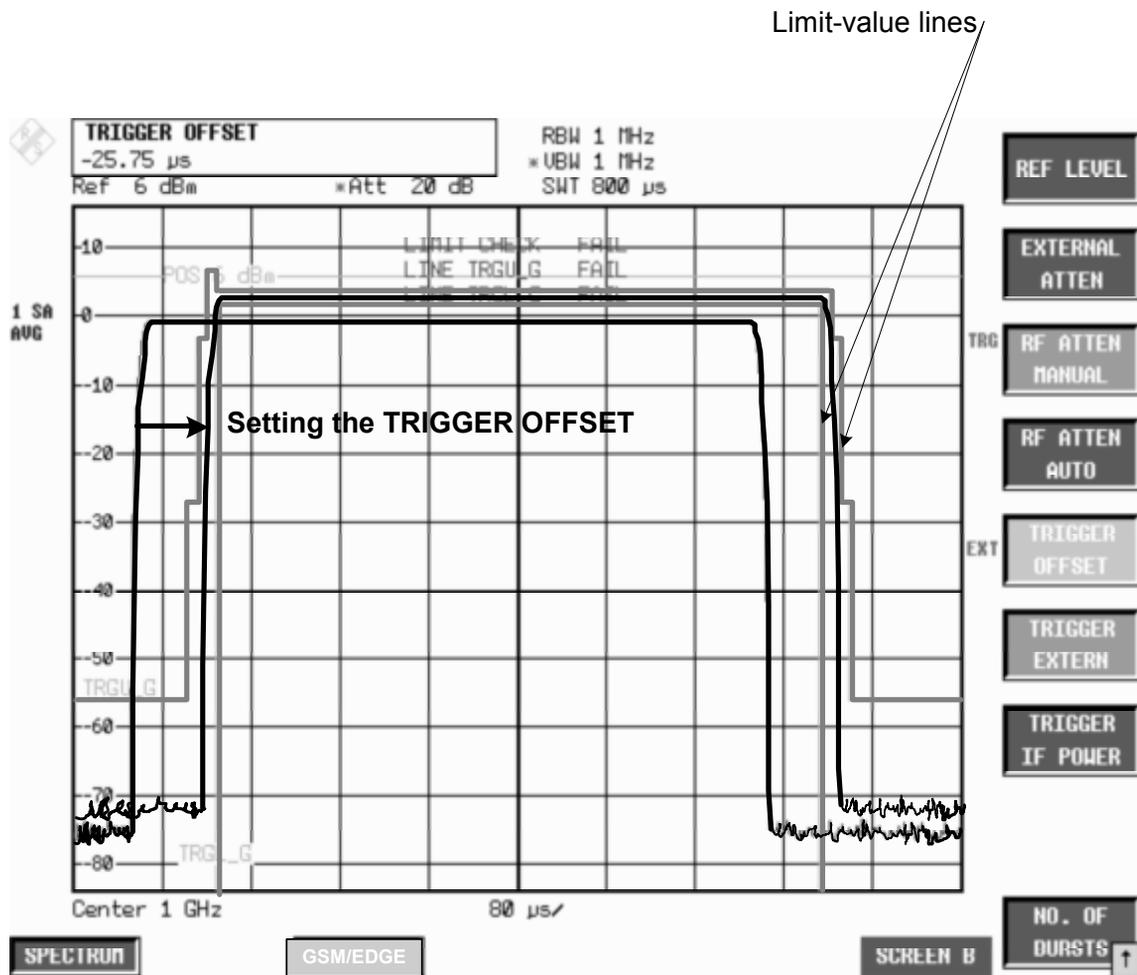
Figure 1-3 Trigger setting in *GENERAL SETTINGS* menu

Two values are computed: trigger offset and GSM/EDGE trigger offset.

Trigger offset   Time between trigger and start of display.

GSM trigger offset   Time between trigger and start of slot.

The value of the GSM trigger offset, in other words the time between the trigger and the start of the slot, is needed for remote control. This time is displayed when you exit the *GENERAL SETTINGS* menu or modify the Trigger.

```
             Trigger Offset between
    external Trigger and 'begin of slot':
                    85.75 µs

                       OK
```
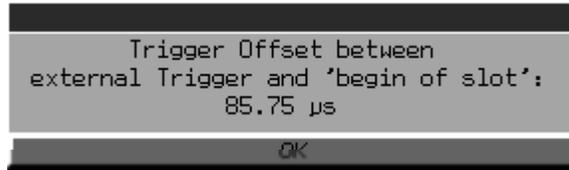
Figure 1-4   Trigger shows the trigger and time references used in the GSM firmware.

time slot = 156,25 symbols = 576,92us

active part =148 symbols =546,46us

8PSK bits	12,375	9	174	78	174	9	12,375
GMSK bits	4,125	3	58	26	58	3	4,125
	15,231us	11,077us	214,154us	96us	214,154us	11,077us	15,231us
	4,125 guard symbols	3 tail symbols	57 encrypted symbols S	Training Sequence	S 57 encrypted symbols	3 tail symbols	4,125 guard symbols

Begin 'useful part' = Middle of the first Tail-Symbol

17.077 µs

MidMidamble

559,846us

Slottime/2=288,46 µs

Slottime=576,92 µs

useful duration (part)= 147 symbols = 542,769us

17.077 µs

Trigger (incl. Triggeroffset)

HW-Trigger

Virtual Begin of Slot

Virtual End of Slot

Begin first useful bit

Bittransition 13/14

End last useful bit

Trigger to Sync Start

DUT dependent Triggeroffset

first Sample of first Midamble Symbol

Trigger Offset

GSM Triggeroffset

Symbol 0	Symbol 1

0,25 0,5 0,75

0   1

Die Zeiten sind auf den ersten Abtastwert eines Symbols bezogen. Dies ist zu berücksichtigen, da der useful part in der MITTE des 1.Tail-Symbols beginnt!

Times are referenced to first sampling value of a symbol. This must be taken into account, because useful part starts at the MIDDLE of the 1st tail symbol

Figure 1-4 Trigger and time references for normal mode
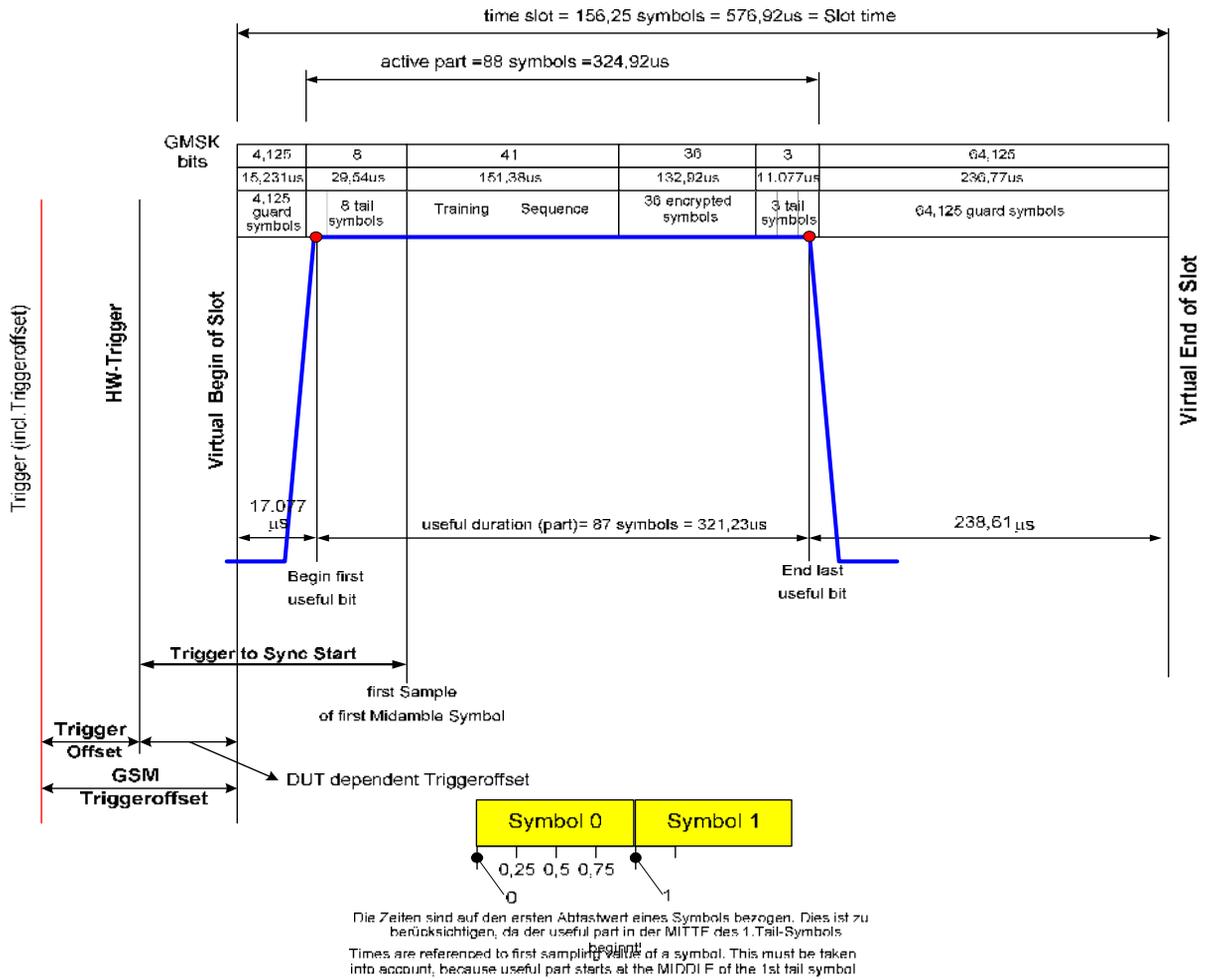
Figure 1-5 Trigger and time references for access burst mode

Possible errors and difficulties during measurement

The three main sources of error in GSM/EDGE measurement are described below:

- **No carrier signal**

Causes:	Wrong working frequency (ARFCN), slow frequency hopping active, test line defective or wrong attenuation, wrong reference level	
Effects:	Reference measurement:	Inadequate power is measured (e.g. average measurement with slow frequency hopping), measurement issues warning.
		Sweep stops (measurements with midamble synchronization), warning message: Sync not found
		Sweep stops (measurements with IF Power trigger)
	Main measurement:	Sweep stops with midamble synchronization active (PFE, PVT) or IF Power trigger in use. Sweep resumes when signal is restored.
Remedy:	- Select correct frequency (***FREQ*** ...)	
	- Deactivate slow frequency hopping (see "Measurements with slow frequency hopping" in the descriptions of the individual measurements)	
	- Set correct external attenuation (*GENERAL SETTINGS\EXT ATTEN)*	
	- Set correct reference level (*GENERAL SETTINGS \REF LEVEL* ...)	

- **No trigger**

Effects:	All triggered measurements: sweep stops. This is not immediately apparent on screen.
Remedy:	- Change trigger
	- IF/RF Power trigger: reduce level of IF/RF power trigger
	reduce external attenuation
	increase signal level

- **Trig. to Sync Start is not available during PVT measurement**

Causes:	Power-Trigger used instead of external trigger
	TRGS is only available with external trigger
Effects:	During PVT measurement the result display TRGS is not available
Remedy:	Change trigger to Extern

- **Burst not found/Sync not found**

Causes:	Dummy burst, slow frequency hopping active, wrong midamble, wrong modulation type
Effects:	Sweep stops (measurements with midamble synchronization)
Remedy:	Necessary only if measurement does not run, otherwise measurement is possible
	- Check the modulation type
	- Check the midamble
	- Deactivate slow frequency hopping

Messages in GSM/EDGE mode

All the messages explained below remain on screen only for as long as is absolutely necessary. They are cleared automatically three seconds after the reason why they were issued no longer applies. You can close any box with an 'OK button' by pressing ENTER.
You can continue to use softkeys, keys and hotkeys while a message box is displayed on screen.
If a message box includes an 'ABORT' key, you can abort the action in progress by pressing ENTER.

Message	Explanation
LIST MEAS in progress ABORT	- Indicates that list measurement (MOD or TRA) is in progress - Abort possible ➢ If this message remains in view and no progress in the trace is apparent on the screen, measurement might be waiting for a trigger.
LIST MEAS Aborted OK	- List measurement aborted by user - Values obtained during this measurement are ignored
REF MEAS in progress ABORT	- Reference measurement for PVT or MOD measurement in progress - Abort possible ➢ If this message remains in view and no progress in the trace is apparent on the screen, measurement might be waiting for a trigger.
REF MEAS Aborted OK	- Reference measurement aborted by user - Values obtained during this measurement are ignored
IF Power Trigger active! OK	- When the GSM/EDGE software is activated, this message is displayed to show that the IF Power trigger has been activated by default. ➢ See "*Trigger and time references*".
WARNING! Signal power = -9.34 dBm. REF LEVEL too high! DECREASE REF LEVEL to -6.34 dBm! OK	- Indicates that the power measured in reference measurement does not correspond to the setting for the reference level (reference level is too high). ➢ Reduce the reference level to approx. the value given in the message so that the reference level is about 3 dB higher than the actual power.
WARNING! Signal power = -0.35 dBm. REF LEVEL too low! INCREASE REF LEVEL to 2.65 dBm! OK	- Indicates that the power measured in reference measurement does not correspond to the setting for the reference level (reference level is too low). ➢ Increase the reference level to approx. the value given in the message so that the reference level is about 3 dB higher than the actual power .
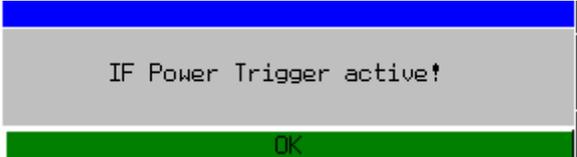
Message	Explanation
NOTE BURST FIND always ON in this version **OK**	- Indicates that the *BURST FIND* function is always on in this version (see DEMOD SETTINGS).
NOTE SYNC FIND always ON in this version **OK**	- Indicates that the *SYNC FIND* function is always on in this version (see DEMOD SETTINGS).
Trigger Offset between external Trigger and 'begin of slot': 0.00 µs **OK**	- Indicates the current setting for the time between the trigger (external) and the start of the slot. ➢ See "*Trigger and time references*"
Trigger Offset between IF Power Trigger and 'begin of slot': 0.00 µs **OK**	- Indicates the current setting for the time between the trigger (IF Power) and the start of the slot ➢ See "*Trigger and time references*"
LIMIT LINE ERROR No or wrong limit line or limit checks disabled on TRACE 1. **ABORT**	- Indicates that an expected limit line was not found or is incorrect ➢ Use the *RESTORE GSM LIMITS* softkey to restore the original GSM/EDGE limit lines, correct the limit line or switch on the Limit Checks on *TRACE 1*.
AUTO LEVEL/TIME ok! Signal power = -24.77 dBm. IF Power Trigger and 'begin of slot': -6.87 µs **OK**	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are completed sucessfully. Values obtained during this measurement are indicated.
AUTO LEVEL/TIME MEAS Aborted **OK**	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are aborted.
AUTO LEVEL/TIME in progress **ABORT**	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are in progress. ➢ If the measurement stops here, check the trigger and the trigger levels.
WARNING! No Carrier! **OK** or "Carrier OVERLOAD"	- Indicates that the automatic level and time offset settings (*AUTO LEVEL & TIME*) are aborted automatically because of a missing signal. - This error may also occur if the level at the instrument is higher than 27 dBm. In this case, the message "Carrier Overload" is output.
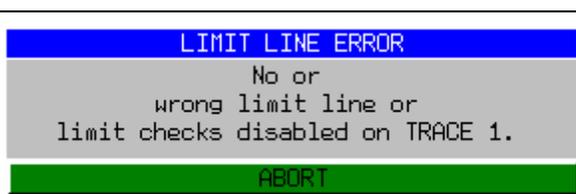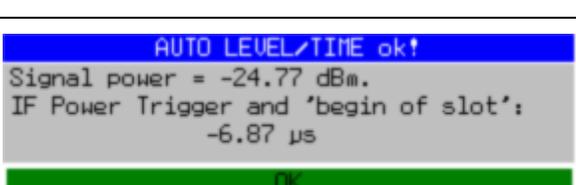
Table of Contents - Measurements

Figures

Tables

2 Measurements with Application Firmware R&S FS-K5 (GSM/EDGE Base and Mobile Station Tests)

The following measurements are possible with the R&S FS-K5 application firmware in single slot or multi slot mode:

- PFE   Phase-frequency error   Measurement of phase and frequency error with synchronization to midamble, IQ offset and IQ imbalance
- MAC   Modulation Accuracy   Measurement of EVM, of 95:th percentile value, origin offset suppression, of frequency error, of IQ offset and IQ imbalance with synchronization to midamble
- CPW   Carrier power   Measurement of carrier power
- PVT   Power versus time   Measurement of carrier power versus time with synchronization to midamble
- MOD   Modulation spectrum   Measurement of spectrum due to modulation
- TRA   Transient spectrum   Measurement of spectrum due to transients
- SPU   Spurious   Measurement of spurious

Midamble: A standard midamble or an user defined midamble can be selected.

The GSM/EDGE Hotkey

Pressing the *GSM/EDGE* hotkey calls the application. A menu compliant with the applicable standards is displayed, with a measurement assigned to each softkey. The *GENERAL SETTINGS* and *DEMOD SETTINGS* contain the functions for setting default values.

There are **two** situations in which the **GSM/EDGE** hotkey can be pressed:

1)   The GSM/EDGE mode is **not** active, the **GSM/EDGE** hotkey has a grey background:

       ➢ Pressing the **GSM/EDGE** hotkey starts the GSM/EDGE application and opens the main menu of the R&S FS-K5.
At the same time the display changes to Zero Span and the trigger changes to the GSM trigger.

2)   The GSM/EDGE mode is active, the **GSM/EDGE** hotkey has a green background:

       Most of the keys of the device are operational, so you can exit the GSM/EDGE menu by pressing a key. The GSM/EDGE mode remains active. Press the GSM/EDGE hotkey to return to the GSM/EDGE main menu.

       ➢ Pressing the **GSM/EDGE** hotkey opens the R&S FS-K5 main menu.

       The measurements continue. All user-modified parameter settings are retained.
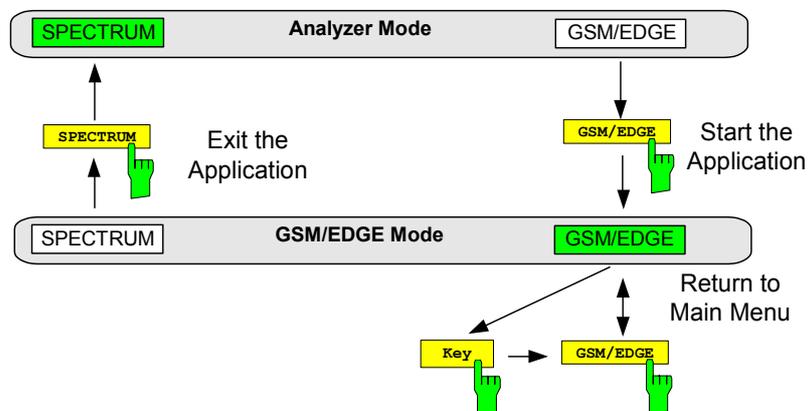
Figure 2-1   Starting and exiting the application

Menu Overview
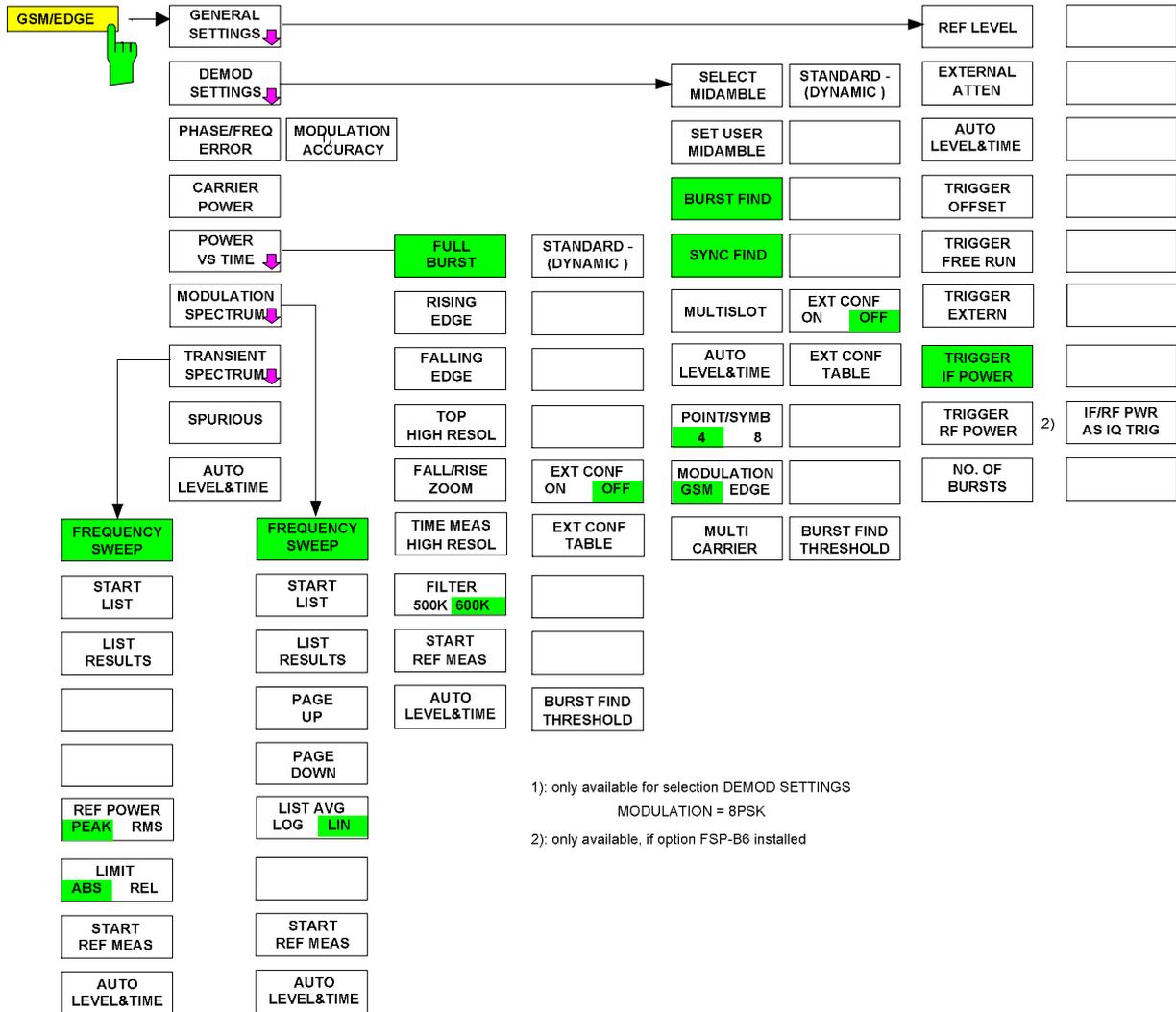
Figure 2-2   Overview of menus

Selecting default settings

External reference frequency

Depending on whether or not the mobile station can be set to a service mode or whether another device (CMD, CMU) "calls" the mobile, it may be necessary to synchronize the reference frequencies of the devices in use.
This is particularly important before measuring the phase/frequency error or the carrier power.
The procedure for switching to an external reference frequency is the same as in the basic unit.

SETUP menu:

```
REFERENCE
INT      EXT
```

Press the *REFERENCE INT / EXT* softkey to toggle between the internal and the external reference sources.

> ***Notes:***   *If you toggle to external reference and the reference signal is not present, the word "EXREF" is displayed to indicate that synchronization has not been achieved.*
>
> *When switching to the internal reference, it is important to ensure that the external reference signal has been disconnected, in order to avoid undesirable interaction with the internal reference signal.*

IEC/IEEE bus command   `:ROSC:SOUR INT`

GENERAL SETTINGS menu

GSM/EDGE menu

```
GENERAL
SETTINGS
```
→
```
REF LEVEL

EXTERNAL
ATTEN

AUTO
LEVEL&TIME

TRIGGER
OFFSET

TRIGGER
FREE RUN

TRIGGER
EXTERN

TRIGGER
IF POWER

TRIGGER
RF POWER     2)

NO. OF
BURSTS
```

```
IF/RF PWR
AS IQ TRIG
```
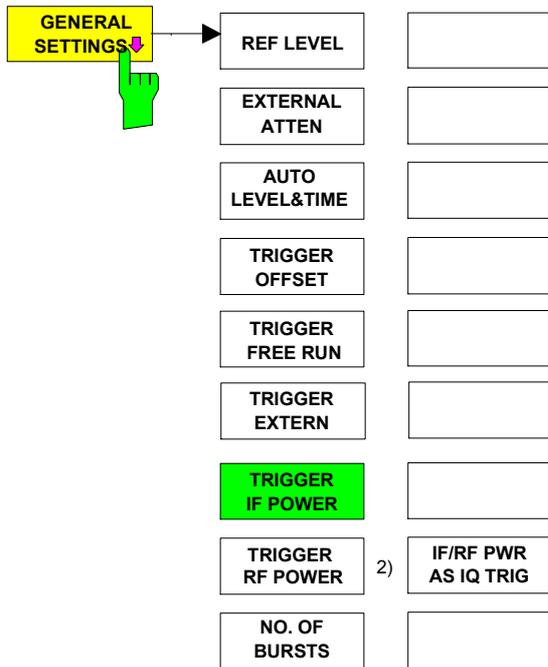
Pressing the *GENERAL SETTINGS* softkey opens a submenu for setting the major parameters of the GSM/EDGE base and mobile station tests application.

When you open this menu the burst mask is displayed, offering graphic support for setting the reference level and the trigger offset. The burst mask corresponds to the PVT limit lines. In order for measurement to be correct, the GSM/EDGE signal burst must be positioned between these lines automatically or manually (see Figure 2-3 and the descriptions of the *REF LEVEL TRIGGER OFFSET* and *AUTO LEVEL & TIME* softkeys).

This submenu offers the only opportunity of setting the reference level (REF LEVEL) and the trigger settings for the application with graphic support.

The *AUTO LEVEL & TIME* softkey enables the automatic setting of the reference level and trigger offset for the active GSM trigger.

The *TRIGGER RF POWER* softkey is available with option FSP-B6 (TV and RF trigger) only.

Limit lines
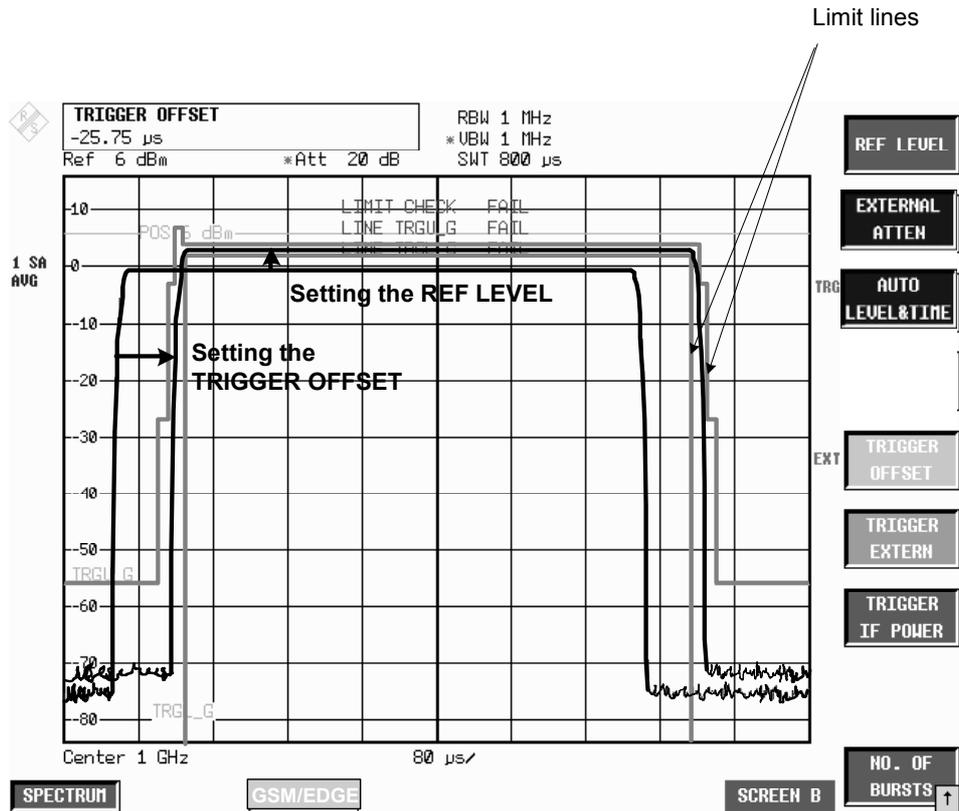
Figure 2-3   Setting trigger offset and reference level with graphic support
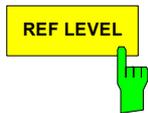
REF LEVEL

The *REF LEVEL* softkey activates the input of the reference level.

You can adjust the reference level graphically by turning the spinwheel so that the useful part of the burst is between the two horizontal limit lines.
Graphic adjustment takes into account the fact that the reference level must be approx. 3 dB higher than the power of the mobile station. This is the reason why the burst mask is 3 dB below the reference level. This protects the analyzer against overload.

In all other respects the effect of the softkey is the same as that of the *REF LEVEL* in the *AMPT* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command   :DISP:TRAC2:Y:RLEV –130dBm to 30dBm

EXTERNAL ATTEN

The *EXTERNAL ATTEN* softkey activates the input of external attenuation.

The attenuation is taken into account when the level reading is corrected. All measured levels and the gradations on the Y axis of the measured-value diagram are shifted by the selected correction value.

Note: It is recommended to automatically adjust the reference level and the trigger offset using softkey AUTO LEVEL & TIME.

The effect of the softkey is the same as that of entering a level offset with the *REF LEVEL OFFSET* softkey in the *AMPT* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command   :DISP:TRAC2:Y:RLEV:OFFS <num_value>

**AUTO
LEVEL&TIME**

The *AUTO LEVEL & TIME* softkey automatically sets the trigger offset and the reference level.

If necessary, the IF or RF trigger level and the setting of the mechanical and (if available) electronic attenuator are optimized in addition.

The following parameters must be correctly set **before** this auto function is started:
- center frequency
- GSM trigger mode
- modulation mode
- multislot settings
- midamble
- multi carrier

During the *AUTO LEVEL & TIME* measurement, the signal level is measured and the reference level is set to 3 dB above the measured signal level. After a successful measurement, the signal power and the trigger level are indicated.

If the measurement is not successfully completed (termination by the user or as a result of a "Carrier Overload" error (more than +27 dBm) or "No Carrier" error), the trigger offset and reference level settings are not changed.

During the *AUTO LEVEL & TIME* measurement, the attenuation is set to *AUTO* and the trigger slope to *POSITIVE* (for IF-Power trigger only). After the measurement, the user defined settings are restored.

In the course of the *AUTO LEVEL & TIME* measurement, the premeasurement for PVT is performed. It is not necessary to repeat this premeasurement after a successful *AUTO LEVEL & TIME* measurement. The premeasurement for MOD, however, has to be performed separately because it uses a different measurement bandwidth.

If automatic setting is not successful, the settings must be made manually with the *REF LEVEL* and *TRIGGER OFFSET* softkeys.

IEC/IEEE bus command   `READ:AUTO:LEVT?`

**TRIGGER
OFFSET**

The *TRIGGER OFFSET* softkey activates the manual input of the trigger offset (time between trigger and start of display).

The trigger offset can be adjusted graphically by turning the spinwheel so that the burst is within the vertical limit lines (see Figure 2-3).

Note: *It is recommended to automatically adjust the trigger offset and the reference level using softkey AUTO LEVEL & TIME.*

A trigger-offset value is saved for the external GSM trigger and another for the GSM trigger IF Power. This means:

When GSM-Trigger Extern is active, you can press the *TRIGGER OFFSET* softkey to set the offset of the external trigger.

When GSM-Trigger IF Power is active, you can press the *TRIGGER OFFSET* softkey to set the offset of the IF Power trigger.

When you change the trigger, the offset belonging to the trigger is activated at the same time.

When you exit the trigger-offset function, a status window appears showing the GSM trigger offset (time between trigger and start of slot) needed for remote control. The time references are described in Chapter 1, "Trigger options".

```
           Trigger Offset between
     external Trigger and 'begin of slot':
                  0.00 µs

                     OK
```

```
           Trigger Offset between
     IF Power Trigger and 'begin of slot':
                  0.00 µs

                     OK
```
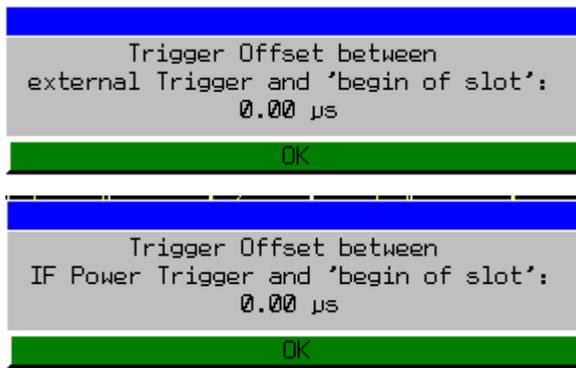
> *Note:* *The values determined here for the GSM trigger offset must be specified in remote-control mode for correct synchronization with the* `TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal,` `TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower or` `TRIGger[:SEQuence]:SYNChronize:ADJust RFPower` **commands.**

IEC/IEEE bus command-- `(the GSM trigger offset must be specified in remote-control mode)`

TRIGGER FREE RUN

The *TRIGGER FREE RUN* softkey switches on the FREE RUN GSM trigger.

The FREE RUN trigger is very useful in conjunction with R&S FSQ base band inputs if no external trigger is available and IF power triggering is not possible because of unbursted signals.

> *Note:* *Please be aware that some triggering is necessary for most of the GSM measurements. If FREE RUN is used e.g. the CPW measurement does not any longer deliver useful results. IQ measurements (PVT, PFE & MAC) are working without a problem because of burst and/or sync search.*

IEC/IEEE bus command　　　`:TRIG:SYNC:ADJ:IMM`
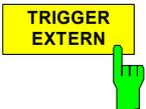
TRIGGER EXTERN

The *TRIGGER EXTERN* softkey switches on the external GSM trigger.

Triggering is either by an external trigger (PFE, CPW, PVT, MOD) or by a free-running trigger (TRA, SPU), see Chapter 1, "Trigger options".

When the external trigger is used triggering is by a TTL signal at the *EXT TRIGGER/GATE* input at the rear of the device.
With this softkey also the external trigger level can be adjusted in the range from 0.5 V to 3.5 V. The default value is 1.4 V.

> *Note:* *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command　　　`:TRIG:SYNC:ADJ:EXT  -460µs to 8s`
　　　　　　　　　　　　　　`:TRIGg:SEQ:LEV:EXT     <numeric_value>`

TRIGGER IF POWER

The *TRIGGER IF POWER* softkey switches on the IF Power GSM trigger and activates the input for the IF trigger level.

Triggering is either by the IF Power trigger (CPW, MOD) or by a free-running trigger (PFE, PVT, TRA, SPU), see Chapter 1, "Trigger options".

When the IF Power trigger is used, triggering is by signals in a bandwidth of approx. 10 MHz (FSP) or 40 MHz (FSU/FSQ) around the center frequency, where they

exceed an adjustable level value.

To this end, the spectrum analyzer employs a level detector on the third intermediate frequency. This threshold can be adjusted and is preset to approx. -20 dBm of the level at the input connector (for detailed description see manual of basic instrument).

The bandwidth on the intermediate frequency is nearly 10 MHz (FSP) or nearly 40 MHz (FSP). Triggering occurs when the trigger threshold is exceeded within 10/40 MHz of the defined frequency (= start frequency in frequency sweep).

Note: *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command   `:TRIG:SYNC:ADJ:IFP -460µs to 8s`

TRIGGER RF POWER

The *TRIGGER RF POWER* softkey switches on the RF Power GSM trigger and activates the input for the RF trigger level.

This softkey is only available for FSP with option FSP-B6 installed.

Triggering is either by the RF Power trigger (CPW, MOD) or by a free-running trigger (PFE, PVT, TRA, SPU), see Chapter 1, "Trigger options".

When the RF Power trigger is used, triggering is by signals in a bandwidth of approx. 40 MHz around the center frequency, where they exceed an adjustable level value.

To this end, the spectrum analyzer employs a level detector on the second intermediate frequency. This threshold can be adjusted and is preset to approx. –40 dBm of the level at the input connector (for detailed description see manual of basic instrument).

The bandwidth on the intermediate frequency is 80 MHz. Triggering occurs when the trigger threshold is exceeded within 80 MHz of the defined frequency (= start frequency in frequency sweep).

Note: *In remote-control mode the GSM trigger offset has to be entered at the same time as the GSM trigger is selected.*

IEC/IEEE bus command   `:TRIG:SYNC:ADJ:RFP -460µs to 8s`

NO. OF BURSTS

Press the *NO. OF BURSTS* softkey to activate input of the number of bursts to be taken into account in calculation.

The effect of the softkey is the same as that of the *SWEEP COUNT* softkey in the *SWEEP* menu of the spectrum analyzer in the Analyzer mode.

IEC/IEEE bus command   `:SENS:SWEep:COUNt  0 to 32767`

Menu GENERAL SETTINGS – NEXT

IF/RF PWR AS IQ TRIG

Press the *IF/RF PWR AS IQ TRIG* softkey in order to force the IF-power or with FSP-B6 RF-power trigger. If the trigger source is set to IF- or RF-power and an IQ measurement like PFE/MAC or PVT is used the free run trigger is selected, because a synchronization can be done with sync and burst search. Now also for these measurements the IF or RF power trigger will be selected if *IF/RF PWR AS IQ TRIG* is active. Default state is OFF.

Note: For using the power triggers in IQ mode the detector board with the model number 03 or higher must be part of the analyzer hardware. (Without that kind of detector board the free run trigger is used.)

IEC/IEEE bus command   `:TRIG1:SEQ:SYNC:IQP 0 | 1`

Table 2-1   **Trigger Übersicht**

Measurement	Possible trigger(s)	Trigger used when trigger mode =		
		Extern	**IF Power**	**RF Power (FSP only)**
PFE	External / IF Power / RF Power / Free Run	External	Free Run / Im Access Burst Modus oder wenn IF/RF PWR AS IQ TRIG aktiv: IF Power	Free Run/ Im Access Burst Modus oder wenn IF/RF PWR AS IQ TRIG aktiv: RF Power
CPW	External / IF Power / RF Power	External	IF Power	RF Power
PVT	External / IF Power / RF Power / Free Run	External	Free Run / Im Access Burst Modus oder wenn IF/RF PWR AS IQ TRIG aktiv: IF Power	Free Run/ Im Access Burst Modus oder wenn IF/RF PWR AS IQ TRIG aktiv: RF Power
MOD	External / IF Power / RF Power	External	IF Power	RF Power
TRA	Free Run	Free Run	Free Run	Free Run
SPU	Free Run	Free Run	Free Run	Free Run

DEMOD SETTINGS menu

GSM/EDGE menu:

DEMOD SETTINGS	→	SELECT MIDAMBLE	STANDARD - (DYNAMIC)
		SET USER MIDAMBLE	
		BURST FIND	
		SYNC FIND	
		MULTISLOT	EXT CONF ON OFF
		AUTO LEVEL&TIME	EXT CONF TABLE
		POINT/SYMB 4 8	
		MODULATION GSM EDGE	
		MULTI CARRIER	BURST FIND THRESHOLD

Pressing the *DEMOD SETTINGS* softkey opens a submenu for setting the major parameters of the demodulator in the GSM/EDGE application.

These parameters cannot be set in the Analyzer mode of the spectrum analyzer.

- **Default:**
  Single slot used, GMSK or 8PSK

- **Multi Slot:**
  1, 2, 3, 4 or 8 Slots active,
  same signal power and modulation or each slot

- **Extended Slot Configuration:**
  1 or more slots active,
  different signal power and/or modulation for each slot

The following chapter describes the extended slot configuration mode

SELECT MIDAMBLE

Press the *SELECT MIDAMBLE* softkey to open a picklist for selecting the midamble.

Use this softkey to specify the midamble to be used for GSM/EDGE measurements with demodulation (PFE and PVT).
The user has a choice of 8 GSM or EDGE standard training sequences or an user defined training sequence (TSC_USER) in normal mode.

```
         MIDAMBLE

      TSC_0
  ✔   TSC_1
      TSC_2
      TSC_3
      TSC_4          ─┐
      TSC_5            ├─  Normal Mode
      TSC_6
      TSC_7
      TSC_USER        ┘
      TS0  (ACCESS)  ─┐
      TS1  (ACCESS)    ├─  Access Burst Mode
      TS2  (ACCESS)   ┘
```

TSC bit pattern for GMSK

NAME	PATTERN (Bit no.: 61 - 86)	HexCode
TSC_0	00 1001 0111 0000 1000 1001 0111	x0970897
TSC_1	00 1011 0111 0111 1000 1011 0111	x0b778b7
TSC_2	01 0000 1110 1110 1001 0000 1110	x10ee90e
TSC_3	01 0001 1110 1101 0001 0001 1110	x11ed11e
TSC_4	00 0110 1011 1001 0000 0110 1011	x06b906b
TSC_5	01 0011 1010 1100 0001 0011 1010	x13ac13a
TSC_6	10 1001 1111 0110 0010 1001 1111	x29f629f
TSC_7	11 1011 1100 0100 1011 1011 1100	x3bc4bbc

TSC bit pattern for EDGE
NAME   PATTERN   (Bit no.: 61 - 86)
```
TSC0   001001   111001001111   001111111111   001001001001   111001001001
       111001001111 001111111111
TSC1   001001   111001111111   001111111111   001111111111   111001001001
       111001111111 001111111111
TSC2   001111   001001001001   111111111001   111111111001   111001001111
       001001001001 111111111001
TSC3   001111   001001001111   111111111001   111111001111   001001001111
       001001001111 111111111001
TSC4   001001   001111111001   111001111111   111001001111   001001001001
       001111111001 111001111111
TSC5   001111   001001111111   111001111001   111111001001   001001001111
       001001111111 111001111001
TSC6   111001   111001001111   111111111111   001111111001   001001111001
       111001001111 111111111111
TSC7   111111   111001111111   111111001001   001111001001   111001111111
       111001111111 111111001001
```

The bit pattern for EDGE results from the symbol pattern for EDGE using the following transformation:

SYMBOL   PATTERN

SYMBOL	PATTERN
0	111
1	011
2	010
3	000
4	001
5	101
6	100
7	110

With selection TS0 (ACCESS), TS1 (ACCESS) or TS2 (ACCESS) the access burst mode is activated using the access burst midamble pattern and slot structure from the GSM standard.
When the access burst mode is entered the current measurement (like PVT, PFE, MOD, etc.) is left and the modulation is set to GMSK.
In access burst mode the measurements power versus time (PVT) or phase frequency error (PFE) can be selected – other measurements are not available.
The IF and RF (on R&S FSP) power trigger are used in access burst mode to trigger the IQ measurements (PVT/PFE) if the detector board with the model number 03 or higher is part of the analyzer hardware. (Without that kind of detector board the free run trigger is used as known from the IQ measurements in normal mode.) The external trigger is available as usual.
The access burst mode is left by selecting a normal TSC0-TSC7 or the TSC-USER. The active measurement mode from access burst mode (PVT or PFE) is left and a new measurement mode configuration is necessary.

IEC/IEEE bus command   :CONFigure:CHANnel:TSC 0...7 |
                                          USER |AB0 | AB1 | AB2

SET USER MIDAMBLE

The *SET USER MIDAMBLE* softkey activates the input of an user specific midamble.

The midamble is entered bit by bit (GMSK: 1bit/symbol, 8PSK: 3 bits/symbol). The only admissible values are 1 and 0. Values other than 0 or 1 are set to 1.

Input fields that are not completely filled are filled with 0, inputs that are too long are cut off. If this is the case, a message appears that has to be confirmed by means of ENTER.

The midamble for EDGE (8PSK) is entered in two successive fields. The first 40 bits are entered in the first field, the remaining 38 bits in the second field . If the input of data into the second field is aborted by means of ESC/CANCEL, the data in

the first field are nevertheless accepted by the instrument.

The user midamble is stored separately for each modulation type. It is set to 0 only when the instrument is switched off or when PRESET is activated.

IEC/IEEE bus command   `CONFigure:CHANnel:TSC:USER <string>`

BURST FIND

Press the *BURST FIND* softkey to toggle between active burst search and inactive burst search.
When this mode is active, the GSM/EDGE measurement software presumes that a burst has been found. The burst level for detecting a valid burst can be adjusted with the softkey BURST SEARCH THRESHOLD.

Switching BURST FIND off is very useful in conjunction with R&S FSQ base band inputs to analyze unbursted signals.

One search type (burst or sync find) must always be active.

IEC/IEEE bus command   `:CONF:BSE ON | OFF`

SYNC FIND

Press the *SYNC FIND* softkey to toggle between active synchronization search and inactive synchronization search.

When this mode is active, the GSM/EDGE measurement software presumes that the midamble found corresponds to the preset TSC.

Switching SYNC FIND off is very useful if ramped signals without GSM modulated bits shall be measured.

One search type (burst or sync find) must always be active.

IEC/IEEE bus command   `:CONF:SSE ON | OFF`
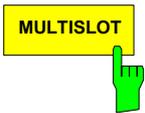
MULTISLOT

The *MULTISLOT* softkey opens a table for selecting the multi slot configuration.

In column ACTIVE SLOTS, the number of active slots is set.
In column SYNC TO SLOT, the slot is specified
a,   to be used to synchronize on it (for GSM measurements
     with demodulation (PFE and PVT))
b,   or to be measured (for GSM measurements without
     demodulation (CPW, MOD) .

ACTIVE SLOTS:	SYNC TO SLOT:
1	1
2	1
2	2
3	1
3	2
3	3
4	1
4	2
4	3
4	4
8	1
8	2
8	3
8	4
8	5
8	6
8	7
8	8

The midamble set under *SELECT MIDAMBLE* must be the same as the midamble of the slot selected in the SYNC TO SLOT column.

Also the limit lines will be adapted if the number of active slots is changed.

Example 1:   - 2 slots active
- the PFE measurement should be made for the **first** slot
-> ACTIVE SLOTS = 2, SYNC TO SLOT = 1
see figure above

Example 2:   - 2 slots active
- the PFE measurement should be made for the **second** slot
-> ACTIVE SLOTS = 2, SYNC TO SLOT = 2

Example 3:   - 3 slots active
- the PVT measurement should be synchronized to the **third**
slot
-> ACTIVE SLOTS = 3, SYNC TO SLOT = 2

Example 4:   - 3 slots active, EDGE/GSM/EDGE
- the MAC measurement should be made for the **second**
EDGE slot (=slot 3)
-> ACTIVE SLOTS = 3, SYNC TO SLOT = 3

IEC/IEEE bus command   `:CONF:CHAN:SLOT:MULT ACT1SYNC1`

The measurements can be optimized by varying the parameters listed above. See the description of the individual measurements (MOD and TRA).
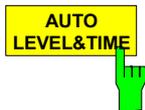
AUTO LEVEL&TIME

The *AUTO LEVEL & TIME* softkey automatically sets the trigger offset and the reference level.
If necessary, the IF or RF trigger level and the setting of the mechanical and (if available) electronic attenuator are optimized in addition.

If the measurement is not completed successfully (termination by user or as a result of an error), no setting is changed.

The following parameters must be correctly set **before** this auto function is started:
              - center frequency
              - GSM trigger mode
              - modulation mode
              - multislot settings
              - midamble
              - multi carrier

If automatic setting is not successful, make the settings manually with the *REF LEVEL* and *TRIGGER OFFSET* softkeys.

IEC/IEEE bus command   `:READ:AUTO:LEVT?`
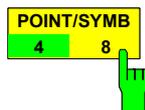
POINT/SYMB
4 **8**

The *POINT/SYMB* softkey switches the resolution for PFE/PVT/MAC measurements between 4 and 8 points per analyzed symbol.

This settings does not influence the CPW/MOD/TRA/SPU measurements.

For POINT/SYMB = 8, twice the amount of data is processed. As a result, the resolution for the PFE/MAC/PVT measurements increases. The measurement speed, however, decreases because of longer computing times. The data can be retrieved by using the *TRACE ASCII EXPORT* function of the basic unit or by using the remote control command `TRAC:DATA? TRACE1`.

IEC/IEEE-bus command: `:CONF:PRAT 4 | 8`
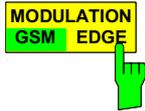
The *MODULATION GSM / EDGE* softkey selects the modulation type. The limit lines are adapted to the selected modulation type upon switchover.

IEC/IEEE bus command   `:CONF:MTYP GMSK | EDGE`
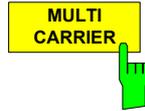
Press the MULTI CARRIER softkey to enable or disable (default state) the multi carrier functionality.

If MULTI CARRIER is active a filter with steeper edges is used for the IQ measurements (PVT, PFE & MAC). In addition a 1 MHz analog filter is used in front of the digital filter. This allows for example to measure on a 4 carrier situation with 600 kHz carrier spacing. The IQ measurements are also possible on a carrier 30 dB below the other carriers.

Hint: Switch off BURST FIND or adjust the BURST SEARCH THRESHOLD in such a scenario.

Also the Auto Level & Time function will behave according to the setting of MULTI CARRIER.

The softkeys FILTER BW 500K/600K and TIME MEAS HIGH RESOL are not available in MULTI CARRIER mode.

IEC/IEEE bus command   `:CONF:MCAR ON | OFF`
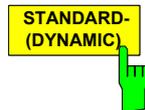
The STANDARD- (DYNAMIC) softkey controls the behaviour of the extended slot configuration mode for Power vs Time measurements.

The default value DYNAMIC uses a fixed Power vs Time limit line template. Selecting GSM900, GSM1800 or GSM1900 (mobile station) the limit lines are calculated internally by taking into account special user settings as 'control level' and 'absolute level'.

The actually 4 possibilities to be choosen are:

- MS/BTS DYNAMIC
- MS - GSM 900
- MS - GSM 1800
- MS - GSM 1900

IEC/IEEE bus command: `:CONF:MS:ECON:STAN:SEL`
                                              `DYNAMIC | GSM900 | GSM1800 | GSM1900`
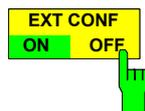
The EXT CONF ON/OFF softkey toggles between standard and extended slot configuration mode. For extended slot configuration a definition table for the GSM slots is taken into account, specifying e.g. the used modulation and the signal level for each slot.

IEC/IEEE bus command: `:CONF:ECON:STAT ON | OFF`
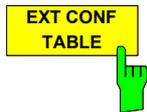
EXT CONF TABLE

- *The EXT CONF TABLE* softkey opens the extended slot configuration table. This table defines the 8 slots of a GSM signal.
- Equal Slot Length
- Long Slots

For every Slot:

- Modulation
- Reference power mode
- Reference power
- Limit line mask

IEC/IEEE bus command

```
:CONF:MS:ECON:LSL:STAT ON |OFF
:CONF:MS:ECON:LSL:VAL <numeric_value>,<numeric_value>
:CONF:MS:ECON:MREF <numeric_value>
:CONF:MS:ECON:OFR ON |OFF
:CONF:MS:ECON:TREF <numeric_value>
:CONF:MS:ECON:SLO7}>:MOD GMSK | EDGE | OFF
:CONF:MS:ECON:SLOT7}>:RLEV:MODE AUTO | ABS | REL |
                         <numeric_value> <numeric_value>
:CONF:MS:ECON:SLOT7:RLEV:VAL
:CONF:MS:ECON:SLOT7:LIMit:ABS <numeric_value>
:CONF:MS:ECON:SLOT7:LIMit:ABS:STAT
:CONF:MS:ECON:SLOT7:LIMit:ABS:BASE2 <string>
:CONF:MS:ECON:SLOT7:LIM:CLEV <string>
:CONF:MS:ECON:SLOT7:LIMit:LOWer <string>
:CONF:MS:ECON:SLOT7:LIMit:UPPer <string>
```

BURST FIND THRESHOLD

Press the *BURST FIND THRESHOLD* softkey to change the burst find threshold. The level of the measured signal must change at least as much as that given threshold value to be recognized as a burst.

The value is in dB, with a minimum of –100 dB and maximum of 0 dB. The default is –35 dB.

IEC/IEEE bus command   `:CONF:BSTH <numeric_value>`

Restoring the limit lines –RESTORE GSM LINES softkey

LINES menu

Press the *RESTORE GSM LINES* softkey to reset all the limit lines of the GSM/EDGE application to their default values.
This softkey appears in the LINES menu of the spectrum analyzer as soon as the GSM/EDGE application is enabled.

Users have the option of adjusting the limit lines to suit their purposes. These custom settings are retained in a preset. They are not overwritten until the user explicitly presses the *RESTORE GSM LINES* softkey.

User-defined limit lines can be protected against being overwritten when the *RESTORE GSM LINES* softkey is pressed by assigning them names other than those of the GSM/EDGE limit lines.

IEC/IEEE bus command   `:CONF:REST`

Note: *In remote-control mode the names of the limit lines are predefined and cannot be changed. Users must assign the limit lines these names before using them:*

Example:

```
CALC1:LIM1:NAME 'PVTU_G'
where   PVT = measurement (PVT / CPW / MOD /TRA)
        U   = Upper limit line (Upper / Lower)
        _G  = modulation type (GMSK / EDGE)
```

Setting the transmit channel

The operating frequency is defined - as usual in spectrum analyzer – by pressing the *FREQ* key.

Press the *FREQ* key to open the box for manual input of the center frequency.

IEC/IEEE bus command   :FREQ:CENT 100MHz

The relationships between channel number and frequency as specified in the standards are shown below.

Table 2-2   Relationship between frequencies and channels

P-GSM 900	Fl(n) = 890 + 0.2*n	$1 \leq n \leq 124$	Fu(n) = Fl(n) + 45
E-GSM 900	Fl(n) = 890 + 0.2*n	$0 \leq n \leq 124$	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	$975 \leq n \leq 1\,023$	
R-GSM 900	Fl(n) = 890 + 0.2*n	$0 \leq n \leq 124$	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	$955 \leq n \leq 1023$	
DCS 1 800	Fl(n) = 1710.2 + 0.2*(n-512)	$512 \leq n \leq 885$	Fu(n) = Fl(n) + 95
PCS 1 900	Fl(n) = 1850.2 + .2*(n-512)	$512 \leq n \leq 810$	Fu(n) = Fl(n) + 80
GSM 450	Fl(n) = 450.6 + .0.2*(n-259)	$259 \leq n \leq 293$	Fu(n) = Fl(n) + 10
GSM 480	Fl(n) = 479 + .0.2*(n-306)	$308 \leq n \leq 340$	Fu(n) = Fl(n) + 10
GSM 850	Fl(n) = 824.2 + .0.2*(n-128)	$128 \leq n \leq 251$	Fu(n) = Fl(n) + 45

P-GSM 900	935.2MHz			959.8MHz	FREQ
	1			124	ARFCN
E-GSM 900	925.2MHz	934.8	935	935.2	959.8MHz	FREQ
	975	1023	0	1	124	ARFCN
R-GSM 900	921.2MHz	934.8	935	935.2	959.8MHz	FREQ
	955	1023	0	1	124	ARFCN
DCS 1800	1805.2MHz			1879.8MHz	FREQ
	512			885	ARFCN
PCS 1900	1930.2MHz			1989.8MHz	FREQ
	512			810	ARFCN
GSM 450			450.6MHz	457.4MHz	FREQ
			259	293	ARFCN
GSM 480			479MHz	485.8MHz	FREQ
			306	340	ARFCN
GSM 850	824.2MHz			848.8MHz	FREQ
	128			251	ARFCN

Measurement of modulation accuracy of EDGE signals

The modulation accuracy of 8PSK modulated signals is characterized by the following quantities:

- Error vector magnitude (EVM)
  The error vector magnitude is the magnitude of the error vector that links the measured I and Q values at the complex level to the ideal I and Q values at the decision points.
  During the measurement the EVM of each of the 142 stipulated symbols of a normal burst is determined, displayed and compared to the limit values according to GSM 05.05 and GSM 11.21. The RMS value and the peak EVM are evaluated.

- Origin offset suppression
  The origin offset suppression (or the IQ offset) is indicated as a measure of carrier suppression. According to the standard this value is given in dB. This measurement is to verify that a defined minimum suppression is reached, so the lowest suppression value measured is stored as "HLD" (Min Hold) value. In addition, the IQ offset is given in %.

- 95th percentile
  The 95:th percentile is a statistical value describing EVM. It expresses the value not attained in 95%, or exceeded in 5%, of all cases.

- Frequency error
  The frequency error is the difference between the measured frequencies from the expected frequencies. The frequency error is computed from the phase of the symbols in accordance with the standards; this frequency error is also displayed.
  In addition, the IQ imbalance is given in %.
  For multislot measurements (more than one slot active), use the MULTISLOT softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness) (this applies only if multislot is off, i.e. active slots = sync to slot = 1)
- Sync sequence must be present in the timeslot to which synchronization is to be made

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey
Select modulation type *EDGE*	Softkey *DEMOD SETTINGS* Softkey *MODULATION EDGE*
Set midamble Default: TSC0	*DEMOD SETTINGS* softkey *SELECT MIDAMBLE* softkey
Select GSM trigger Default: IF Power	*TRIGGER EXTERN* or *IF POWER* softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey (recommended) or *REF LEVEL* softkey → Position burst in mask
Start measurement	Hotkey *PREV* Softkey *MODUALTION ACCURACY*

Measurement

GSM/EDGE menu

> MODULATION
> ACCURACY
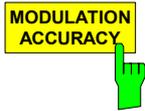
The *MODULATION ACCURACY* softkey starts the measurement of the modulation accuracy in accordance with the standard (see Figure 2-4).

The overview of the numeric modulation errors is shown on the screen. The error is calculated over the 147 useful bits without tail bits (ie over 142 symbols).

The EMV value of each symbol is calculated and displayed as trace. The following values are then calculated and displayed:

PEAK HLD: Peak value of the EVM, calculated over 142 bits * *NO OF BURST.*

PEAK AVG: Average of the peak value of EVM per burst calculated over the number of bursts defined by *NO OF BURSTS.*

RMS HLD: Maximum value of the RMS value of the EVM, calculated over 142 bits * *NO OF BURSTS.*

RMS AVG: Average of the RMS value of EVM per burst calculated over the number of bursts defined by *NO OF BURSTS.*

FREQ HLD: Peak value of the magnitude of the frequency error, calculated over 142 bits * *NO OF BURSTS.*

FREQ AVG: Average of the frequency error calculated over the number of bursts defined by *NO OF BURSTS.*

OOS HLD: Peak value of the Origin Offset Suppression, calculated over 142 bits * *NO OF BURSTS.*

OOS AVG: Average of the maximum Origin Offset Suppression value per burst calculated over the number of bursts defined by *NO OF BURSTS.*

PERC HLD: Peak value of the 95:th percentile value, calculated over 142 bits * *NO OF BURSTS.*

PERC AVG: Average of the PERC value per burst calculated over the number of bursts defined by *NO OF BURSTS.*

IQOF HLD: Peak value of IQ offset, calculated over 142 bits * *NO OF BURSTS*

IQOF AVG: Average of the maximum IQ offset per burst calculated over the number of bursts defined by *NO OF BURSTS*

IQIM HLD: Peak value of IQ imbalance, calculated over 142 bits * *NO OF BURSTS*

IQIM AVG: Average of the maximum IQ imbalance per burst, calculated over the number of bursts defined by *NO OF BURSTS*

These readings can be switched on and off in **MEAS** / *TIME DOM POWER*.

The EVM value versus time within the 142 bits of the normal burst is shown in the measuring window. Three traces are displayed simultaneously:

Trace No. 1: Clear Write; Trace No. 2: Max Hold; Trace No. 3: Min Hold

The midamble selected in *DEMOD SETTINGS / SELECT MIDAMBLE* is used for synchronization.

IEC/IEEE bus commands

```
:INST:SEL MGSM
:CONF:MTYP EDGE
C:ONF:BURS:MACC:IMM
:SWE:COUN 20
:INIT:IMM; *WAI
```

Result queries: `:FETC:BURS:MACC:RMS:AVER?`
                         `:FETC:BURS:MACC:RMS:MAX?`
                         `:FETC:BURS:MACC:PEAK:AVER?`
                         `:FETC:BURS:MACC:PEAK:MAX?`
                         `:FETC:BURS:MACC:OSUP:AVER?`
                         `:FETC:BURS:MACC:OSUP:MAX?`
                         `:FETC:BURS:MACC:PERC:AVER?`
                         `:FETC:BURS:MACC:PERC:MAX?`
                         `:FETC:BURS:MACC:FREQ:AVER?`
                         `:FETC:BURS:MACC:FREQ:MAX?`
                         `:FETC:BURS:MACC:IQOF:AVER?`
                         `:FETC:BURS:MACC:IQOF:MAX?`
                         `:FETC:BURS:MACC:IQIM:AVER?`
                         `:FETC:BURS:MACC:IQIMMAX?`
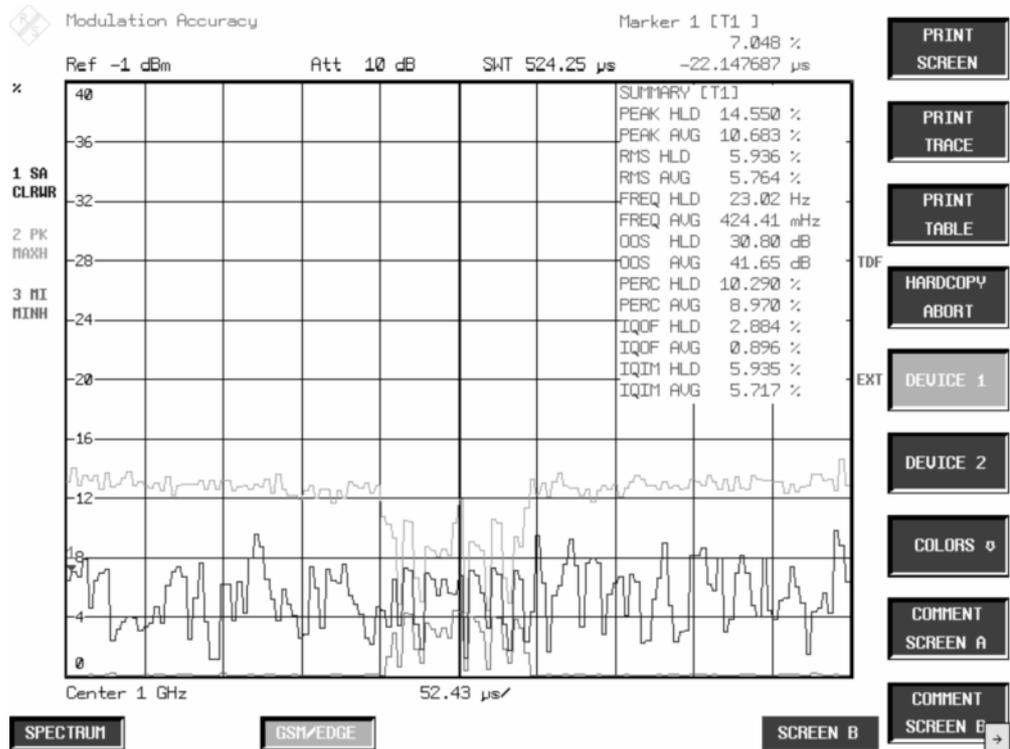
Figure 2-4   Measurement of Modulation Accuracy

SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger, i.e.   IF Power, assuming IF-Power was set
                               External trigger, assuming Extern was set

IEC/IEEE bus command   `:INST:SEL SAN`

Test hints

Number of bursts to be measured - *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).

You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

This mode can be used to measure a mobile with slow frequency hopping, because errors are computed only in the bursts in which the midamble was correctly recognized. When the carrier hops, therefore, the only bursts measured are those whose frequency corresponds to the preset center frequency.

Additional information

MAC measurement requires a time reference to the midamble (TSC 0 to 7 or user midamble). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement.
The given names are examples for EDGE and SINGLE SLOT.

Parameter	Setting	Note
MODE	IQ mode	R&S FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	Analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples to be recorded = symbols * oversampling
Bits per Symbol	3	Number of bits describing a symbol, constant for EDGE measurements
BURST FIND	ON	Burst find is active
SYNC FIND	ON	Sync find is active
PFE Result Length	142	Number of symbols shown
PFE Sync Mid Offset	0	Offset in symbols of the midamble from the center of the screen.
Teilung der Y-Achse	0 to 40 %, linear, a grid line every 4 % (10 lines)	Trace shows t EVM (Error Vector Magnitude)
TRACE 1	CLEAR WRITE	Trace shows EVM (Error Vector Magnitude)
DETECTOR 1	SAMPLE	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
LIMIT LINE	None	
LIMIT CHECK	-	

Availability of keys and softkeys

Parameter	Availability	Note
All BW parameters (**BW** menu)	Not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL/ZERO/LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Level reading (REF LEVEL, RANGE LOG/MANUAL/ LINEAR, REF LEVEL POSITION, GRID ABS/REL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Set reference level to current marker value (REF LEVEL = MKR LEVEL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Time domain measurement – determine reference values (SET REFERENCE)	Function not available	Unit in DEG
Time domain measurement – select power measurement (POWER ABS/REL)	Function not available	Unit in DEG
Time domain measurement – set standard deviation (STANDARD DEVIATION)	Function not available	Unit in DEG
Unit (UNIT menu)	Function not available	
Create limit lines (NEW LIMIT LINE)	Function not available	There are no limit lines with the DEG unit

Measurement of phase and frequency error

This measurement is used to determine the accuracy of the phase of each of the 147 useful bits and show the RMS phase error across the useful bits and the maximum phase error in accordance with GSM 05.05 and GSM 11.10 for modulation type GMSK.
The frequency error is computed from the phase of the symbols in accordance with the standards; this frequency error is also displayed.

In addition the IQ imbalance and IQ offset are given in %.

For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness)(this applies only if multislot is off, i.e. active slots = sync to slot = 1)
- Sync sequence must be present in the timeslot to be measured

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey
Select GSM trigger Default: IF Power	*TRIGGER EXTERN* or *IF POWER* softkey
Fine-tune level to within approx. 3 dB	AUTO LEVEL&TIME softkey (the trigger offset is set automatically) or *REF LEVEL* softkey → Position burst in mask

Set midamble
        Default: TSC0
	DEMOD SETTINGS softkey
	        SELECT MIDAMBLE softkey

Start measurement	*PREV* hotkey *PHASE/FREQ ERROR* softkey

Measurement

GSM/EDGE menu

PHASE / FREQ ERROR

The *PHASE/FREQ ERROR* softkey starts the measurement of the phase and frequency error in accordance with the standard (see Figure 2-5).

The overview of the numeric modulation errors is shown on the screen. The error is calculated over the 147 useful bits.

The amount of the phase error for each of the 147 symbols is calculated. The following values are then calculated and displayed:

PEAK HLD: Peak value of the magnitude of the phase error, calculated over 147 useful bits * *NO OF BURSTS*

PEAK AVG: Average of the peak value of the phase error per burst calculated over the number of bursts defined by *NO OF BURSTS*

RMS HLD: Maximum value of the RMS phase error, calculated over 147 useful bits * *NO OF BURSTS*

RMS AVG: Average of the RMS value of the phase error per burst calculated over the number of bursts defined by *NO OF BURSTS*

FREQ HLD: Peak value of the magnitude of the frequency error, calculated over 147 useful bits * *NO OF BURSTS*

FREQ AVG: Average of the frequency error calculated over the number of bursts defined by *NO OF BURSTS*

IQOF HLD: Peak value of IQ offset, calculated over 147 bits * *NO OF BURSTS*

IQOF AVG: Average of the maximum IQ offset per burst calculated over the number of bursts defined by *NO OF BURSTS*

IQIM HLD: Peak value of IQ imbalance, calculated over 147 bits * *NO OF BURSTS*

IQIM AVG: Average of the maximum IQ imbalance per burst, calculated over the number of bursts defined by *NO OF BURSTS*

These readings can be switched on and off in **MEAS** / *TIME DOM POWER*.

The phase error versus time within the 147 useful bits of the normal burst is shown in the measuring window. Three traces are displayed simultaneously:

Trace No. 1: Clear Write

Trace No. 2: Max Hold

Trace No. 3: Min Hold

The midamble selected in *DEMOD SETTINGS / SELECT MIDAMBLE* is used for synchronization.

IEC/IEEE bus commands
```
:INST:SEL MGSM
:CONF:MTYP GMSK
:CONF:BURS:PFER:IMM
:SWE:COUN 20
:INITIMM; *WAI
```

Result queries:
```
FETC:BURS:PERR:RMS:AVER?
FETC:BURS:PERR:RMS:MAX?
FETC:BURS:PERR:PEAK:AVER?
FETC:BURS:PERR:PEAK:MAX?
FETC:BURS:FERR:AVER?
FETC:BURS:FERR:MAX?
FETC:BURS:IQOF:AVER?
FETC:BURS:IQOF:MAX?
FETC:BURS:IQIM:AVER?
FETC:BURS:IQIM:MAX?
```
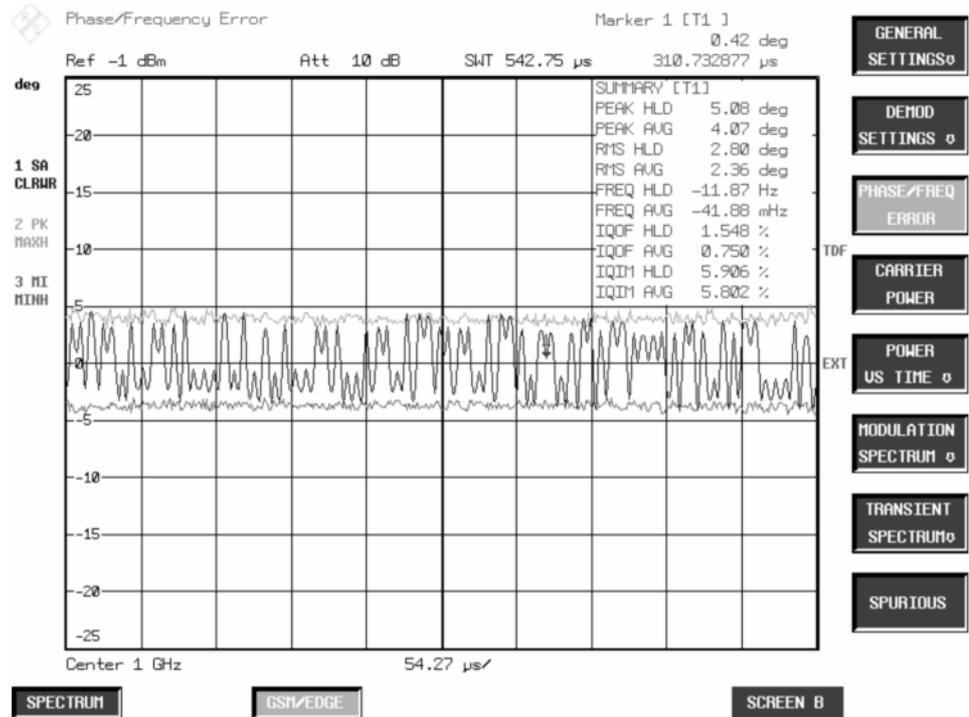

Figure 2-5   Measurement of phase and frequency error
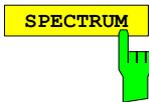
Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger, i.e.   IF Power, assuming IF-Power was set
                               External trigger, assuming Extern was set

IEC/IEEE bus command   `:NST:SEL SAN`

Test hints

Number of bursts to be measured - *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).

You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

This mode can be used to measure a mobile with slow frequency hopping, because errors are computed only in the bursts in which the midamble was correctly recognized. When the carrier hops, therefore, the only bursts measured are those whose frequency corresponds to the preset center frequency.

Additional information

PFE measurement requires a time reference to the midamble (TSC 0 to 7 or user midamble). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement. The given names are examples for EDGE and SINGLE SLOT.

Parameter	Setting	Note
MODE	IQ mode	R&S FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	Analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples to be recorded = symbols * oversampling
Bits per Symbol	1	Number of bits describing a symbol, constant for GSM measurements
Receiver Filter	Gauss with BT = 0.3	Constant for GSM measurement
BURST FIND	ON	Burst find is active
SYNC FIND	ON	Sync find is active
PVT Result Length	147	Number of symbols shown
PVT Sync Mid Offset	0	Offset in symbols of the midamble from the center of the screen.
Y axis pitch	-20 to +20 degrees linear, a grid line every 4 degrees	Trace shows phase versus time
TRACE 1	CLEAR WRITE	Trace shows phase versus time
DETECTOR 1	SAMPLE	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
LIMIT LINE	None	
LIMIT CHECK	-	

Availability of keys and softkeys

Parameter	Availability	Note
All BW parameters (**BW** menu)	Not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL/ZERO/LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Level reading (REF LEVEL, RANGE LOG/MANUAL/ LINEAR, REF LEVEL POSITION, GRID ABS/REL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Set reference level to current marker value (REF LEVEL = MKR LEVEL)	Function not available	Instead of showing the level, Y axis shows phase angle in DEG
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Time domain measurement – determine reference values (SET REFERENCE)	Function not available	Unit in DEG
Time domain measurement – select power measurement (POWER ABS/REL)	Function not available	Unit in DEG
Time domain measurement – set standard deviation (STANDARD DEVIATION)	Function not available	Unit in DEG
Unit (UNIT menu)	Function not available	
Create limit lines (NEW LIMIT LINE)	Function not available	There are no limit lines with the DEG unit

Measurement of carrier power

The purpose of measuring carrier power is to determine the output power of the mobile during the useful bits.

This measurement is intended for users whose signal does not have a midamble for time synchronization.
This measurement is performed in the time domain (Zero Span) at the set frequency.
Unlike power display in the PVT measurement mode, the signal is not demodulated for this measurement. This means that measurement in this mode is possible without a midamble.

There are two preconditions for correct measurement, namely correct timing of the trigger offset and correct reference level setting (*AUTO LEVEL&TIME* softkey).

For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

Requirements for the measuring signal

The signal's peak power cannot be more than 1 dB above the reference level.

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/EDGE* hotkey

Enter external attenuation
      Default: 0 dB
	GENERAL SETTINGS softkey
	      EXTERNAL ATTEN softkey

Select GSM trigger	*TRIGGER EXTERN* or *TRIGGER IF POWER* softkey
Fine-tune level to within approx. 1 dB	*AUTO LEVEL&TIME* softkey (the trigger offset is set automatically) or *REF LEVEL* softkey $\rightarrow$ Position burst in mask
Set trigger offset	*TRIGGER OFFSET* softkey $\rightarrow$ Position burst time exactly in mask
Start measurement	*PREV* hotkey *CARRIER POWER* softkey

Measurement

GSM/EDGE menu
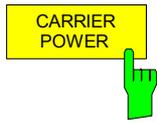
| CARRIER POWER |

Press the *CARRIER POWER* softkey to start measurement of carrier power over the 147 useful bits, in accordance with the standard.

The limit lines are displayed.

When power is exactly 3 dB below the reference level, the trace is centered between the upper and lower limit lines.

IEC/IEEE bus commands
```
:INST:SEL MGSM
:CONF:MTYP GMSK
:CONF:BURS:POW:IMM
:SWE:COUN 20
:INIT:IMM; *WAI
```

Result queries:
```
:CALC:MARK:FUNC:SUMM:MEAN:RES?
:CALC1LIM1:NAME 'CPWU_G'
:CALC1:LIM2:NAME 'CPWL_G'
:CALC1:LIM1:FAIL?
:CALC1:LIM2:FAIL?
```

Note: *In remote-control mode, the user must assign the following names to the limit lines before they are used:*
```
CALC1:LIM1:NAME 'CPWU_G' or 'CPWU_E'
CALC1:LIM2:NAME 'CPWL_G' or 'CPWL_E',
```
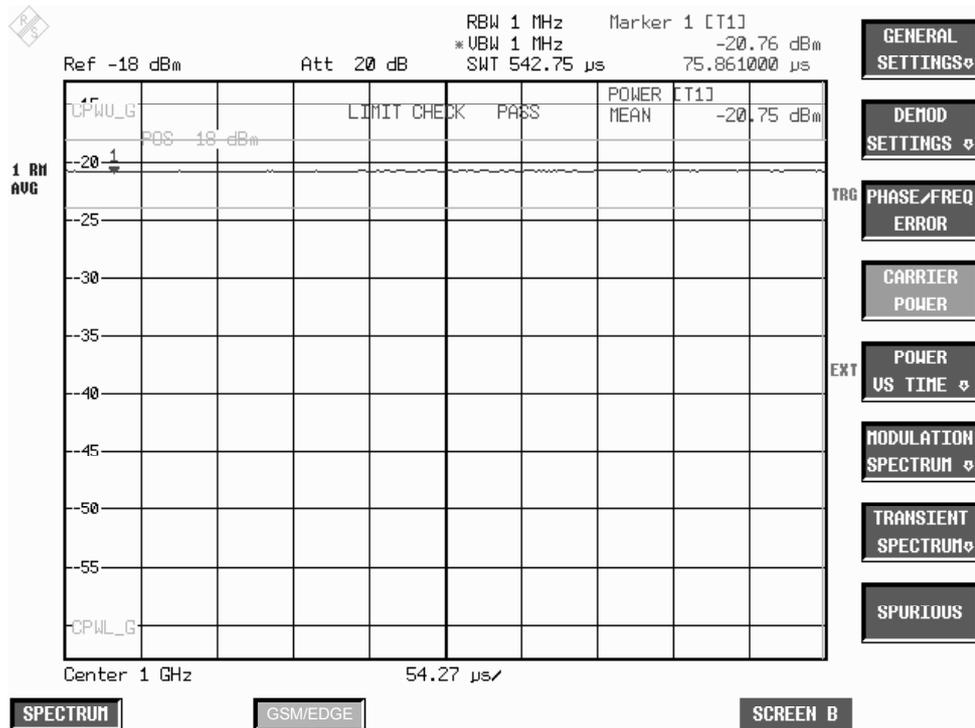

Figure 2-6   Measurement of carrier power
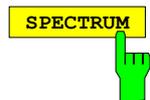
| SPECTRUM |

Press the *SPECTRUM* hotkey to launch the Analyzer mode. All settings are taken from the GSM/EDGE mode. IF-Power is set for GSM Trigger IF Power, and the external trigger is set for GSM Trigger Extern.

IEC/IEEE bus command   `:INST:SEL SAN`

Test hints

Increase of measurement speed

In remote control, the measurement speed is considerably increased by using the SENSe:MPOWer subsystem. This subsystem provides a fast measurement of the power control levels of a series of consecutive bursts with monotonically decreasing power.

The commands of this subsystem are used to determine the mean burst power or peak burst power for a given number of signal bursts, and for outputting the results in a list. Since all the settings required for a measurement are combined in a single command, the measurement speed is considerably higher than when using individual commands.

For measuring the signal bursts, the GATED SWEEP function is used in the time domain. The gate is controlled either by an external trigger signal or by the video signal. An individual trigger event is required for each burst to be measured. If an external trigger signal is used, the threshold is fixed to TTL level, while with a video signal the threshold can be set as desired.

The following graphics shows the relation between trigger time, trigger offset (for delayed gate opening) and measurement time.
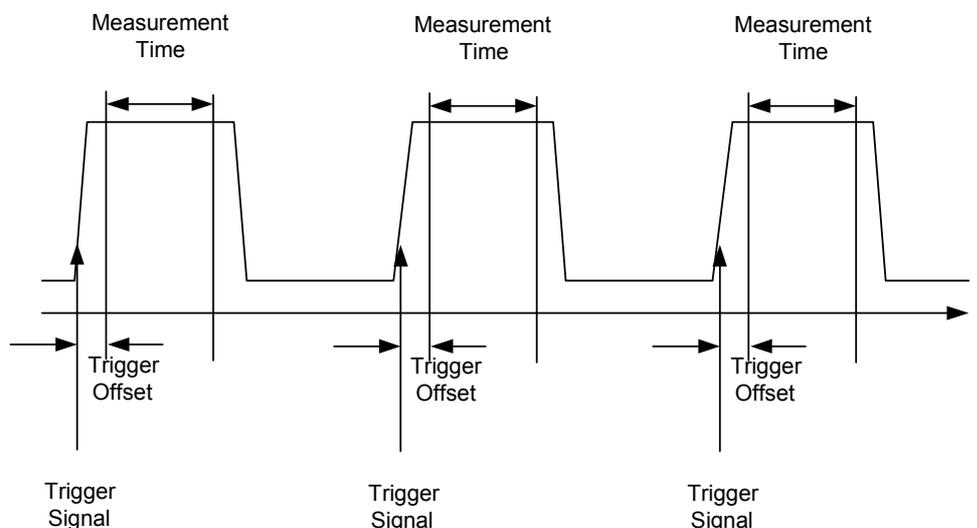
Depending on the settings made, the measurements are performed with the RMS detector for RMS power or the PEAK detector for peak power. For all these measurements, TRACE 1 of the selected system is used.

The setting parameters for this measurement are:

analyzer frequency

resolution bandwidth

measurement time used for a single burst

trigger source

trigger level

trigger offset

type of power measurement (PEAK, MEAN)

number of bursts to be measured

See operating manual of basic unit for details on the SENSe:LIST subsystem.

Transducer factors

The R&S FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Number of bursts to be measured -> *NO OF BURSTS*

The default setting when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measuring with slow frequency hopping

Measurement with slow frequency hopping is possible under the following conditions only:
GSM-Trigger Extern: Trigger only when the burst is transmitted on the defined frequency.
GSM-Trigger IF Power: The IF trigger level is permanently set and cannot be changed.

This means that measurement with slow frequency hopping is very limited and is strictly dependent on the level to be measured.

Measurement of individual power control levels and power classes

The relationships between power, control level and power class specified in the standards are listed in the tables below.

Table 2-2 Power classes

Power Class	Power				
	P-GSM 900 Phase I	E/P/R-GSM900 Phase II	DCS1800 Phase I	DCS1800 Phase II	PCS1900
1	43 dBm	--	30 dBm	30 dBm	30 dBm
2	39 dBm	39 dBm	24 dBm	24 dBm	24 dBm
3	37 dBm	37 dBm	--	36 dBm	33 dBm
4	33 dBm	33 dBm	--	--	--
5	29 dBm	29 dBm	--	--	--

Table 2-3 Power control levels

Power Control Level	Power				
	GSM900 Phase I	GSM900 Phase II/II+	DCS1800 Phase I	DCS1800 Phase II/II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	0 dBm	reserved
17	--	9 dBm	--	0 dBm	reserved
18	--	7 dBm	--	0 dBm	reserved
19	--	5 dBm	--	0 dBm	reserved
20..28	--	--	--	0 dBm	reserved
20..31	--	5 dBm	--	--	--

Additional information

Parameter	Setting	Note
MODE	Zero Span	
SWEEP mode	CONT under local control SINGLE under remote control	
RBW	1 MHz	
VBW	1 MHz	Coupling off
SWEEP TIME	147 * symbol duration = 147 * 3.6923 µs = 542.75 µs	
REF LEVEL POSITION	90%	
Y axis	LOG_50DB	
TRACE 1	AVERAGE	
DETECTOR 1	RMS	
TRACE 2	BLANK	
DETECTOR 2	-	
TRACE 3	BLANK	
DETECTOR 3	-	
Limit Line	CPWU_G GSM) CPWU_E (EDGE)	X relative to screen left, X values symmetrical with 0, therefore X offset, see below Y relative to reference level
Limit Checks	ON	
Limit Line	CPWU_G GSM) CPWU_E (EDGE)	-"-
Limit Checks	ON	
Limit X OFFSET	SWT/2 = 270µs	So that limit line symmetrical with 0 is in center of screen
Limit Y OFFSET	- 3dB	
Time Domain Power measurement	ON for Trace 1	

Availability of keys and softkeys

Parameter	Availability	Note
SWEEP TIME	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Span parameters (SPAN, FULL SPAN, ZERO SPAN, LAST SPAN)	Function not available	Measurement is in time domain
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Filter (FILTER TYPE)	Function not available	

Measurement of carrier power versus time

Measuring carrier power versus time provides a means of checking the time characteristic of a burst's power and the time reference between the burst edges and the midamble.
The power of the burst, moreover, is measured with synchronization to the midamble (as stipulated in the standard) and displayed.

To this end freely definable limit lines are shown, and the time characteristic of carrier power is measured against them in the ZERO SPAN mode.
Reference measurement is available as a means of obtaining a correct level setting for the limit values (also referred to as pre-measurement in the rest of the text).

Synchronization with the midamble of the burst is active in this measurement mode (unlike the Carrier Power mode) (13/14 bit transition of the midamble). This ensures a correct time reference for the burst at all times.
An activated Extended Slot Configuration is treated like a multi-slot measurement in this context.
For multislot measurements (more than one slot active), use the *MULTISLOT* softkey to set SYNC TO SLOT to the slot to which synchronization is to be made. This slot then serves as a time reference for the other active slots (for example, if two active slots are to be synchronized to the second slot, set SYNC TO SLOT = 2).

When external trigger is used the time between external trigger and first sample of the first bit of midamble will be calculated and displayed.

Requirements for the measuring signal

- At least one slot must be active and isolated, because this is the only way of reliably detecting a burst (irrespective of edge steepness)
- Sync sequence must be present in the timeslot to which synchronization is to be made

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSM/DEGE* hotkey
Select GSM trigger	*GENERAL SETTINGS* softkey
	TRIGGER EXTERN or TRIGGER IF POWER softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey or
	REF LEVEL softkey → Position burst in horizontal limit-value lines
Enter external attenuation Default: 0 dB	*EXTERNAL ATTEN* softkey
Set midamble Default: TSC0	DEMOD SETTINGS softkey SELECT MIDAMBLE softkey
Start measurement	*PREV* hotkey *POWER VS TIME* softkey
Start reference measurement	*START REF MEAS* softkey

Measurement

GSM/EDGE menu

POWER VS TIME →	FULL BURST	STANDARD - (DYNAMIC)
	RISING EDGE	
	FALLING EDGE	
	TOP HIGH RESOL	
	FALL/RISE ZOOM	EXT CONF ON OFF
	TIME MEAS HIGH RESOL	EXT CONF TABLE
	FILTER 500K 600K	
	START REF MEAS	
		BURST FIND THRESHOLD
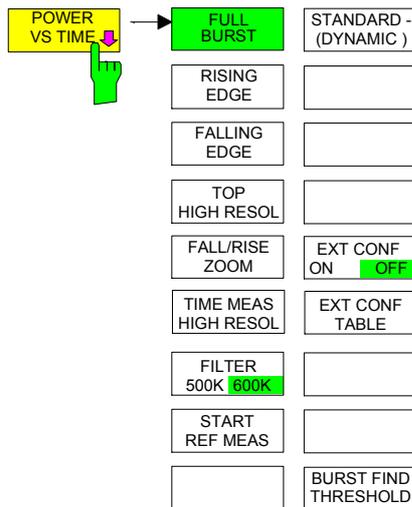
Press the *POWER VS TIME* softkey to start measurement of carrier power versus time and open a submenu for configuring the display. The power of the burst is also measured as centered relative to the midamble and displayed.

When theexternal trigger is used the time between external trigger and first sample of the first bit of midamble will be calculated and displayed (not for rising / falling edge), see figure 1-4 in chapter 1, section "Trigger and time references".

In this time measurement two values are displayed:

TRGS HLD   MaxHold value of the measured times between trigger and midamble start
Example1: 20, -10, 30 => Max 30.
Example 2: 20, -10, -30 => Max –30.

TRGS AVG   Average value of the measured times between trigger and midamble start

The current value (without averaging / max hold) is displayed if Sweep Count (= No.Of Bursts) is set to 1.

Three curves are displayed:

Max Peak, Min Peak and Average (number of bursts > 1, if number of bursts = 1 only one curve is shown).

The limit values are checked against the Average Trace (default)

The settings for checking the max trace against the upper limit line and the min trace against the lower limit line are performed in the LINES menu.

5 display modes are possible:

- Display of entire burst (*FULL BURST*) optionally with TIME MEAS HIGH RESOLUTION
- Display of useful part of burst at high resolution (*TOP HIGH RESOL*)
- Display of rising edge of burst (*RISING EDGE*)
- Display of falling edge of burst (*FALLING EDGE*)
- Display of fall/rise zoom (*FALL/RISE ZOOM*) in multi slot mode

IEC/IEEE bus commands :
```
:INST:SEL MGSM
:CONF:MTYP GMSK
:CONF:BURS:PTEM:IMM
:CONF:BURS:PTEM:SEL FULL
:SWE:COUN 20
:READ:BURS:PTEM:REF:IMM?
:INIT:IMM; *WAI
```

Result queries:
```
:FETC:BURS:PTEM:TRGS:AVER?
:FETC:BURS:PTEM:TRGS:MAX?
:CALC1:LIM1:NAME 'PVTU_G'
:CALC1:LIM2:NAME 'PVTL_G'
:CALC1:LIM1:FAIL?
:CALC1:LIM2:FAIL?
```

Note: In remote-control mode, the user must assign the following names to the limit lines before they are used. You have a free choice of display mode for the measured-value diagram.

```
CALC1:LIM1:NAME 'PVTU_G' or 'PVTU_E' and
CALC1:LIM2:NAME 'PVTL_G' or 'PVTL_E', respectively.
```

In the case of multislot measurements, a digit is appended to the letter to indicate the number of active slots.

Example: EDGE (single slot): PVTU_E
                     EDGE (multi slot, 4 active): PVTU_E4

The name of each activated limit line is displayed next to the line. The upper and the lower limit line for the 8 active slots are each composed of two limit lines (A and B). An A or B is added to the limit line name in this case.

For access burst mode also a different set of limit line is used, here the PVT limit line names are PVTU_AB and PVTL_AB.
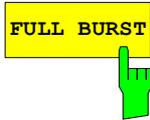
FULL BURST

The *FULL BURST* softkey selects a display mode in which the entire burst (single slot mode) or the set number of active slots (multi slot mode) can be viewed on the monitor.

All eight slots are always displayed in Extended Slot Configuration mode.

The limit check is performed with a resolution of 4 or 8 samples per symbol, not with the display resolution, which may be considerably lower. All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the monitor.

IEC/IEEE bus command   `:CONF:BURS:PTEM:SEL FULL`
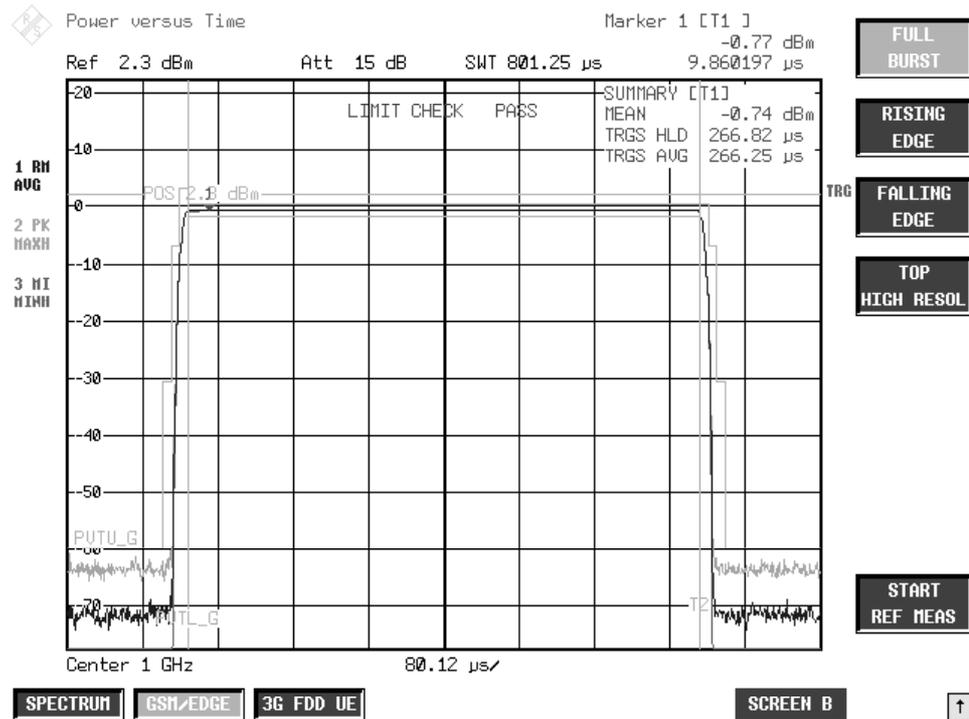
Fig.2-1   PVT single slot measurement – FULL BURST
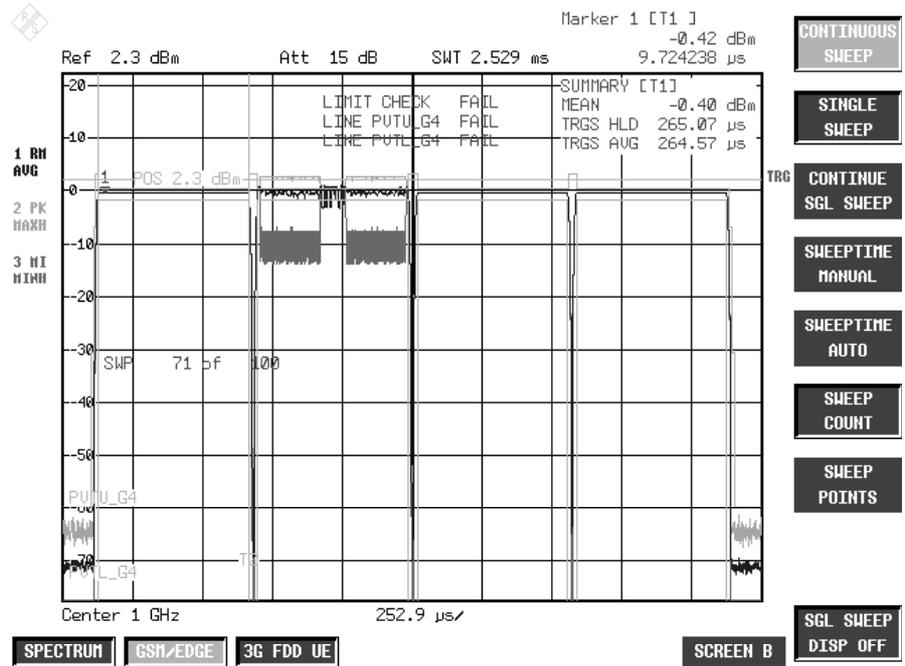
Fig.2-2   PVT multi slot measurement – FULL BURST, 4 slots active

RISING EDGE

Press the *RISING EDGE* softkey to select a display mode in which the rising edge of the burst can be viewed on the monitor.
For multi slot signals, the rising edge of the first active burst is indicated.
The start of slot 0 is always displayed in Extended Slot Configuration mode.
All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.
The corresponding limit lines are shown on the monitor. The 30 symbols are checked against the lmit lines with a resolution of 4 or 8 points per symbol.

IEC/IEEE bus command   :CONF:BURS:PTEM:SEL RIS
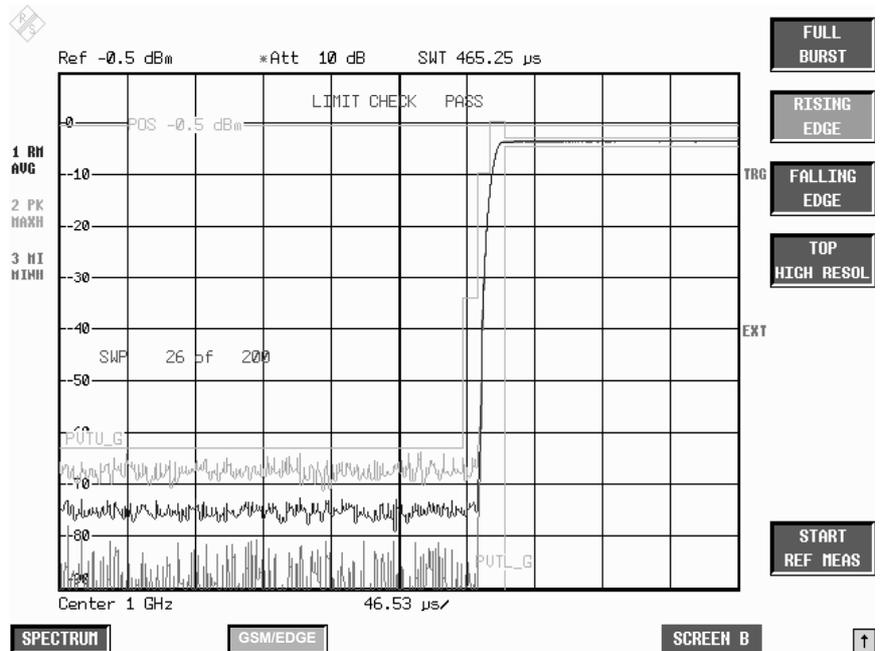
Fig.2-3   PVT measurement – RISING EDGE

FALLING EDGE

Press the *FALLING EDGE* softkey to select a display mode in which the falling edge of the burst can be viewed on the monitor.

For multi slot signals, the falling edge of the last active burst is indicated.
The falling edge of slot 7 is displayed in Extended Slot Configuration mode.

All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the monitor.The 30 symbols are checked against the lmit lines with a resolution of 4 or 8 points per symbol.

IEC/IEEE bus command   `:CONF:BURS:PTEM:SEL FALL`
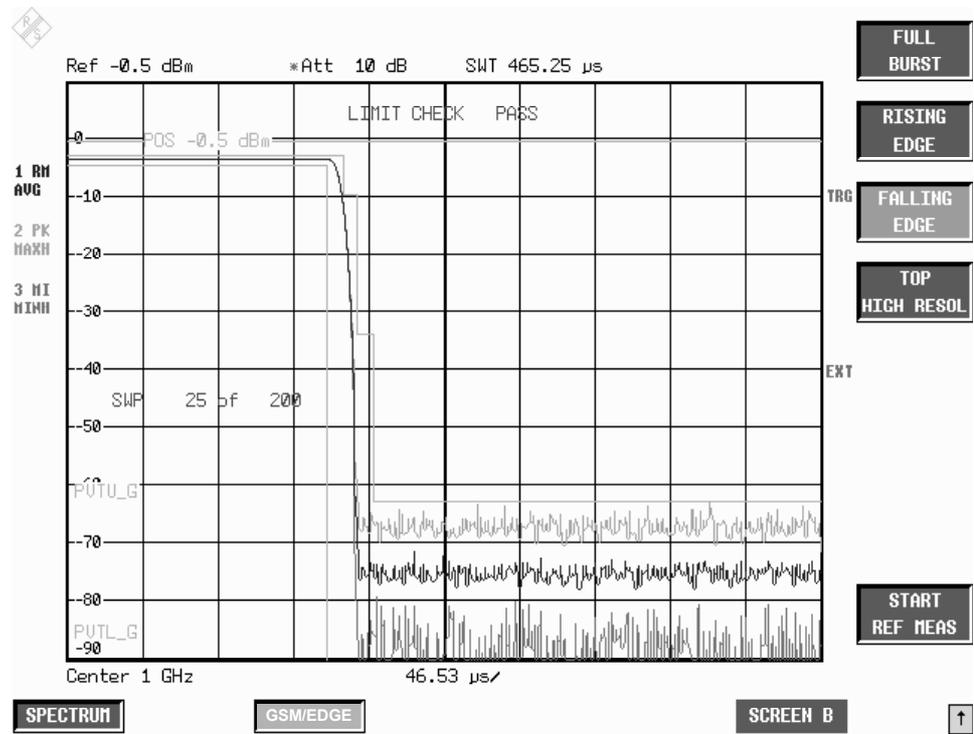
Fig.2-4   PVT measurement – FALLING EDGE

```
TOP
HIGH RESOL
```

Press the *TOP HIGH RESOL* softkey to select a display mode in which the useful part of the entire burst/bursts can be viewed on the monitor with a level resolution of 1 dB/Div.

The limit check is performed wit a resolution of 4 samples per symbol, not with the display resolution, which may be considerably lower.

All the settings of relevance to this display mode are reset to their default values (see Test hints). No reference measurement is performed and the limit values are not adjusted.

The corresponding limit lines are shown on the display.

IEC/IEEE bus command   :CONF:BURS:PTEM:SEL TOP
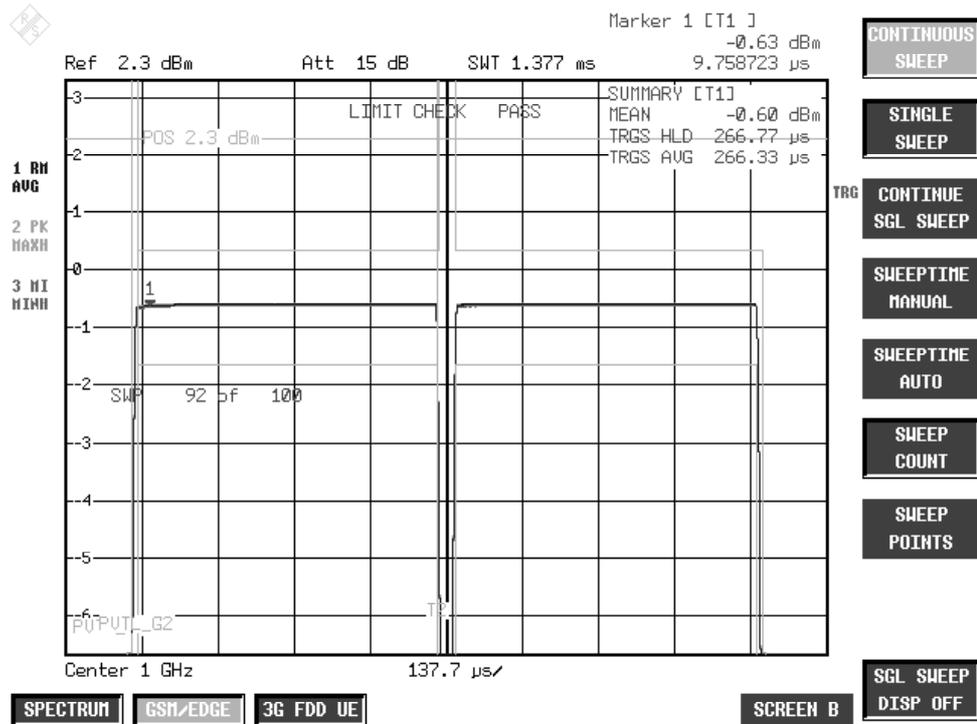
Fig. 2-5   PVT measurement – TOP HIGH RESOLUTION

```
FALL/RISE
ZOOM
```

The softkey *FALL/RISE ZOOM* is available if more than one slot is active. (See MULTISLOT under the DEMOD SETTINGS menu).
If the softkey is pressed the transition number where the zoom shall be carried out can be entered. The valid range is 1..(active slots-1). In the FALL/RISE ZOOM mode 30 symbols on the x-axis are shown.

IEC/IEEE bus commands   :INST:SEL MGSM
                          :CONF:BURS:PTEM:IMM
                          :CONF:CHAN:SLOT:MULT ACT3SYNC1
                          :CONF:BURS:PTEM:SEL FRZ
                          :CONF:BURS:PTEM:FRZ 2
                          :READ:BURS:PTEM:REF:IMM?

TIME MEAS HIGH RESOL

The softkey *TIME MEAS HIGH RESOL* is available if the external trigger is selected and the PVT is running in FULL BURST MODE. In this mode the power versus time works with a higher sampling rate. The TRGS (trigger to start symbol of midamble) is displayed with high display resolution. The absolute minimum (MIN), the absolute maximum (MAX) and the average (AVG) value are displayed. Increasing the sweep count will increase the accuracy of the value.

If 8 slots are active on a R&S FSP without B70 and the time measurement high resolution modus is activated, the active 4 sync to 2 configuration is automatically started, and the slot under investigation will be slot 2. This happens due to the higher sampling rate and the smaller amount of IQ samples within FSP. Still the value of TRGS is with higher resolution, only the other 4 slots are not shown on the screen.

Measurement with high time resolution is not possible in Extended Slot Configuration mode.

IEC/IEEE bus commands `:INST:SEL MGSM`
`:CONF:BURS:PTEM:IMM`
`:CONF:BURS:PTEM:SEL FULL`
`:TRIG1:SYNC:ADJ:EXT 100us`
`:CONF:BURS:PTEM:TMHR ON`
`:READ:BURS:PTEM:REF:IMM?`

FILTER BW 500K 600K

The softkey *FILTER BW 500K/600* changes between the default low pass filter with 600 kHz bandwidth and the gaussian 500 kHz bandwidth filter. The later is useful for signals with steep edges.

IEC/IEEE bus commands `:INST:SEL MGSM`
`:CONF:BURS:PTEM:IMM`
`:CONF:BURS:PTEM:FILT G500`
`:READ:BURS:PTEM:REF:IMM?`
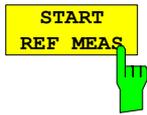
START REF MEAS

Press the *START REF MEAS* softkey to start reference measurement and determine the reference power for the relative measured values as well as obtain the correct level setting for the limit lines of the measurement.

Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum modulation of the device.

IEC/IEEE bus commands
```
INST:SEL MGSM
CONF:BURS:PTEM:IMM
CONF:BURS:PTEM:SEL FULL
READ:BURS:PTEM:REF:IMM?
```

Details of reference measurement:

The purpose of reference measurement is to obtain the reference for the applicable limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS = SWEEP COUNT*) selected for measurement as such.

If reference measurement is cancelled, the existing level of the limit lines remains unaffected.

If reference measurement is successful, the measured level is displayed and the limit lines centered relative to it (i.e. the Y offset parameter of the limit lines is recalculated).
Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.
This means that after performing reference measurement once, the user can perform other GSM measurements for the same signal.
The reference level, once measured, is stored in memory when the GSM/EDGE application is closed, which means that it remains available for the next session.

Warnings issued during reference measurement

The expected power of the DUT is 3 dB below the reference level. If GSM/EDGE measurements were performed right at the reference level, there would be a danger of overloading the analyzer above the reference level.

If the reference level is too low, i.e.

Signal level of DUT – (reference level + reference-level offset) > - 5 dB

the following message is issued:

```
           WARNING!
   Signal power = -0.35 dBm.
        REF LEVEL too low!
 INCREASE REF LEVEL to  2.65 dBm!
              OK
```
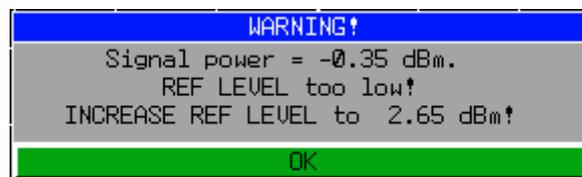
The carrier overload bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (reference level + reference-level offset) > -11 dB
the following message is issued:

```
                    WARNING!
          Signal power = -9.34 dBm.
              REF LEVEL too high!
     DECREASE REF LEVEL to -6.34 dBm!
                      OK
```

The no carrier bit in IEC/IEEE bus status management is set.

If the reference level is in range, i.e.
-11 dB < signal level of DUT – (reference level + reference-level offset) < - 5 dB
the following message is issued:

```
            GSM PVT REF MEAS ok!
          Signal power = -0.77 dBm.
                      OK
```

AUTO LEVEL&TIME

The *AUTO LEVEL&TIME softkey* starts a measurement by means of which an automatic and best possible level and, if required, trigger setting of the measuring device is performed.
The measurement first determines the maximum level of the signal and sets the measuring device reference level so that there are maximum level dynamics with sufficient base saturation reserve.
If the device is not operated in FreeRun mode and a Sync sequence is simultaneously specified as a trigger support (Trigger Sync ON), a trigger delay is set up in the data stream in a subsequent step by determining the Sync sequence so that the data sequence can be "suitably" recorded in the data store.

IEC Bus command `:TRIG:SEQ:SYNC:ADJ:AUTO`
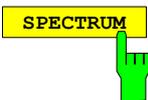
SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically as described below; all other settings are taken from the GSM/EDGE mode:

Span = ZERO SPAN
RBW = 300 kHz
Trigger = GSM trigger

IEC/IEEE bus command `:INST:SEL SAN`

Extended Slot Configuration for Multi Slot measurements

The R&S K5 supports several operating mode to measure GSM signals:

- Default: Single slot used, GMSK or 8PSK

- Multi Slot: 1, 2, 3, 4 or 8 Slots active,
  same signal power and modulation or each slot

- Extended Slot Configuration: 1 or more slots active,
  different signal power and/or modulation for each slot

The softkeys are describes in the menu DEMOD SETTINGS. The following chapter offers a summarized description of the extended slot configuration mode.

Overview and basic properties

The Multi Slot mode of the R&S K5 (GSM) firmware permits GSM measurements during multi-slot operation, i.e., allows the software to be configured to support several active slots per frame. For this, all slots must have the same power rating and the same modulation type. In addition, the slots to be measured must be in a directly consecutive time sequence; gaps between individual active slots within a frame are not permissible.

When using the Extended Slot Configuration, the user is free to configure the 8 slots of a frame individually. The system will support mixed modulation as well as variant slot power for each individual slot. In addition, the PvT (Power vs Time) limit lines are calculated either with a fixed limit line template relative to the mean signal power or take into account some exceptions described in the GSM standards.

Of course, the user should obey a few rules when setting up the configuration in order to achieve reasonable measurement results. These rules will be explained in detail in the following sections.

Extended Slot Configuration Mode- Configuration Settings

Apart from the on/off switch, two controls are provided for setting the Extended Slot Configuration:

STANDARD- (DYNAMIC)   The *STANDARD- (DYNAMIC)* softkey opens a selection table by means of which the default can be selected in accordance with which the limit lines should be calculated.
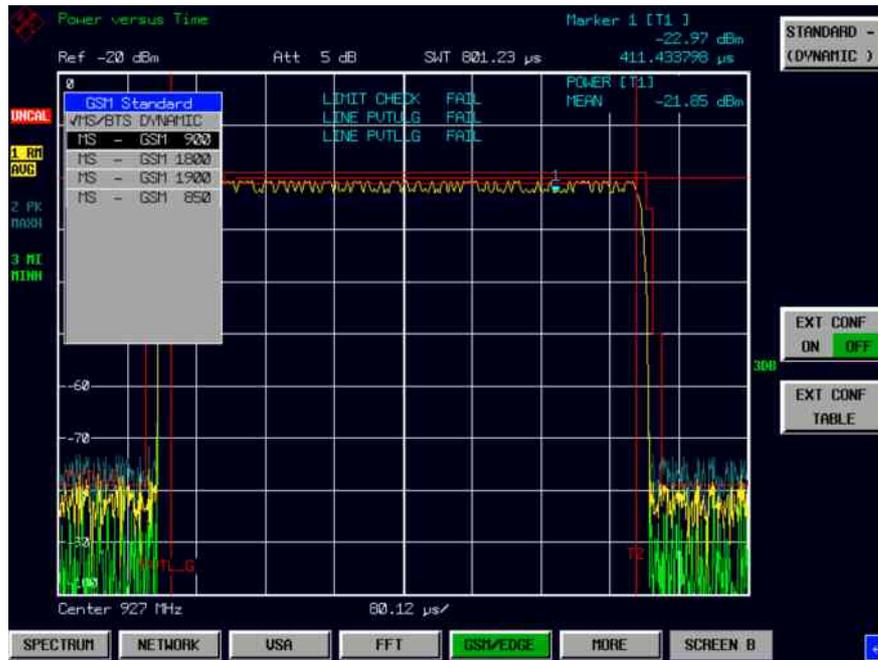
Fig. 2-6   Default selection

For every single standard and also for the generic "dynamic" case already familiar from the K5 a set of setting parameters are kept ready which can be accessed in table form via the EXT CONF TABLE softkey:

Fig. 2-7   Ext Conf table for GSM-900>

The settings in the first and third lines of this table can be described as "global" as these settings are identical for all standards:

- LongSlots Active (same slot length)
- LongSlots (slots with excess length)
- Just *one* frame YES/NO

In contrast, all other settings for each selected standard are managed separately:

- Trigger reference
- Midamble
- Setting absolute levels
- **Selected** absolute level specifications
- Modulation and level for each slot

IEC bus command: `:CONF:MS:ECON:STAN:SEL DYNAMIC | GSM900 | GSM1800 | GSM1900`

Extended slot configuration settings in detail

Standard Selected controls some details about how the limit lines of the PvT measurement will be assembled. The default MS/BTS DYNAMIC setting uses a series of limit value lines either specified or pre-defined by the user and dorresponds to the R&S FS-K5's usual behavior. In addition, the MS-GSM900, MS-GSM1800 (previously DCS1800) and MS-GSM1900 (previously PCS1900) GMS standards can be selected. When one of the GSM standards is selected the limit value lines are internally calculated more specifically, taking into account further user settings such as the power setting and the absolute level (control level and absolute level) (see below for more details).
With the exception of the following two settings, all further extended slot configuration configuration specifications are managed individually for every standard.

The LongSlot Feature supports the two different timing models of the GSM system.
If Long Slots Active = No it is assumed that all eight slots have the same length of 156.25 symbols.
In the other case, two slots must be denoted which will last for a time period of 157 symbols; the remaining six slots are then each assigned a length of 156 symbols. This feature is important for the assembly and exact positioning of the limit lines regarding the time scale.

Only One Frame controls the limit line interpolation between end of last slot and begin of first slot.
If NO is selected, the limit line is continued at the end of the frame for 3/4 of a slot. That means the limit at the end of slot 7 is equal to the begin of slot 0 and vice versa.

If YES was selected the limit value check is only performed within a frame.

These two parameters are uniform for all standards and for dynamic standard selection. All other settings are special to the selected standard so the user can operate with individual settings for each standard.

The Trigger Reference specifies the slot which is used as the reference for time and level positioning.
It is the mean power of this slot which will be returned as the result of the premeasurement and which will be used as the level reference for proper adjustment of limit lines and measurement device.

At the same time, the time axis which underlays the measurement data is adjusted in this slot in accordance with the GSM timing model. The slots are numbered consecutively from 0 to 7 within the frame in accordance with GSM convention.

Ref Midamble will be used to identify the reference slot within the stream of data.
Since, in general, a well-defined power ramp cannot be assumed the simplest burst search mechanism is deactivated and final identification of the reference slot is achieved by comparing the specific midamble.

For stable measurement condiitons in case of Extended Slot Configuration a distinct mid-amble sequence must therefore be specified for the reference slot and the test device set up so that this distinctness is also guaranteed. Otherwise the measurement result will – at best – be unstable due to ambiguous trigger and slot identification or – what will rather be the case– no valid data is recognised and the sweep stops with output of the "Sync Not Found" error message.

When switching into the other measurements of the R&S FS K5 option, it is the reference slot which will be used as the basis for the measurement. Especially, the kind of modulation of this slot and the midamble will be used to control the PFE/MAC measurement and to address the proper data within the sampled stream.

The **Absolute Level** group settings are available only when one of the GSM standards has been selected beforehand. They consist of an activation field (Yes/No state) and two values to be provided by the user in case of activated absolute levels (*LIMIT BASE* and *LIMIT STEP* value). Both values restrict the relative step height (the edge) of the upper limit line to an absolute base value as formulated in the GSM standard description: "(quote:… -30 dBc or -17 dBm depending on which [limit value] is higher ") as an example for the GSM900 standard. The first value provides the absolute base value for the region beyond 28 µs apart from the useful area at either side of the burst; the second value specifies the base value for the region between 18 µs and 28 µs distant to the useful part of the slot at either side.

A third *PREC ACTIVE* value setting supports a speciality of the GSM-900 standard: this base value – somewhat reduced in the standard – is used directly before an active slot instead of the LimitBase value.

The absolute level settings are necessary because the K5 option normally allows the PvT measurement to be executed independent of any restriction to absolute power. The GSM standard in turn refers to absolute power values in several points. In order to avoid this deviation between flexible measurement and the defined GSM absolute power values the option of adapting the measurement to the current power level has been created with the specification of arbitrary absolute level values for the settings; the user is thus free to perform GSM-like measurements regardless of the special "power situation" they actually encounter.

Settings specific to a Slot

For each slot, the following items can be specified individually:

- Modulation
- Reference power
- Limit (Line) power level (control level)

For the kind of modulation either GMSK or 8PSK (EDGE) can be selected. The modulation controls the demodulator and the kind of limit line to be used.

Selecting OFF marks the slot as inactive. The user is free to use:
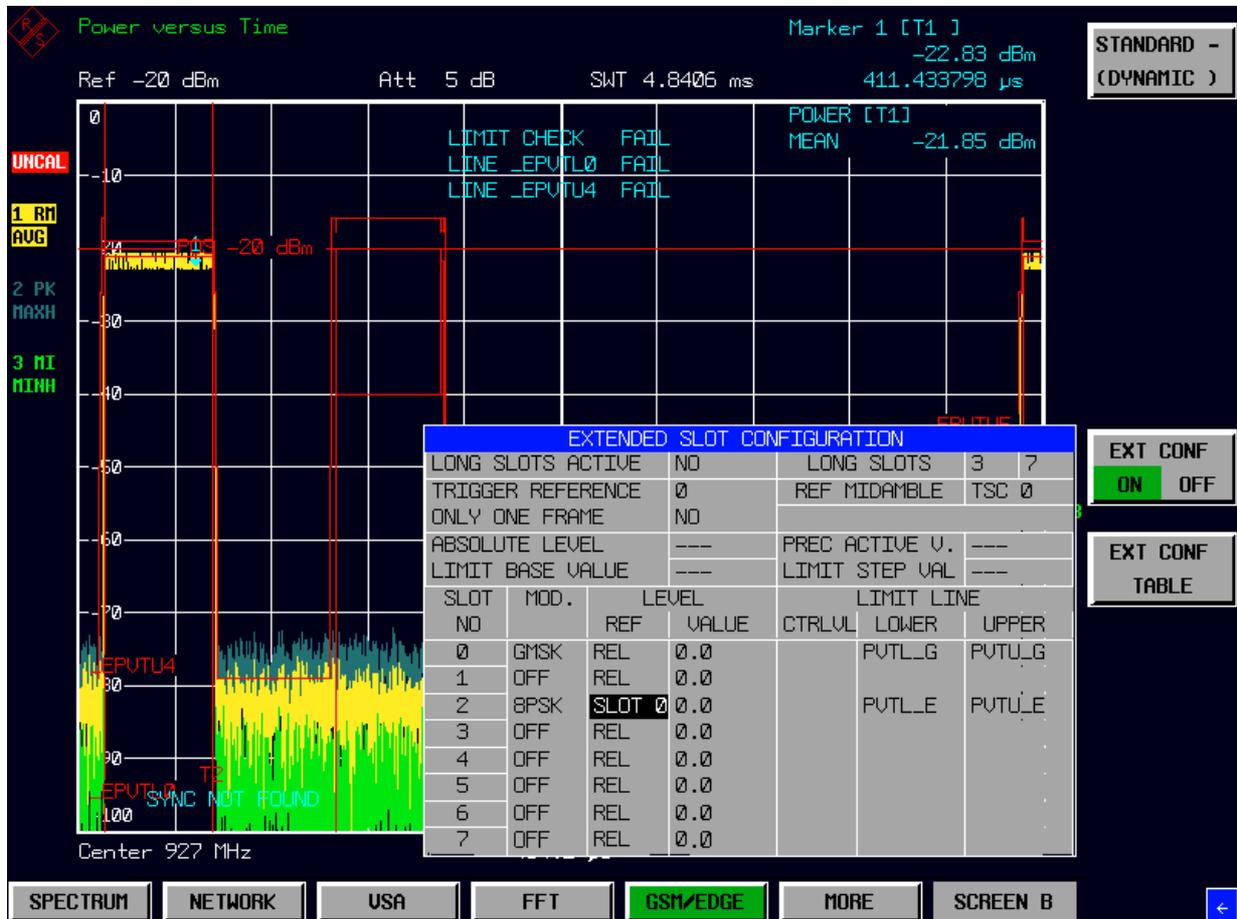
Fig. 2-8   Dynamic extended slot configuration – incorrect level profile>

With the **LEVEL REF/VALUE** settings group the 0dB reference line is individually defined for each slot. The limit line template which arises from the standard is adjusted to this 0dB line.

- relative
- relative to another slot
- absolute or
- automatic

settings for each slot.

An additionally specified level offset (VALUE) permits fine adjustment of the respective lines.

Relative Denotes the placement of the limit lines relative to the "reference power" which in turn is a result of the PvT pre-measurement. An offset of 0 dB will place the lines exactly to the mean power of the reference slot.

Relative to slot Is nearly the same, but instead of the reference slot, any active slot can be used as a base for the power level calculus. This setting just makes sense if the slot level depends on the level of another slot just different to the reference slot.

Absolute Means that the lines are to be placed in a way which is consistent with a mean power of 'x' dBm, whereas 'x' is the level value provided with the configuration data.

Automatic Will place the line according to the measured power of the pre-measurement.

A detailed explanation of the placing of the limit lines is given in the next section.

Fig. 2-9   Dynamic extended slot configuration – incorrect level

CTRLVL (Control Level)

Limit lines – power levels (CTRLVL – Control Level) I are necessary to calculate the edges of the limit lines at an offset of 18 µs from the useable range of a burst. These edges are normally a function of a mobile's power level. As already explained above, the control level cannot be derived by the measured power. The user must provide this value instead. The input field is available for GSM standards only and not accessible in dynamic mode. The height of the level varies between 6 dB und 1 dB depending on the standard selected; in addition, the selection of a standard defines which power levels can be selected.

Extended Slot Configuration Mode- Explanation of the Limit Line Calculus

Taking into account the overall settings, the PvT limit lines have to be calculated and applied to the sampled IQ data. Two tasks have to be fulfilled step by step:

- Assembly of the slot-related power profiles into a complete GSM frame.

- Proper placement of this set regarding the GSM time scale.

For each single slot, a limit line is specified according to the GSM scheme. This limit line is specified as a relative line in time as well as in level. The time zero is the symbol transition of symbol 13 to 14 (the center of the midamble) in accordance with the symmetric definition of the power profile in the GSM specs.

The "level zero" is defined by the mean power of the slot and is identical to the 0dB point in the GSM specs for the power profile. The limit line is defined relative to this zero level.

Depending on the modulation type two variants of limit lines will be used (either GMSK or 8PSK profile).

When using the extended slot configuration, the 0dB line varies from slot to slot. Therefore, the lines have to be calculated for each slot individually in order to meet the PASSED condition. In addition, for the transition region between two active slots a special rule has to be applied for the upper limit line. This rule guarantees the unproblematic adjustment of two adjacent lines (and is not described in any more detail here; for details see GSM standards).

Depending on the configured settings, the calculation of lines will work as explained below:

Relative Lines:

For relative lines, the result of the pre-measurement will be taken as usual. The specified offset is added to the lines before they are merged into the resulting line.

As a result, the relative lines will relate to the pre-measurement value plus the offset as specified in the configuration data.

The same algorithm is used for relative lines which relate to another specific slot. In addition to the offset specified in the configuration data, the difference between the level values of the reference slot and the slot to be calculated are determined; together with the specified offset this difference gives a total offset which is used on the level values of the line of the slot to be calculated.

The 0 dB point of the slot specified as a reference is used as the reference for the relevant line instead of the reference slot's 0 dB point.

Absolute Lines:

This new extended slot configuration option permits allocation of a slot mask to an absolute level, i.e., the 0 dB point is allocated one of the specified dBm value in accordance with the settings made. This value (in dBm) demonstrates no natural connection to the pre-measurement.

Automatic Lines:

This is a totally new feature, too: the 0dB point of a slot marked as "auto" is derived from the pre-measurement of the PvT measurement. In addition to the usual pre-measurement with which the mid-range power of the specified reference slot is measured, the mid-range power of the slot set to "auto" is also calculated and serves as a basis for the 0 dB point for this slot.

The absolute time zero is defined to be start of symbol 0 of slot 0, i.e. the time zero is positioned at the start of the very first symbol of the GSM frame. Depending on the configured reference slot and the GSM timing model, the proper 1/4–symbol-shift between the individual slots will be taken into account.

The overall result is a set of limit lines extending over the time scale of a complete GSM frame.

Fig. 2-10 Dynamic extended slot configuration

Hints for a Proper Setup of the Measurement Device

From the description given so far, a few rules can be established which should (or must) be obeyed in order to achieve proper and reliable measurement results..

- The reference slot should always be the slot with the highest output power.
  Reason: The reference level of the device (with Auto Level & Time) is controlled by the mean power of the reference slot. When another slot will yield more power an overload condition will be given.

- The midamble of the reference slot must be unique.
  Reason: The midamble sequence is the only way to setup a proper and stable timing within the IQ data stream.

- If the AUTO Level function is used the offset should normally be 0 (zero) dB. The offset should also be 0 dB for the reference slot and the level setting should be set to 'relative'. Otherwise the limit lines for these slots will be positioned incorrectly.

- The signal-to-noise relation of the measurement device must be taken into account! In general, it will make hardly any sense to deal with level differences of 50dB or more between the strongest and the weakest slot. The typical signal-to-noise ratio of the R&S FSQ is approximately 80 dB; if limit lines with a typical relative extend of 60 dB are applied the largest "sensible" level difference is some 20 dB. Otherwise, the measurement would fail, i.e. a FAILED due to the dynamic limit.

- Limit Line handling in remote operation:
  The limit lines for extended slot configuration mode are automatically generated, as described above. For that reason following conventions for the CALC:LIMIT sub system has to observed:
  Up to 4 limit lines for upper and lower limits are generated. Following names are used:

Lower limit line names:	_epvtl0 ... _epvtl3
Upper limit line names:	_epvtu4 ... _epvtu7

  The digit at the end of the limit line name represents the SCPI Limit Check status bit number and therefore after adding "1" the numerical suffix used in the SCPI limit line subsystem.

  Example: "_epvtl1"

  Power vs Time, Lower Limit Line 1

  Bit 1 of the STAT:QUES:LIM:COND register

  Addressed by: CALC:LIM2:..

  The limit line state (whether it is switch ON - "CALC:LIMx:STAT?") and the PASSED/FAILED information ("CALC:LIMx:FAIL?") has to be checked.

- **Burst and sync search** in the Extended slot Configuration
  The burst search switch (*BURST FIND*) is not available the extended slot configuration; the switch for synchronizing to the midamble (*SYNC FIND*) is permanently active.
  If the extended slot configuration is activated, an extended burst search is used which refers to the entire frame's slot level profile for rough chronological orientation in the IQ data stream. If the level profile measured deviates too strongly from the specified slot profile the record is rejected and a new recording is started.
  Following successful rough orientation, the range in question is then searched for the specified midamble's pattern sequence. If this is found, the time length of the record is uniquely defined within the GSM frame and controlled for further analysis (trace display in the PvT). If the pattern is not found "Sync Not Found" is displayed and output and measurement data recording is restarted.

Example for Extended Slot Configuration

A mixed GSM/EDGE signal has to be measured with following attributes:

- Slot 0:   Modulation 8PSK (EDGE), TSC0, used as the reference slot
- Slot 1:   OFF
- Slot 2:   Modulation GMSK (GSM), relative signal power 0 dB
- Slot 3:   Modulation GMSK (GSM), relative signal power -10dB
- Slot 4:   Modulation GMSK (GSM), relative signal power 0 dB
- Slot 5:   OFF
- Slot 6:   OFF
- Slot 7:   OFF

Slot 0 wird als Referenzschlitz verwendet.

Fig. 2-11   Full Burst of mixed Edge/GSM signal

Fig. 2-12 shows the complete frame measured with Power vs Time - FULL BURST.
Using the FALL/RISE ZOOM display will show the timing between individual slots..
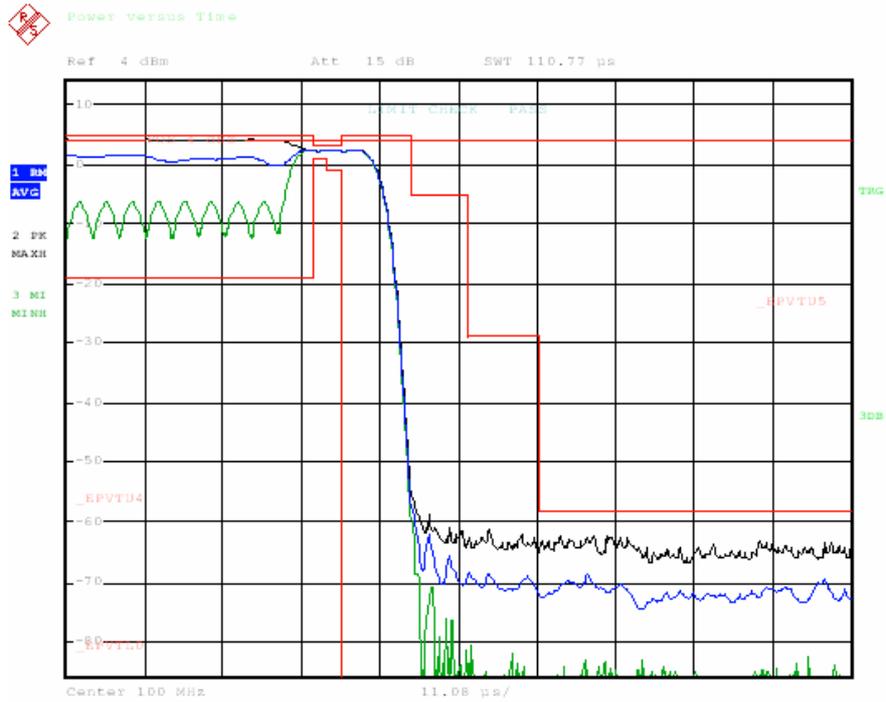
Fig. 2-13   FALL/RISE ZOOM Transition area between slot 1 and slot 2 selected
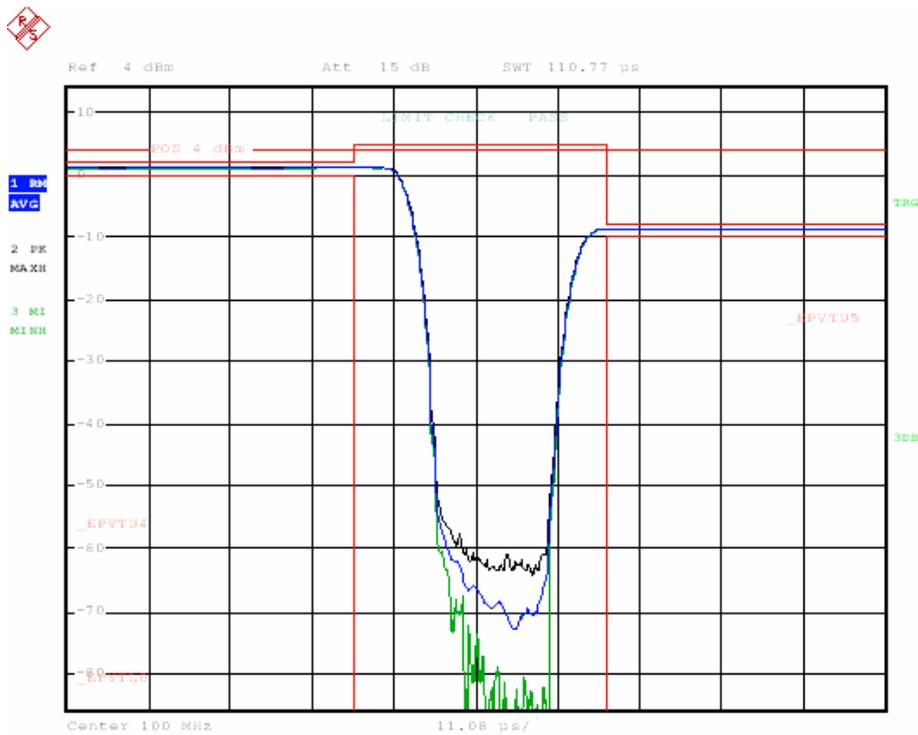
Fig. 2-14   FALL/RISE ZOOM Transition area between slot 2 and slot 3 selected

Test hints

Power measurement with reference to midamble

The PVT mode can be used for high-precision measurement of burst power referenced to the 13/14 bit transition of the midamble.

The relationships between power, control level and power class specified in the standards are listed in the tables below.

Table 2-4   Power classes

Power Class	Power				
	P-GSM 900 Phase I	E/P/R-GSM900 Phase II	DCS1800 Phase I	DCS1800 Phase II	PCS1900
1	43 dBm	--	30 dBm	30 dBm	30 dBm
2	39 dBm	39 dBm	24 dBm	24 dBm	24 dBm
3	37 dBm	37 dBm	--	36 dBm	33 dBm
4	33 dBm	33 dBm	--	--	--
5	29 dBm	29 dBm	--	--	--

Table 2-5   Power control level

Power Control Level	Power				
	GSM900 Phase I	GSM900 Phase II/II+	DCS1800 Phase I	DCS1800 Phase II/II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	0 dBm	reserved
17	--	9 dBm	--	0 dBm	reserved
18	--	7 dBm	--	0 dBm	reserved
19	--	5 dBm	--	0 dBm	reserved
20..28	--	--	--	0 dBm	reserved
20..31	--	5 dBm	--	--	--

Measuring with slow frequency hopping

Analysis of the burst's time characteristic and the power readings include only the bursts that
a) can be demodulated correctly and
b) have the midamble set under DEMOD SETTINGS.
If these conditions are not fulfilled the "SYNC NOT FOUND" message is issued and evaluation of the measured values stops. Measurement automatically resumes on arrival of a burst with the defined midamble.

Demodulation is possible only when the DUT's carrier is on the defined frequency.
This precaution is adopted to avoid falsification of the measured values by bursts outside ARFCN and bursts with the wrong midamble.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see spectrum analyzer manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Measurement with maximum dynamic range

Once you have used *FULL BURST* or *TOP HIGH RESOLUTION* to ascertain that the limit lines cannot be exceeded, you can employ the method described below to extend the analyzer's usable dynamic range by a few dB:

➢ Move the reference level to max. 2 dB below the actual power of the signal (see power reading on the screen in Full Burst mode),

➢ Set RF ATTEN as low as possible

➢ Reselect measurement (*FULL BURST, RISING EDGE, FALLING EDGE*)
This slightly overloads the device, without falsifying the measurement. The mask is now automatically centered relative to the actual level.

Note: *If the power of the mobile is less than –20 dBm it is essential to remove external attenuation in order to achieve the maximum possible dynamic range.*

The increase in S/N ratio in dB is roughly equal to the reduction in reference level and the removed attenuation (RF ATTEN = 10 dB).

Increasing the measurement speed during remote control

The following example shows a fast PVT measurement without using a pre-measurement (Start Ref Meas).
The signal level is determined during the measurement.
With this level the Limit Line reference level is adjusted after all measurements but before limit check.

```
//------------------------------------------------------------------------------
//------------------------------------------------------------------------------
//----------------------------
//PVT_without_refmeas_cnt0.cmd
// no PVT reference measurement because Limit Line Y Offset calculated alone
// the reference level is correctly set due to the power control level
// Complete time with display off: 1.5 s
// Select PVT MEAS -> switch to single sweep automatically

//Assumes following settings before script:
//INST:SEL MGSM
//CONFIGURE:BURST:PTEMPLATE
//SENSE1:SWEEP:COUNT 0

// Mid channel PL0
FREQ:CENTER                   1.0GHZ
DISP:WIND:TRAC:Y:SCAL:RLEVEL 3 DBM
:INPUT1:ATTENUATION 15

//!no ref meas! :READ:BURST:PTEMPLATE:REFERENCE?
INIT;*WAI

//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.5     //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?

// Mid channel PL8
// no FREQ:CENTER   because same channel
DISP:WIND:TRAC:Y:SCAL:RLEVEL 4 DBM
:INPUT1:ATTENUATION 20
INIT;*WAI
//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.3      //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?

// Low channel PL15
FREQ:CENTER                   0.999999GHZ
DISP:WIND:TRAC:Y:SCAL:RLEVEL 5 DBM
:INPUT1:ATTENUATION 25
INIT;*WAI;
//read out value of mean power
:CALCULATE1:MARKER1:FUNCTION:SUMMARY:MEAN:RESULT?
//the limit values are relative to the reference level
//calculate the y-limit offset so that the lines correspond
//with the current measured mean power: YOffVal=MeanResult-RefLevel
//Use the calculated new YOffVal
//:CALCULATE1:LIMIT:UPPER:OFFSET YOffVal
:CALCULATE1:LIMIT:UPPER:OFFSET -0.6      //Example
:CALCULATE1:LIMIT1:FAIL?
:CALCULATE1:LIMIT2:FAIL?
```

Additional information

PVT measurement requires a time reference to the midamble (TSC 0 to 7). The IF signal is digitized, demodulated and processed (IQ mode) for this measurement.
The times and names displayed for the limit lines refer to GSM and single-slot measurements.

Parameter	Setting	Note
MODE	IQ mode	R&S FS-K5-specific internal mode for demodulation
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	analog prefilter with 10 MHz 600 kHz filter	
VBW	-	Irrelevant in IQ mode
REF LEVEL POSITION	90 %	Level overshoots visible at 90%
Symbol rate	270.833 kbit/s	
Oversampling	4/8	
Sampling Length	1600 * oversampling	Number of samples = symbols * oversampling
Bits per Symbol	1	Number of bits describing a symbol, constant for GSM measurements
Receiver Filter	Gauss with BT = 0.3	Constant for GSM measurement
BURST FIND	ON	Burst find is active
BURST FIND	ON	Sync find is active
PVT Result Length FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 217 126 126	Number of symbols shown
PVT Sync Mid Offset FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 0 93 –93	Offset in symbols of the midamble from the center of the screen. Positive means that the midamble is offset to the right of center. Explanation: To put rising on symbol 82: 82 – 0.5 Result Length + symbols between edge and midamble = 82 – 0.5*126 + 0.5*148 To put falling on symbol 44: 0.5*126-44-0.5*148=-55
Y axis pitch FULL & RISING & FALLING TOP HIGH RESOL	 LOG_100DB LOG_10DB	Trace shows level versus time
TRACE 1	AVERAGE	
DETECTOR 1	RMS	
TRACE 2	MAX HOLD	
DETECTOR 2	MAX PEAK	
TRACE 3	MIN HOLD	
DETECTOR 3	MIN PEAK	
Limit Line	PVTU_G	
Limit Checks	ON	
Limit Line	PVTL_G	
Limit Checks	ON	
Limit X-Offset FULL BURST & TOP HIGH RES RISING EDGE FALLING EDGE	 400.625µs 576.00µs -110.75µs	Limit line is centered on midamble
Limit Y-Offset	Signal power measured in reference measurement – (Ref Level + Ref Level Offset)	Reference measurement result corrects the limit lines

Availability of keys and softkeys

Availability		
All BW parameters (**BW** menu)	Not available	Parameters not available in IQ mode
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Trigger (VIDEO, If POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Start frequency (START)	Function not available	Measurement is in time domain
Stop frequency (STOP)	Function not available	Measurement is in time domain
Span parameters (SPAN, FULL SPAN, ZERO SPAN, LAST SPAN)	Function not available	Measurement is in time domain
Step width of center frequency coupled to resolution bandwidth (AUTO X x RBW)	Function not available	Step width of the center frequency is switched to manual, value 2 kHz
Frequency counters (SIGNAL COUNT, COUNTER RESOLUTION)	Function not available	
Reference Fixed-Marker (REFERENCE FIXED menu)	Function not available	
Quasipeak, autopeak detectors (DETECTOR AUTO PEAK, DETECTOR QPK)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Switch to linear scaling (RANGE LINEAR)	Function not available	Logarithmic scaling for PVT
Noise measurement (NOISE MEAS)	Function not available	
Measurement of phase noise (PHASE NOISE menu)	Function not available	
Trigger offset (TRIGGER OFFSET)	Function not available	Although it can be set in the GENERAL SETTINGS menu, this parameter has on effect in this mode of measurement.

Measurement of spectrum due to modulation

In order not to influence the transmission quality of the adjacent channels, it is important to ensure that the power of the GSM transmit signal in the adjacent channels does not exceed the limits set down in the GSM standards. On account of the TDMA structure of the GSM signal, a distinction has to be drawn between the spectrum due to modulation and the spectrum due to switching of the TDMA bursts. Measurement of the spectrum due to modulation determines power outside the transmission channel due to the GMSK modulation procedure used and the noise.
In accordance with the GSM standard, the spectrum due to modulation is measured in the range between 50% and 90% of the active TDMA bursts. This ensures that the influence of the burst edges is excluded.

Defined limit values apply; these values depend on the transmit power of the transmitter and the offset from the nominal channel frequency. These limit values (with the exception of the absolute lower limits) are relative to the power measured at 30 kHz RBW. This power has to be ascertained by reference measurement. Depending on the result of this reference measurement, the spectrum analyzer selects the correct reference value for the user-selected limit values for the spectrum due to modulation.
The R&S FS-K5 offers two different ways of measuring the spectrum due to modulation:

- General measurement across the frequency range (the FREQUENCY SWEEP softkey) with display of the spectrum, and

- Measurement of the spectrum due to modulation in the time domain with discrete frequencies (±100, ±200, ±250 kHz, $\pm$ n x 200 kHz ($2 \leq n \leq 38$) from the carrier frequency) and output of the measured values in a list (the *START LIST* softkey).

The time reference for measurement is provided by the set trigger offset. Starting at this time, the spectrum between 50% and 90% of the active burst is measured (gating). It is, therefore, important to ensure that trigger timing is set correctly in the *GENERAL SETTINGS* menu, as otherwise the spectrum due to modulation cannot be measured correctly.
A correct reference level is important for optimum dynamic range of the spectrum analyzer.

Requirements for the measuring signal

At least one GSM timeslot must be switched on for the signal to be measured.

Multislot Measurements

If several slots are active (multislot measurement), two methods are available:
1. Measurement of one slot selectable from the active slots.
2. Measurement of several active slots and output of combined result.
   The second method yields a considerable increase in the MOD measurement speed.

Method 1
   Purpose:
      This method is used for measuring the modulation spectrum of a specific slot if there are several active slots.

   Precondition:
      An external frame trigger must be available.

   Settings:
      ➢ Enter the number of active slots (ACTIVE SLOTS softkey) and the slot to be measured (*SYNC TO SLOT* softkey) in the *MULTISLOT* submenu.

SYNC TO SLOT informs the GSM measurement software of the number of the slot to be measured. The GSM measurement software sets the correct trigger offset (and thus the correct gate times) for the selected slot (based on the slot timing defined by the ETSI standard).

➢ If the slots are separated by variable offsets, it is advisable to run the AUTO LEVEL&TIME function before starting the MOD measurement. Prior to starting this function, the midamble of the slot to be measured must be correctly set under *DEMOD SETTINGS / SELECT MIDAMBLE*. Thus, the trigger offset setting of the slot to be measured is referred to its midamble.

Method 2

    Purpose:

        This method is used to measure the modulation spectrum of each slot and average the results over the number of slots (= NO. OF BURSTS) if there are several active slots.

        The measurement speed increases with the number of active slots.

    Example:

        Measurement 1

NO. OF BURSTS = 200

Frame pattern: 10000000 (1: slot active, 0: slot inactive)

Duration of measurement (theoretical):

$\geq$ **20 sec** (number of bursts (200) x freq meas points (22) x frame period (4.6 ms))

Measurement 2:

NO. OF BURSTS = 200

Frame pattern: 10101010 (1: slot active, 0: slot inactive)

Duration of measurement (theoretical):

$\geq$ **5 sec** (number of bursts (200) x freq meas points (22) x frame period (4.6 ms) **/ 4**)

    Precondition:

        The RF power trigger (FSP) or the IF power trigger (FSU/FSQ) or an external slot trigger (responding to active slots only) must be set.

    Settings:

Set the number of active slots to 1 by means of the *MULTISLOT* softkey.

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	*FREQ* key
Start application	*GSMEDGE* hotkey
Enter external attenuation Default = 0 dB	*GENERAL SETTINGS* softkey *EXTERNAL ATTEN* softkey
Select trigger	*TRIGGER EXTERN* or *TRIGGER IF POWER* softkey
Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey (the trigger offset is set automatically) or *REF LEVEL* softkey → Position burst in mask
Set trigger offset	*TRIGGER OFFSET* softkey → Position burst time exactly in mask
Start reference measurement	*PREV* hotkey *START REF MEAS* softkey
Start measurement	*START LIST* softkey

Measurement

GSM/EDGE menu

MODULATION SPECTRUM	→	FREQUENCY SWEEP
		START LIST
		LIST RESULTS
		PAGE UP
		PAGE DOWN
		LIST AVG LOG **LIN**
		START REF MEAS
		AUTO LEVEL&TIME
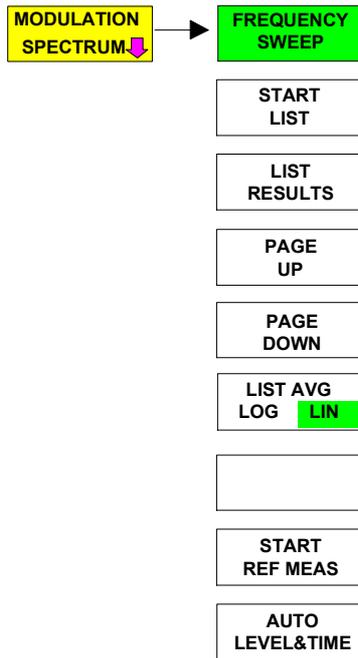
The *MODULATION SPECTRUM* softkey calls the submenu for measuring the spectrum due to modulation. In the default setting, the spectrum analyzer measures the spectrum due to modulation in the frequency domain (*FREQUENCY SWEEP*).

Alternatively and in accordance with the standard, *START LIST* can be used to measure in the time domain.
In this mode the spectrum analyzer measures the spectrum due to modulation in the time domain at the frequency offsets required by the GSM standard (in the spectral range from max. ARFCN +/- 7.6 MHz) and presents the results in list form.
You can use *LIST RESULTS* at any time to view the last measurement in the time domain. If the list is too long to fit onto one screen page, you can use *PAGE UP* and *PAGE DOWN* to scroll through the list.

When the *MODULATION SPECTRUM* menu is opened for the first time, the parameters are set in accordance with the GSM standards (see Additional information for other settings):

Span	3.6 MHz
Resolution bandwidth	30 kHz
Video bandwidth	30 kHz
Detector/trace	Average, log average
Sweep time	75 ms
Sweep count	0 (floating trace averaging)
Sweep	gated (50 to 90 % of the burst)
Main PLL mode	narrow (is only valid for R&S FSU/R&S FSQ)

The settings correspond to those made when the *FREQUENCY SWEEP* softkey is pressed. The parameter settings can be changed. They are not reset until you exit MOD measurement (by starting another measurement or exiting the GSM/EDGE) or press the *FREQUENCY SWEEP* softkey.

When you start list measurement (*START LIST*) or reference measurement (*START REF MEAS*), the parameter settings used are those currently valid.

The applicable limit values are referred to the signal's absolute level measured in a user-definable bandwidth (preset is 30 kHz). This reference level is determined by reference measurement performed with *START REF MEAS*.

FREQUENCY SWEEP

The *FREQUENCY SWEEP* softkey starts continuous measurement of the spectrum due to modulation in the "Continuous Sweep" mode.
All the parameters used in MOD measurement are reset to their default values (see above, the *MODULATION SPECTRUM* softkey).
The spectrum analyzer displays the spectrum and a limit line with limits corresponding to the level (determined beforehand in reference measurement) of the DUT.

IEC/IEEE bus commands

```
INST:SEL MGSM
CONF:MTYP GMSK
CONF:SPEC:MOD:IMM
SWE:COUN 20
READ:SPEC:MOD:REF:IMM?
INIT:IMM; *WAI
```

Result queries:

```
CALC1:LIM1:NAME 'MODU_G'
CALC1:LIM1:FAIL?
```

Note: *In remote-control mode, the user must assign the following name to the limit line before it is used:*
```
CALC1:LIM1:NAME 'MODU_G' or 'MODU_E'
```


Figure 2-12 Spectrum due to modulation in frequency domain

```
START
LIST
```

Press the *START LIST* softkey to start measurement of the spectrum due to modulation in the time domain in the section of the TDMA burst defined in the standards (50% to 90% of the useful part).

The analyzer measures at the following offsets from the channel frequency:
$\pm$ 100 kHz, $\pm$ 200 kHz, $\pm$250 kHz, $\pm$400 kHz, $\pm$n*200 kHz
(n whole number and n $\leq$ 38; limit frequency included, the channel frequency itself is excluded).
The number n of discrete frequencies is defined by the span , which is user-selectable in the range from 200 kHz to 15.2 MHz. This value is always determined from the SPAN value used also for the *FREQUENCY SWEEP* measurement:
The following conventions apply:

SPAN = 0	spectr. measuring range = $\pm$ 1.8 MHz
0 < SPAN $\leq$ 200 kHz	spectr. measuring range = $\pm$ 100 kHz
200 kHz < SPAN $\leq$ 15.2 kHz	spectr. measuring range = SPAN
SPAN = 15.2 MHz	spectr. measuring range $\pm$ 7.6 MHz

You can choose the resolution bandwidth, but note that this bandwidth is reset to 30 kHz when you press the *FREQUENCY SWEEP* softkey.

In the time domain, the measurement is performed with the AVERAGE detector. Since firmware version 2.60/3.60 it is also possible to work with RMS detector. In the FREQUENCY MEASUREMENT this detector needs to be switched on. Additionaly since that firmware version the reference level is reduced by 25 dB from $\pm$600 kHz distance from the carrier.
Averaging is done during the active part of the GSM or EDGE burst (50 to 90 %) over the selected number of bursts. The measurement time depends on the number of averages required (SWEEP COUNT = number of TDMA burts to be averaged.

While measurement is in progress, the measured values at the various frequency offsets are displayed briefly in the measurement diagram. The curve reflects progress of the measurement.
The power measured beforehand with a freely selectable resolution bandwidth is used as the reference power for the relative measured values and for the position of the limit lines. Reference measurement therefore has to be performed beforehand with the appropriate parameter settings in order for measurement to be correct.

When the measuring sequence is completed, the results are displayed in list form.

The values marked with an x violate the margin.

The values marked with an asterisk (*) violate the limit value.

IEC/IEEE bus commands
```
INST:SEL MGSM
CONF:SPEC:MOD:IMM
SWE:COUN 20
READ:SPEC:MOD:REF:IMM?
READ:SPEC:MOD:ALL?
```

Figure 2-13 Time domain measurement in progress

Figure 2-14Results of time domain measurement

LIST RESULTS

Press the *LIST RESULTS* softkey to view the most recent results in the time domain measurement.

IEC/IEEE bus commands `:FETC:SPEC:MOD:REF?`
`:FETC:SPEC:MODu:ALL? ARFC`
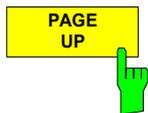
PAGE UP

Press the *PAGE UP* softkey to browse through the results table if it is too long to fit onto one page (depending on span).
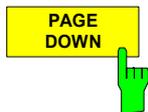
PAGE DOWN

Press the *PAGE DOWN* softkey to browse through the results table if it is too long to fit onto one page (depending on span).

LIST AVG LIN LOG

The *LIST AVG LIN/LOG* softkey toggles between linear and logarithmic (default) averaging in the modulation spectrum list measurement. In LIN mode voltages are averaged. In LOG mode levels.

IEC/IEEE bus command   `:CONF:SPEC:MOD:LIST:AVER:TYPE LIN | LOG`
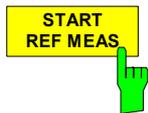
START REF MEAS

Press the START REF MEAS softkey to start reference measurement. It determines the reference for the relative measured values and for the limit lines. Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum loading of the spectrum analyzer.
It is also possible to work with RMS detector. In the FREQUENCY MEASUREMENT this detector needs to be switched on.

Details of reference measurement:

The purpose of reference measurement is to define the reference for the limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS= SWEEP COUNT*) selected for measurement as such.

The purpose of reference measurement is to determine the reference level for measurement of the spectrum due to modulation. If measurement is successful, the reference power is saved. The resolution bandwidth used for measurement is also saved (the preset bandwidth is 30 kHz). If the result is not tolerable (see below), a warning is issued, but the measured value is used nevertheless. If the operation is cancelled by the user, the reference power is not changed.

If reference measurement is successful, the measured level is displayed and the limit line positioned relative to it (the Y offset parameter of the limit line is recalculated).

Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.

IEC/IEEE bus commands `:INST:SEL MGSM`
`:CONF:SPEC:MOD:IMM`
`:SWE:COUN 20`
`:READ:SPEC:MO:REF:IMM?`

If the reference level is too low, i.e.

Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > lower level limit - 3 dB

the following message is issued:

```
            WARNING!
   Signal power = -0.35 dBm.
       REF LEVEL too low!
 INCREASE REF LEVEL to  2.65 dBm!
                OK
```

The Carrier Overload Bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > upper level limit - 3 dB
the following message is issued:

```
            WARNING!
   Signal power = -9.34 dBm.
       REF LEVEL too high!
 DECREASE REF LEVEL to -6.34 dBm!
                OK
```
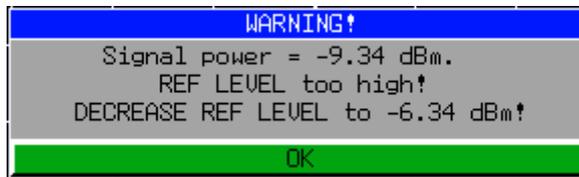
The No Carrier Bit in IEC/IEEE bus status management is set.

The "lower level limit" and "upper level limit" values depend on the selected bandwidth:

Level limit \	RBW≤30 kHz	100 kHz	≥300 kHz
Lower level limit	-7 dB	-5 dB	+1 dB
Upper level limit	-13 dB	-11 dB	-5 dB

Values between 30 kHz and 100 kHz and between 100 kHz and 300 kHz are mapped to near-match values from the table.

When the reference level is within the valid range, the following message is issued:

```
            REF MEAS ok!
   Measured power = -8.43 dBm.
                OK
```

The expected power of the DUT is 3 dB below the reference level. If the settings are not compliant with the above, there is a risk either of the analyzer being overloaded or of the maximum dynamic range not being utilized.
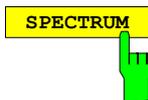
SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically as described below; all other settings are taken from the GSM/EDGE mode:

Trigger offset = OFF
Trigger = GSM trigger
Gating = OFF

IEC/IEEE bus command   `:INST:SEL SANa`

Test hints

Increasing measurement speed

The measurement speed is considerably increased by using one of the two methods described above (method1 & 2).
This applies for manual as well as for remote control and for both measurement types (frequency sweep and list mode).

The best performance is obtained when the display output is switched off during remote control.

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in the time domain (span = 0 Hz).

A new trigger event is required for each test point (exception: Trigger FREE RUN).

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average).

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is via a configuration command (SENSe:LIST:POWer:SET). This also includes the setting for trigger and gate parameters.

The following setting parameters can be selected independently for each frequency point:
- Analyzer frequency
- Reference level
- RF attenuation
- RF attenuation
- RF attenuation of attenuator (only with option B25)
- Resolution filter
- Resolution bandwidth
- Video bandwidth
- Measurement time
- Detector

For details see manual of instrument, chapter "Remote Control – Command Description", section "SENSe:LIST Subsystem".

Example:

```
// Script for MODULATION SPECTRUM MEASUREMENT
//  with user set frequencies.

// Assumes the following Signal:
// 1 GHz, GSM Signal with 0 dBm Power, External Trigger available
// Slot    0   1   2   3   4   5   6   7
// Power   off on  off off off off off off
// TSC     -   1   -   -   -   -   -   -


//Reset Device
*RST

//Switch to Single Sweep
INIT:CONT     OFF

//Set Center Frequency
FREQ:CENTER              1.0GHZ

//Set Level 3 dB above expected Signal Power
//Precise value is measured with the auto level and
//time function below
```

```
DISP:WIND:TRAC:Y:SCAL:RLEVEL 3 DBM

//Switch to GSM Mode
INST MGSM

//Set GSM Trigger mode to external and specifiy
//time from ext Trigger to begin of virtual slot
//0 is used for unknown value which is measured
//with the auto level and time function below
TRIG:SEQ:SYNC:ADJ:EXT 0S

//Set the Trainings Sequence
CONF:CHAN:TSC 1

//Do Auto level and Time measurement.
//(Attention: Correct TSC, Modulation type GSM/EDGE and Multislot
// settings necessary for successful termination of Auto Level and Time )
//If the values for Reference LEVEL and Time for ext Trigger
//to begin of slot are already known, this measurement
//can be skipped.
READ:AUTO:LEVTIME?
//returns: Status, Signal Power, Time between Trigger and begin of virtual
slot, Trig. Level, reserved
//Example: PASSED, -0.37, 6.0300000e-004, 1.4, 0

//Select Spectrum due to modulation measurement which adjusts the trigger
// hold off
//for modulation spectrum purpose
CONF:SPEC:MOD

//Read out the Time between ext. Trigger and begin Modulation Measurement
// Time begin Mod = Time between Trigger and begin of virtual slot + 340us +
// SyncToSlot* 576,92us
// The SyncToSlot is 0 if only one slot is measured. See Multislot Settings.
TRIG:HOLD?
//Example: 0.000943S

//Do the reference Measurement
READ:SPEC:MOD:REF?
//Example -7.78042,0.219582,30000
//The first value -7.78 dBm is the modulation reference level

//Read out the Reference Level in dBm
DISP:WIND:TRAC:Y:SCAL:RLEVEL?
//Example: 2.6

//Read out the RF manual attenuation in dB
INP:ATT?
//Example: 15

//Switch on the sense list power command
//the <trigger offset> is the value Time between ext. Trigger and begin Mo-
// dulation Measurement
//the <gate length> is 170 us according to GSM Spec
//Parameters: <PEAK meas>,<RMS meas>,<AVG meas>,<trigger mode>,<trigger slo-
// pe>,<trigger offset>,<gate length>
LIST:POW:SET OFF, OFF, ON, EXT, POS, 943US, 170 US

//Do the list power measurement:
//<analyzer freq>,<ref level>,<rf att>,<el att>,<filter type>,
//<rbw>,<vbw>,<meas time>,<trigger level>,...
//Explanation:  <analyzer freq> is the carrier frequency -/+ offset values
//              <ref level>     is the read out reference Level, if analyzer
//                               freq 800kHz or more away from
//                               carrier the value can be reduced by 10 dB to
//                               increase dynamic
//              <rf att>        is the read out rf manual att value
//              <el att>        0 (if device supports el att, read out the
```

```
//                              value also before List meas)
//              <filter type>   NORMAL
//              <rbw>           30kHz, if analyzer freq 1800kHz or more away
//                               from carrier 100 kHz
//              <vbw>           30kHz, if analyzer freq 1800kHz or more away
//                               from carrier 100 kHz
//              <meas time>     number of sweeps * <gate length> , with 20
//                               sweeps -> 3.4 MS
//              <trigger level> 0 (dummy parameter)
// List for the following freq: -6000, -1800, -1200, -600, -400, -250, -200,
// +200, +250, +400, +600, +1200, +1800, +6000
// in kHz from Carrier 1 GHz:
LIST:POW? 0.994GHZ,   -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS, 0,
          0.9982GHZ,  -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS, 0,
          0.9988GHZ,  -7.4DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS, 0,
          0.9994GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS, 0,
          0.9996 GHZ,  2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          0.99975 GHZ, 2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          0.9998 GHZ,  2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0002 GHZ,  2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.00025GHZ,  2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0004GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0006GHZ,   2.6DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0012GHZ,  -7.4DBM, 15DB, 0DB, NORM, 30KHZ, 30KHZ, 3.4MS,0,
          1.0018GHZ,  -7.4DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS,0,
          1.006 GHZ,   2.6DBM, 15DB, 0DB, NORM, 100KHZ, 100KHZ, 3.4MS,0
// The results are the absolute levels in dBm
// Example: -6000 -84.5517272949,
//          -1800 -84.1594314575,
//          -1200 -89.9604415894,
//          - 600 -86.0749740601,
//          - 400 -77.7151641846,
//          - 250 -48.4437561035,
//          - 200 -44.0330238342,
//          + 200 -43.6994476318,
//          + 250 -49.1217575073,
//          + 400 -78.8327560425,
//          + 600 -85.5941925049,
//          +1200 -90.5564193726,
//          +1800 -84.2997055054,
//          +6000 -82.7216644287
// If the modulation reference level (-7.79 dBm) is substracted from these
results the relative value can be compared against the limit for that
frequency:
// eg. -250KHz Offset: -48.44 - (-7.79) = -40.65 dB < -33.0 dB Limit ->
Check is Passed

//Attention! Switch back to Spectrum due to modulation measurement
//to obtain the overview measurement again!
CONF:SPEC:MOD
```

Transducer factors

The R&S FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Measuring with slow frequency hopping

Bear the following in mind when the DUT is operating in slow frequency hopping mode:

1) If an external trigger signal is used, it should trigger the spectrum analyzer only when a burst is sent on the frequency set at the spectrum analyzer.

2) In principle, the IF trigger can be used. Note, however, that its trigger threshold is pegged (-16 dBm at the input mixer). This means that the level of the signal must be high enough to trigger measurement.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see spectrum analyzer manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Additional information

The tables below show the default settings that apply after you press the *FREQUENCY SWEEP* or *START LIST* softkey.

FREQUENCY SWEEP measurement:

Parameter	Setting	Note
MODE	Frequency sweep, span 3.6 MHz	
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	30 kHz, NORM	3 dB sweep filters are used.
VBW	30 kHz	Coupling off
SWT	75 ms	Time from GSM standard
GATED TRIGGER	ON	
GATE MODE	Edge	
GATE DELAY GSM TRIGGER: Extern GSM TRIGGER: IF Power	= GSM external trigger offset + 340 µs = GSM IF trigger offset + 340 µs	340 µs is a value from GSM standard: 50% to 90% excluding midamble (see Figure 1-1 in Chapter 1).
GATE LENGTH	170 µs	Value from GSM standard
TRACE 1	AVERAGE	
DETECTOR 1	LOG AVERAGE	
TRACE 2	BLANK	
TRACE 3	BLANK	
Limit Line	MODU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y relative to reference level
Limit Checks	ON	
Limit X OFFSET	0	0, because symmetrical with CF
Limit Y OFFSET	Reference measurement result – (REF LEVEL + REF LEVEL OFFSET)	The limit lines are corrected with the result of the reference measurement.

LIST measurement:

Parameter	Setting	Note
SWEEP COUNT	Taken from Frequency Sweep, changed to 10 if 0	
MODE	Zero Span	reduced presentation
RBW	selectable; default is 30 kHz	
VBW	selectable; default is 30 kHz	
SWT	170 µs	
REF LEVEL POSITION	100%	Preset value
TRIGGER OFFSET GSM-Trigger :Extern GSM-Trigger : IF Power	= GSM external trigger offset + 340 µs = GSM IF trigger offset + 340 µs	
TRACE 1	AVERAGE	
DETECTOR 1	Average	
TRACE 2, 3	Not possible	
Limit Line	MODU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y relative to reference level

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Unit (UNIT menu)	Function not available	
Linear scaling (RANGE LINEAR)	Function not available	

Measurement of spectrum due to transients

The spectrum due to transients is defined as the spectrum that results from carrier modulation and switching of the burst signal. This spectrum is measured with the aid of the Max Peak detector and Max Hold. The assumption is that the spectrum due to switching of the burst signal is the more significant.

The R&S FS-K5 offers two different ways of measuring the spectrum due to transients:

- General measurement in the frequency domain (*FREQUENCY SWEEP*) and

- Measurement of the spectrum due to transients in the time domain with discrete frequencies (± n x 200 kHz from carrier frequency) and output of the measured values in a list (the *START LIST* softkey).
The measured values can be checked against absolute or relative limit lines.

Requirements for the measuring signal

The frame pattern should include at least one rising and one falling edge.

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Set frequency	FREQ key
Start application	GSM/EDGE hotkey

Enter external attenuation
        Default: 0 dB
	GENERAL SETTINGS softkey
	        EXTERNAL ATTEN softkey

Fine-tune level to within approx. 3 dB	*AUTO LEVEL&TIME* softkey or *REF LEVEL* softkey → Position burst in mask
Start measurement	*START LIST* softkey

Measurement

GSM/EDGE menu

Press the *TRANSIENT SPECTRUM* softkey to call the submenu for measuring the spectrum due to transients. In the default setting, the SPECTRUM ANALYZER measures the spectrum due to transients in the frequency domain (*FREQUENCY SWEEP*).

Alternatively and precisely in accordance with the standard, *START LIST* can be used to measure in the time domain. In this mode, the SPECTRUM ANALYZER measures the spectrum due to transients in the time domain at the frequency offsets required by the GSM standard and presents the results in list form. You can use *LIST RESULTS* at any time to view the most recent measurement in the time domain.

When the *TRANSIENT SPECTRUM* menu is opened for the first time, the parameters are set in accordance with the GSM standards (see Additional information for other settings):

Span	3.6 MHz
Resolution bandwidth	30 kHz
Video bandwidth	100 kHz
Detector/trace	Max peak, max hold
Sweep time	2.5s
Sweep count	0 (floating trace averaging)
Main PLL mode	narrow (is only valid for R&S FSU/R&S FSQ)

The settings correspond to those made when the *FREQUENCY SWEEP* softkey is pressed. The parameter settings can be changed.
They are not reset until you exit TRA measurement (by starting another measurement or exiting the GSM/EDGE), or press the *FREQUENCY SWEEP* softkey.

When you start list measurement (*START LIST*), the parameter settings used are those currently valid (with the exception of SPAN).

Press the *LIMIT ABS / REL* softkey to toggle between absolute and relative (dependent on pre- measurement) limits.

Since firmware version 3.70 the type of the reference measurement either PEAK (default) or RMS can be selected.

FREQUENCY
SWEEP
👉

Press the *FREQUENCY SWEEP* softkey to start continuous measurement of the spectrum due to transients in the "Continuous Sweep" mode (see Figure 2-15).

All the parameters used in TRA measurement are reset to their default values (see above, the *TRANSIENT SPECTRUM* softkey).

IEC/IEEE bus commands
```
:INST:SEL MGSM
:CONF:MTYP GMSK
:CONF:SPEC:SWIT:IMM
:SWE:COUN 20
:INIT:IMM; *WAI
:CALC1:LIM1:NAME 'TRAU_G'
:CALC1:LIM1:FAIL?
```

Note: *In remote-control mode, the user must assign the following name to the limit line before it is used:*
```
CALC1:LIM1:NAME 'TRAU_G' or 'TRAU_E'
```
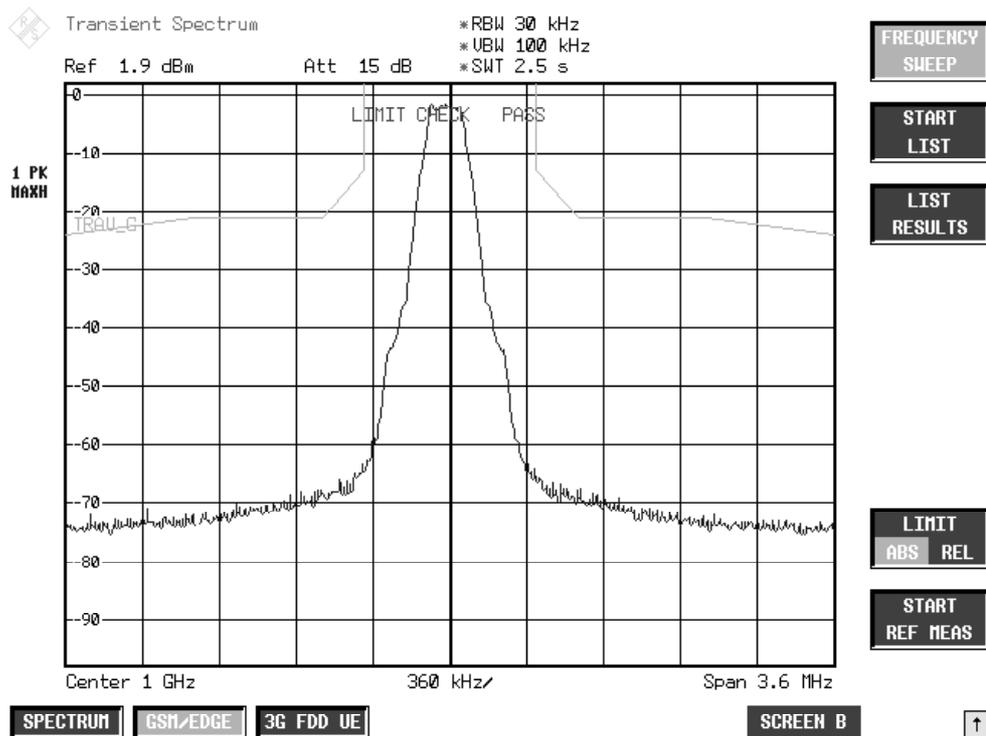

Figure 2-15   Spectrum due to transients in frequency domain
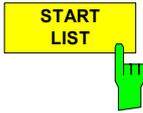
START
LIST

Press the *START LIST* softkey to start measurement of the spectrum due to transients in the time domain (Zero Span).

The analyzer measures at the following pegged offsets from the channel frequency:
$\pm$ 400 kHz, $\pm$ 600 kHz, $\pm$ 1200 kHz, $\pm$ 1800 kHz.

You can choose the resolution bandwidth, but note that this bandwidth is reset to 30 kHz when you press the *FREQUENCY SWEEP* softkey.

Measurement is performed in the time domain with the MAX PEAK detector. The video signal, digitized on the intermediate frequency and filtered with a bandwidth of 30 kHz and bandwidth-limited by the video filter, is measured by the max peak detector during the selected time. The time depends on the number of averages required (*SWEEP COUNT*= number of TDMA bursts to be averaged).

While measurement is in progress, the measured values at the various frequency offsets are displayed briefly in the measurement diagram. The curve reflects progress through the measurement procedure (see Figure 2-16).

In the GSM standards, the mobile's power class is the decisive factor for selecting the right limit line. Consequently, the limit lines specified here are definitive.

When the measuring sequence is completed, the results are displayed in list form (see Figure 2-17). The values marked with an x violate the margin. The values marked with an asterisk (*) violate the limit value.

IEC/IEEE bus commands
```
:INST:SEL MGSM
:CONF:SPEC:SWIT:IMM
:SWE:COUN 20
:READ:SPEC:SWIT:IMM
```
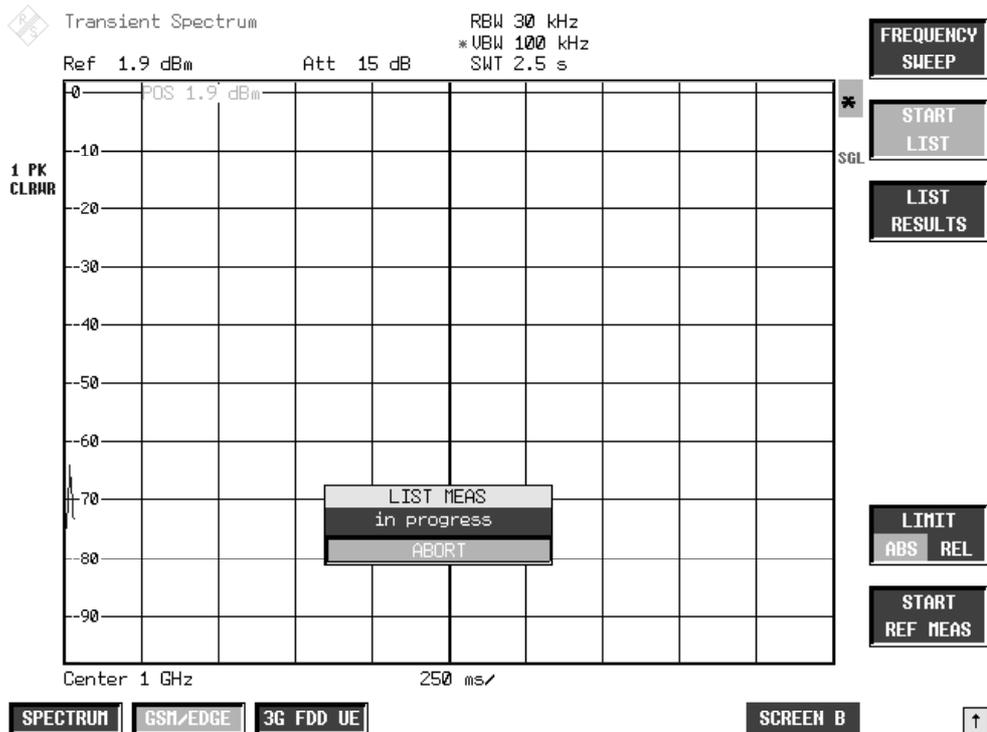
Figure 2-16   Time domain measurement in progress

```
           Transient Spectrum              *RBW 30 kHz
                                           *VBW 100 kHz
           Ref  1.9 dBm          Att  15 dB  *SWT 2.5 s
                              TRANSIENT SPECTRUM LIST
           Frequency:     1.00000 GHz           Status:        PASSED
           Ext Atten:     0.0     dB            No of Bursts:     100
           Ref Level:     1.90    dBm           RBW:  30 kHz VBW: 100 kHz
  1 PK
  MAXH     Offset Freq   +Offset   +Limit   -Offset   -Limit     Status
           [kHz]         [dBm]     [dBm]    [dBm]     [dBm]
              400         -66.3     -13.0    -64.2     -13.0      PASSED
              600         -69.0     -21.0    -68.1     -21.0      PASSED
             1200         -73.2     -21.0    -72.5     -21.0      PASSED
             1800         -75.4     -24.0    -75.3     -24.0      PASSED




           Center 1 GHz                 360 kHz/              Span 3.6 MHz
```

FREQUENCY SWEEP
START LIST
LIST RESULTS
LIMIT ABS REL
START REF MEAS

SPECTRUM   GSM/EDGE   3G FDD UE   SCREEN B   ↑

Figure 2-17 Results of time domain measurement

LIST RESULTS

Press the *LIST RESULTS* softkey to view the most recent results in the list of measurements trigged by *START LIST*.

IEC/IEEE bus command   :FETC:SPE:SWIT:ALL?
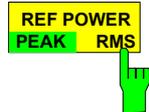
REF POWER PEAK RMS

With the softkey *REF POWER PEAK/RMS* it can be selected if the reference measurement uses the predefined peak hold method or if it uses the RMS method. In RMS mode the reference value is internally determined via the power versus time measurement (PVT). In that case further parameters like modulation type and trainings sequence must be set correctly. Otherwise SYNC NOT FOUND messages may occur. The type of the reference measurement is mentioned in the list result of the list measurement.
This function is available since version 3.70.
IEC/IEEE bus command   :CONF:SPECt:SWIT:TYPE PEAK | RMS
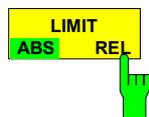
LIMIT ABS REL

With the softkey *LIMIT ABS/REL* it is toggled between absolute and relative (pre- measurement dependent) limits.

IEC/IEEE bus command   :CONF:SPEC:SWIT:LIM REL | ABS
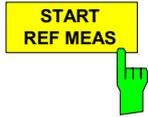
**START
REF MEAS**

Press the START REF MEAS softkey to start reference measurement. It determines the reference for the relative measured values and for the limit lines. Depending on the level obtained in this way, a brief message appears, drawing your attention to the optimum reference level. This permits optimum loading of the spectrum analyzer.

IEC/IEEE bus command   `:READ:SPEC:SWIT:REF:IMM?`

Details of reference measurement:

The purpose of reference measurement is to define the reference for the limit values. Averaging is always over at least 20 bursts, irrespective of the number of bursts (*NO. OF BURSTS= SWEEP COUNT*) selected for measurement as such.

The purpose of reference measurement is to determine the reference level for measurement of the spectrum due to modulation. If measurement is successful, the reference power is saved. The resolution bandwidth used for measurement is also saved (the preset bandwidth is 30 kHz). If the result is not tolerable (see below), a warning is issued, but the measured value is used nevertheless. If the operation is cancelled by the user, the reference power is not changed.

If reference measurement is successful, the measured level is displayed and the limit line positioned relative to it (the Y offset parameter of the limit line is recalculated).

Once determined in this way, the reference level is retained either until a preset is performed (default reference level = -20 dBm), or until a new reference measurement is started.

If the reference level is too low, i.e.

Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > lower level limit - 3 dB

the following message is issued:

```
┌──────────────────────────────────────┐
│              WARNING!                 │
├──────────────────────────────────────┤
│      Signal power = -0.35 dBm.        │
│           REF LEVEL too low!          │
│   INCREASE REF LEVEL to  2.65 dBm!    │
├──────────────────────────────────────┤
│                 OK                    │
└──────────────────────────────────────┘
```

The Carrier Overload Bit in IEC/IEEE bus status management is set.

If the reference level is too high, i.e.
Signal level of DUT – (REF LEVEL + REF LEVEL OFFSET) > upper level limit - 3 dB
the following message is issued:

```
                 WARNING!
        Signal power = -9.34 dBm.
           REF LEVEL too high!
     DECREASE REF LEVEL to -6.34 dBm!
                   OK
```

The No Carrier Bit in IEC/IEEE bus status management is set.

The "lower level limit" and "upper level limit" values are:

lower level limit	+4dB for PEAK and +1dB for RMS reference measurement type
upper level limit	-5dB for PEAK and -5dB for RMS reference measurement type

When the reference level is within the valid range, the following message is issued:

```
               REF MEAS ok!
        Measured power = -8.43 dBm.
                   OK
```

The expected power of the DUT is 3 dB below the reference level. If the settings are not compliant with the above, there is a risk either of the analyzer being overloaded or of the maximum dynamic range not being utilized.
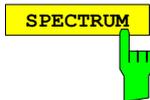
SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Trigger offset = OFF
Trigger = GSM trigger

IEC/IEEE bus command   :INST:SEL SAN

Test hints

Measuring with slow frequency hopping

Bear the following in mind when the DUT is operating in slow frequency hopping mode:

- The default sweep time ensures that at least one frame is recorded for each pixel of the screen. This sweep time must be increased by a factor of three if the hopping period is three frames (B M T).

Increasing measurement speed

In manaual control, the measurement speed is considerably increased by using the two methods described for the MOD measurement. In remote control, the measurement speed is considerably increased by using the SENSe:MPOWer subsystem.

The commands of this subsystem are used for measuring the power at a list of frequency points with different device settings. The measurement is always performed in the time domain (span = 0 Hz).

A new trigger event is required for each test point (exception: Trigger FREE RUN).

The results are output as a list in the order of the entered frequency points. The number of results per test point depends on the number of concurrently active measurements (peak/RMS/average).

Selection of concurrently active measurements and setting of parameters that are constant for the whole measurement is via a configuration command (`SENSe:LIST:POWer:SET`). This also includes the setting for trigger and gate parameters.

The following setting parameters can be selected independently for each frequency point:

- Analyzer frequency
- Reference level
- RF attenuation
- RF attenuation
- RF attenuation of attenuator (only with option B25)
- Resolution filter
- Resolution bandwidth
- Video bandwidth
- Measurement time
- Detector

For details see manual of instrument, chapter "Remote Control – Command Description", section "SENSe:LIST   Subsystem".

Optimizing the Sweep Time

The set sweep time can be reduced if more than one slot is active (multislot operation).

Example:
Measurement 1:   Frame-Pattern: 10000000 ("1" Slot active, "0" Slot inactive)
                        Sweep time $\geq$ 2.5 sec (FSP), $\geq$ 2.9 sec (FSU/FSQ)

Measurement 2:   Frame:Pattern: 10101010 ("1" Slot aktiv, "0" Slot inactive)
                        Sweep time $\geq$ 2.5/4 sec (FSP), $\geq$ 2.9/4 sec (FSU/FSQ)

The sweep time required by the FSE for transient measurements is longer since the FSU/FSQ display has more pixels than that of the SPECTRUM ANALYZER.

Transducer factors

The R&S FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see SPECTRUM ANALYZER manual).
You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Additional information

The tables below show the default settings that apply after you press the *FREQUENCY SWEEP* or *START LIST* softkey.

FREQUENCY SWEEP measurement:

Parameter	Setting	Note
MODE	Frequency sweep span 3.6 MHz	
SWEEP MODE	CONT under local control SINGLE under remote control	
RBW	30 kHz, NORM	3 dB sweep filters are used.
VBW	100 kHz	(Coupling off)
SWT	2.5 s	At least 1 frame per pixel: 4.6154 ms * 501 = 2.31s
TRIG	FREE RUN	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2	BLANK	
TRACE 3	BLANK	
Limit Line	TRAU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y absolute level Y offset has no effect
Limit Checks	ON	
Limit X OFFSET	0	0, because symmetrical with CF
Limit Y OFFSET	0	No effect, because Y absolute

LIST measurement:

Parameter	Setting	Note
SWEEP MODE	SINGLE	
SWEEP COUNT	Use as is, set to 10 if 0	
SPAN	ZERO SPAN	
TRIG	FREE RUN	
RBW	Selectable; default is 30 kHz	
VBW	Selectable; default is 100 kHz	
SWEEP TIME	Sweep time/501 (FSP) Sweep time/625 (FSU/FSQ)	In other words list measurement is dependent on the sweep time of the frequency sweep
REF LEVEL POSITION	100%	Preset value
Y axis	LOG_100DB	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2, 3	All settings possible	
Limit Line	TRAU_G	X relative to center frequency (CF), X values symmetrical with CF, so no X offset, see below Y absolute level Y offset has no effect
Marker 1	Normal marker on trace 1	

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	
Unit (UNIT menu)	Function not available	
Linear scaling (RANGE LINEAR)	Function not available	

Measurement of spurious

Measuring spurious entails examining the entire frequency band (30 MHz to 12.75 GHz or upper frequency limit of the analyzer) for interference.

Note: *The center frequency is changed automatically and restored to its original level when measurement is completed.*

Requirements for the measuring signal

All slots active (if, for example, only one slot is active, the measuring time must be extended by a factor of eight).

Quick reference guide

Without explaining them, the quick reference guide presents the settings required for measurement in a practical sequence. The precondition for the procedure as described here is that the presets are activated (*PRESET* key) before the procedure starts.

Setting	Operation
Start application	*GSM/EDGE* hotkey

Enter external attenuation
        Default: 0 dB
	GENERAL SETTINGS softkey
	        EXTERNAL ATTEN softkey

Fine-tune level to within approx. 1 dB	*AUTO LEVEL&TIME* softkey or *REF LEVEL* softkey → Position burst in mask In case of measurements far off the carrier the reference level can be reduced further.
Start measurement	*PREV* hotkey *SPURIOUS* softkey

Measurement

GSM/EDGE menu
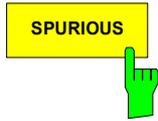
SPURIOUS

The *SPURIOUS* softkey starts measurement of the spurious in the frequency sweep (30 MHz to 12.75 GHz).
The limit lines are displayed.

IEC/IEEE bus commands
```
:INST:SEL MGSM
:CONF:MTYP GMSK
:CONF:SPUR:IMM
:SWE:COUN 20
:INIT:IMM; *WAI
```

Result queries:
```
:CALC:MARK ON
:CALC:MARK:MAX
:CALC:MARK:MAX:NEXT
```
(the marker is at the largest spurious emission)
```
CALC:MARK:MAX
```
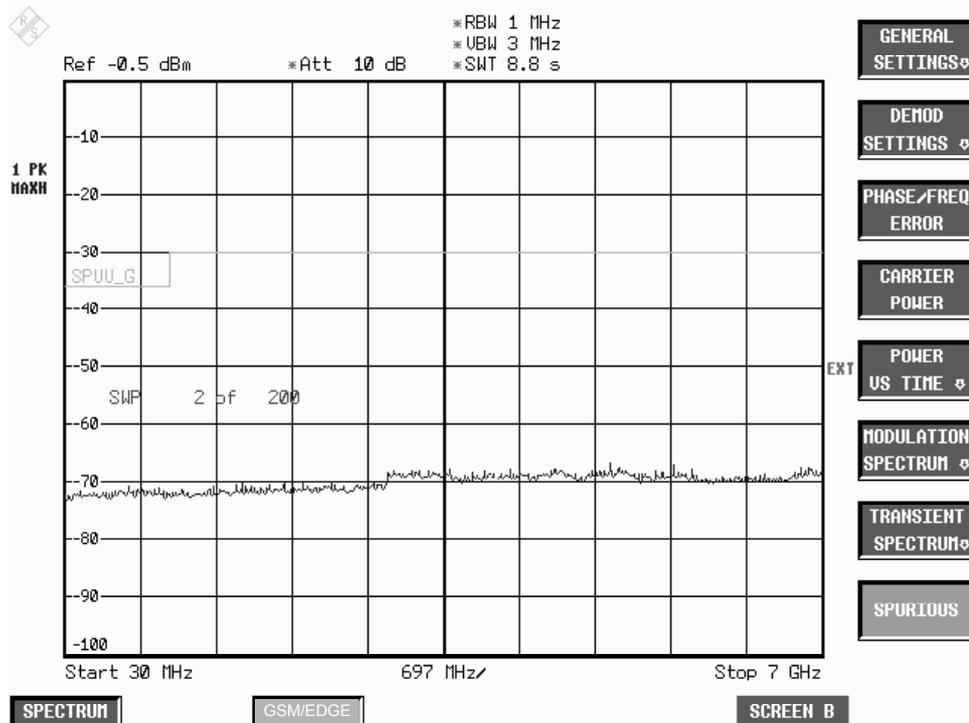

Figure 2-18   Measurement of spurious
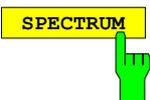
SPECTRUM

Press the *SPECTRUM* hotkey to launch the Analyzer mode. The following settings are changed automatically; all other settings are taken from the GSM/EDGE mode:

Center frequency = The center frequency set before spurious measurements commenced is restored.
Trigger = GSM trigger

IEC/IEEE bus command   `:INST:SEL SAN`

Test hints

Number of bursts to be measured -> *NO OF BURSTS*

The default value when you launch the application is *NO OF BURSTS* (= *SWEEP COUNT*) = 0.
This setting produces a floating average over every 10 bursts (see User Manual). You can change *NO OF BURSTS* if you want to measure across a different number of bursts (e.g. 200).
The settings for NO OF BURSTS / SWEEP COUNT apply to all measurements (they are not measurement-specific, in other words).
You also have the option of using *SINGLE* or *CONTINUOUS SWEEP MODE* in the same way as in the Analyzer mode.

Transducer factors

The R&S FS-K5 provides measurements with transducer factors as described for the basic unit. The frequency response of external components (power splitters, cables, attenuator pads) can be corrected or taken into consideration.

Transducer factors can be activated for CPW, MOD, TRA and SPU general and list measurements. They are set, stored and modified in the SETUP menu using the *TRANSDUCER* softkey.

Additional information

Parameter	Setting	Note
MODE	Frequency sweep	
SWEEP MODE	CONT under local control SINGLE under remote control	
START FREQ	30 MHz	In other words the center frequency is changed with this SPU measurement setting
STOP FREQ	Minimum of 12.75 GHz and the max. stop frequency of the analyzer	
RBW	1 MHz	
VBW	3 MHz	
SWT	(5 s / 3.97 GHz) * SPAN	
REf LEVEL POSITION	100%	Preset value
TRIG	Free Run	
TRACE 1	MAX HOLD	
DETECTOR 1	MAX PEAK	
TRACE 2	BLANK	
DETECTOR 2		
TRACE 3	BLANK	
DETECTOR 3		
Limit Line	SPUU_G	X abs. frequency, so X offset has no effect Y abs. level, so Y offset has no effect
Limit Checks	OFF	
Limit X OFFSET	0	No effect, because X absolute
Limit Y OFFSET	0	No effect, because Y absolute

Availability of keys and softkeys

Parameter	Availability	Note
FFT filter (FILTER TYPE FFT)	Function not available	
Amplitude distribution (SIGNAL STATISTICS)	Function not available	
Channel and adjacent channel power measurements (CHAN POWER / ACP)	Function not available	
Measurement of occupied bandwidth (OCCUPIED BANDWIDTH)	Function not available	
Trigger (VIDEO, IF POWER, EXTERN, FREE RUN, RF POWER)	Function not available	The GSM trigger settings are used
Gated sweep mode (GATED TRIGGER, GATE SETTINGS)	Function not available	
Time domain mode (ZERO SPAN)	Function not available	Measurement is in frequency domain
On-screen presentation (SPLIT SCREEN, REF LEVEL COUPLED, CENTER A = MARKER B, CENTER B = MARKER A, SCREEN B,)	Function not available	

Contents - Chapter 6 "Remote Control"

3 Remote Control

The following sections are to complete and update Chapters 5 and 6 of the user manual.

The "Description of Commands" section includes the new commands valid especially for the R&S FS-K5 application, and all commands not available or available only with restrictions in the GSM/EDGE mode.

Commands come in alphabetical order in separate lists in the "List of Commands" section.

The "Status Reporting Registers for GSM/EDGE Measurements" section provides information on the bit assignment in the STATus:QUEStionable and STATus:QUEStionable:SYNC registers.

The R&S FS-K5 commands were generated with a view to maximum compatibility with those of the FSE-K10/FSE-K11/FSE-K20/FSE-K21 applications for the FSE family. Some commands were included in the command set only for reasons of compatibility.

In the description of measurements in Chapter 2, the corresponding IEC/IEEE-bus commands are stated for each softkey.

Note: *All GSM/EDGE measurements are performed in screen A. Therefore, commands carrying a numerical suffix selecting the screen should start either with the numerical suffix 1 (i.e.* CALCulate1) *or without a numerical suffix (i.e.* CALCulate).*

Description of Commands

CALCulate:DELTamarker Subsystem

CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise[:STATe] ON | OFF

> *Note: This command is not available in GSM/EDGE mode.*

CALCulate<1|2>:DELTamarker<1...4>:FUNCtion:PNOise:RESult?

> *Note: This command is not available in GSM/EDGE mode.*

CALCulate:LIMit Subsystem

Note: *- This command is not available for GSM/EDGE measurements MAC and PFE.*

         - The names of the limit lines are fixed. The names must be assigned by the user prior to their use:

```
CALCulate1:LIMit1:NAME 'xxxU_yz' or
CALCulate1:LIMit2:NAME 'xxxL_yz'

        xxx = measurement              (PVT / CPW / MOD / TRA)
        U   = upper limit line         (PVT / CPW / MOD / TRA)
        L   = lower limit line         (PVT / CPW)
        y   = modulation type          (_G = GMSK / _E = EDGE)
        z   = for all measurements blank, only
              for PVT in multislot:
              active slots             (blank = 1 active slot
                                        2     = 2 active slots
                                        3     = 3 active slots
                                        4     = 4 active slot
        yz  = in Access Burst mode (_AB)

Query:      CALC1:LIM1:FAIL?
            CALC1:LIM2:FAIL?

Example:
CPWU_G =    upper limit line for Carrier Power measurement,
            Modulation type GMSK
PVTL_E3 =   lower limit line for Power versus Time measurement,
            Modulation type EDGE, multislot: 3 active slots
```

CALCulate:MARKer Subsystem

CALCulate:MARKer:COUNt Subsystem

CALCulate<1|2>:MARKer<1...4>:COUNt ON | OFF

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:COUNt:RESolution 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:COUNt:FREQuency?

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate:MARKer:FUNCtion Subsystem

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown <numeric_value>

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:STATe ON | OFF

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:RESult?

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NDBDown:FREQuency?

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe[:STATe] ON | OFF

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:NOISe:RESult?

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI[:STATe] ON | OFF

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:TOI:RESult?

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

CALCulate:MARKer:FUNCtion:POWer Subsystem

Note :   *The commands of this subsystem are not available in GSM/EDGE mode.*

CALCulate:MARKer:FUNCtion:SUMMary Subsystem

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MODE ABSolute | RELative
  Note: *This command is not available for GSM/EDGE measurements MAC and PFE.*

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:REFerence:AUTO ONCE
  Note: *This command is not available for GSM/EDGE measurements MAC and PFE.*

CALCulate:STATistics Subsystem

Note :   *The commands of this subsystem are not available in GSM/EDGE mode.*

CALCulate:UNIT Subsystem

Note :   *This command is not available in GSM/EDGE mode.*
            In GSM measurements the unit is prescribed: either DBM (power measurement) or DEG
            (phase error measurement) have to be used.

CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks, like those provided by the firmware application GSM/EDGE Analyzer (R&S FS-K5). The CONFigure subsystem is closely linked to the functions of the FETCH and READ subsystems, where the measurement cycles are started and/or the results of the measurements are queried.

The purpose of the following commands is configuring the GSM/EDGE mode (firmware application R&S FS-K5) for mobiles and base stations corresponding to the standards P-GSM, E-GSM, R-GSM, DCS1800 or PCS1900.

Note: *Beside the notation* `CONFigure:<command>` *the spectrum analyzer also supports the notation* `CONFigure:MS:<command>` *for reasons of compatibility with the FSE family of instruments.*

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			
[:MS]			
:BSEarch	\<Boolean>		
:BSTHreshold	\<numeric_value>	dB	
:CHANnel			
:SLOT			
:MULTi	ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 | ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 | ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 | ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 | ACT8SYNC6 | ACT8SYNC7 | ACT8SYNC8		
:TSC	\<numeric_value> | USER | AB0 | AB1 | AB2 \<string>	--	
:USER		--	
:ECONfigure			
:LSLot			
[:STATe]	\<Boolean>		
:VALue	\<numeric_value>,\<numeric_value>		
:MREFerence	\<numeric_value>		
:OFRame	\<Boolean>		
:SLOT\<num {0-7}>			
:LIMit			
:ABSolute		DBM	
:BASE\<1|2>	\<numeric_value>		
[:STATe]	\<Boolean>		
:CLEVel	GMSK | EDGE | OFF		
:LOWer	\<string>		
:UPPer	\<string>		
:MODulation	MSK | EDGE | OFF		
:RLEVel			
:MODE	AUTO | ABS | REL | \<numeric_value>	-,DB | DBM	
:VALue	\<numeric_value>		
:STANdard			
:SELect	DYNamic | GSM450 | GSM850 | GSM900 | GSM1800 | GSM1900		
[:STATe]	\<Boolean>		
:TREFerence	\<numeric_value>		
:MCARrier	\<boolean>		
:MTYPe	GMSK | EDGE		
:PRATe	4 | 8		
RESTore	--	--	no query
:SSEarch	\<boolean>		

CONFigure[:MS]:BSEarch ON | OFF

This command toggles between active burst search and inactive burst search. When this mode is active, the GSM/EDGE measurement software presumes that a burst has been found. The burst level for detecting a valid burst can be adjusted with the command `CONF:BSTR`. One search type (burst or sync find) must always be active.

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:BSE OFF"`   'Switches off the BURST SEARCH mode

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

CONFigure[:MS]:BSTHreshold -100..0dB

This command changes the burst find threshold. The level of the measured signal must change at least as much as that given threshold value to be recognized as a burst. .

The value is in dB, with a minimum of –100 dB and maximum of 0 dB. The default is –35 dB.

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:BSTH -23"`   'Sers the burst search threshold to -23 dB

Characteristics: *RST- value: -35 dB
                       SCPI: device-specific

CONFigure[:MS]:CHANnel:SLOT:MULTi   ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 |
                    ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 |
                    ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 |
                    ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 |
                    ACT83SYNC6 | ACT8SYNC7 | ACT8SYNC8

This command defines the used slots of the mobile or base station. The multislot setting defines how many adjacent slots are active and which of the active slots should be used for synchronization.

The following combinations are possible:

ACT1SYNC1   1 active slot   synchronization to 1st active slot
ACT2SYNC1   2 active slots   synchronization to 1st active slot
ACT2SYNC2   2 active slots   synchronization to 2nd active slot
ACT3SYNC1   3 active slots   synchronization to 1st active slot
ACT3SYNC2   3 active slots   synchronization to 2nd active slot
ACT3SYNC3   3 active slots   synchronization to 3rd active slot
ACT4SYNC1   4 active slots   synchronization to 1st active Slot
ACT4SYNC2   4 active slots   synchronization to 2nd active slot
ACT4SYNC3   4 active slots   synchronization to 3rd active slot
ACT4SYNC4   4 active slots   synchronization to 4th active slot
ACT8SYNC1   8 active slots   synchronization to 1st active Slot
ACT8SYNC2   8 active slots   synchronization to 2nd active Slot
ACT8SYNC3   8 active slots   synchronization to 3rd active Slot
ACT8SYNC4   8 active slots   synchronization to 4th active Slot
ACT8SYNC5   8 active slots   synchronization to 5th active Slot
ACT8SYNC6   8 active slots   synchronization to 6th active Slot
ACT8SYNC7   8 active slots   synchronization to 7th active Slot
ACT8SYNC8   8 active slots   synchronization to 8th active Slot

For the phase-frequency error, modulation accuracy and power vs. time measurement the midamble (trainingssequence) for the slot to synchronize must be set correctly!

The reference measurement of power vs. time measurement and the questionable signal power of the main measurement is related to the slot to synchronize. In the main measurement of power vs. time the slot to synchronize defines the synchronization point of the multislot signal on the screen.

All results of the phase-frequency error and modulation accuracy measurement are related to the slot to synchronize.
In carrier power and modulation spectrum measurement the slot to synchronize is used to adjust the triggerdelay in order that the slot to synchronize is measured.

With the slot to synchronize it is therefore possible to investigate a certain slot of multislot signals.

This command is only available with the GSM/EDGE Analyzer R&S FS-K5 option.

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:CHAN:SLOT:MULTI ACT3SYNC2"`	
		'Selects the multislot configuration with 3 adjacent active slots and synchronization on the 2nd (middle)

Characteristics:	*RST-value:	ACT1SYNC1 (one slot active)
	SCPI:	device-specific

CONFigure[:MS]:CHANnel:TSC <numeric_value> | USER | AB0 | AB1 | AB2

This command selects the midamble used by the mobile or base station. With selection USER, the user defined midamble set with command `CONFigure:CHANnel:TSC:USER` is used. The normal mode is selected with TSC0-TSC7 and USER.
With selection TS0 (ACCESS), TS1 (ACCESS) or TS2 (ACCESS) the access burst mode is activated using the access burst midamble pattern and slot structure from the GSM standard.
When the access burst mode is entered the current measurement (like PVT, PFE, MOD, etc.) is left and the modulation is set to GMSK.
In access burst mode the measurements power versus time (PVT) or phase frequency error (PFE) can be selected – other measurements are not available.
The IF and RF (on R&S FSP) power trigger are used in access burst mode to trigger the IQ measurements (PVT/PFE) if the detector board with the model number 03 or higher is part of the analyzer hardware. (Without that kind of detector board the free run trigger is used as known from the IQ measurements in normal mode.) The external trigger is available as usual.
The access burst mode is left by selecting a normal TSC0-TSC7 or the TSC-USER. The active measurement mode from access burst mode (PVT or PFE) is left and a new measurement mode configuration is necessary.This command is only available in GSM/EDGE mode (R&S FS-K5).

Note: *The selected midamble is only significant for GSM/EDGE measurements MAC, PFE and PVT.*

Parameter:	<numeric_value> ::=	0...7 (training sequence for normal burst)
		USER (the TSC set with `CONF:CHAN:TSC:USER` is used)
		AB0	AB1	AB2 (access burst mode)

Example:	`"INST MGSM"`	'Switches instruement to GSM/EDGE mode
	`"CONF:CHAN:TSC 3"`	'Selects TSC 3

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

CONFigure[:MS]:CHANnel:TSC:USER <string>

This command defines the bit pattern of the user midamble (training sequence). The user midamble is selected with command `CONF:CHAN:TSC USER`.
For each modulation type, a separate user midamble can be defined.

Parameter:	<string>	**For modulation type GMSK:**

The first 26 characters are evaluated.
'0' and '1' represent the GMSK symbols -1 and 1.
If the number of characters is insufficient, the string is filled with '0' up to the 26th character. Characters other than '0' are processed as '1'.

For modulation type 8PSK (EDGE):
The first 78 characters are evaluated. The character patterns are
 assigned to the 8PSK (EDGE) symbols as follows:

Pattern	8PSK Symbol
111	0
011	1
010	2
000	3
001	4
101	5
100	6
110	7

If the number of characters is insufficient, the string is filled with '0' up to the 78th character . Characters other than '0' are processed as '1'.

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`   'Selects modulation type GMSK
`"CONF:CHAN:TSC:USER '01010101010101010101010101'"`
   'Defines TSC USER for GMSK
`"CONF:CHAN:TSC USER"`   'Selects TSC USER.
`"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
`"CONF:CHAN:TSC:USER '010101010101010101010101010`
`101010101010101010101010101010101010101010101010101'"`
   'Defines TSC USER for EDGE

Characteristics: *RST value: '00000000000000000000000000' for GMSK,
   78 times '0' for 8PSK (EDGE) accordingly
SCPI: device-specific

CONFigure:ECONfigure:LSLot[:STATe] ON | OFF

This command defines whether a GSM frame contains long slots or not. If this state is switched on both positions of the long slots have to be set with command CONF:ECON:LSL:VAL.

Example: `"INST:SEL MGSM"`   'Select GSM/EDGE application
`"CONF:ECON:LSL  1"`   'Extended slot configuration with long slots

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

CONFigure:ECONfigure:LSLot:VALue < slot_number >, <slot_number>

This command defines the long slots of the GSM frame.

Example: `"INST:SEL MGSM"`   'Select GSM/EDGE application
`"CONF:ECON:LSL:VAL  1,4"`   'Slot 1 and slot 4 are long slots

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

CONFigure:ECONfigure:MREFerence <slot_number >

This command defines the midamble of the reference slot in the extended slot configuration mode.

| **Example:** | `"INST:SEL MGSM"` | 'Select GSM/EDGE application |
| | `"CONF:ECON:MREF 2"` | 'Midamble 2 is used for the reference slot |

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

CONFigure:ECONfigure:OFRame ON | OFF

This command defines the limit line handling before begin of slot 0 and after end of slot 7 in the extended slot configuration mode.

As default (OFF) the limit checking is additionally done before slot 0 and after slot 7. Here a repetitive signal is required. Slot 7 signal is followed by slot 0 as defined in the configuration table.

In other cases, e.g. if an idle burst follows, it may be required to only check the time period of the frame itself but not the period before slot 0 and after slot 7. Here parameter ON has to be used.

| **Example:** | `"INST:SEL MGSM"` | 'Select GSM/EDGE application |
| | `"CONF:ECON:OFR ON"` | 'only the frame is checked |

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

CONFigure[:MS]:ECONfigure:SLOT<0 | [1] … 7>:LIMit:ABSolute:BASe<[1] | 2> <numeric value>

This command specifies which absolute limit base value should be taken into account upon calculation of the upper limit line(s). 'BASE' or 'BASE1' specifies the value for the line area situated 28 µs and more apart from either side of the useful part of the slot; 'BASE2' provides the value for the region located from 18 µs to 28 µs outside the useful part of the slot at either side.
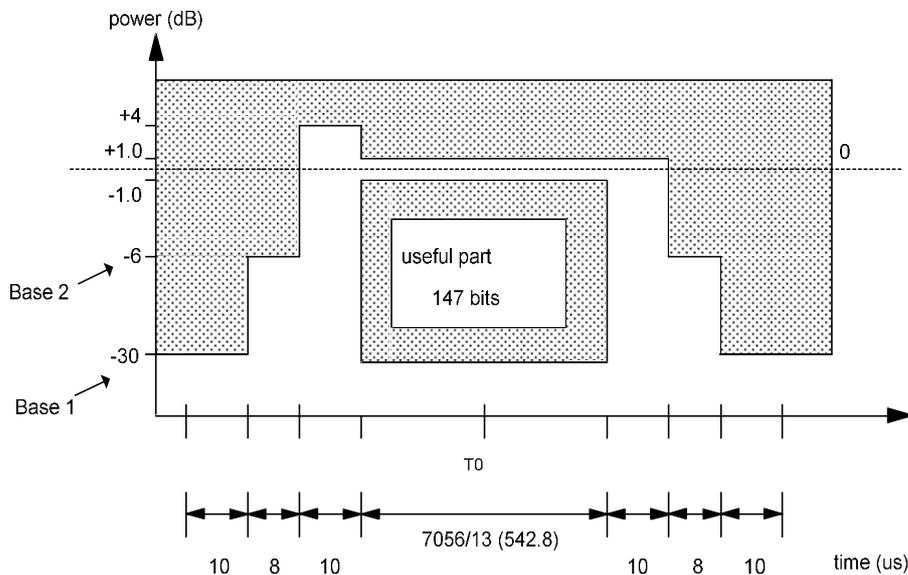
The provided values are maintained individually for each standard.

The numeric suffix at SLOT is ignored.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON:STAN:SEL  GSM900"`	'Select GSM standard
	`"CONF:ECON:SLOT:LIM:ABS:BASE  -36`	'Sets base #1 to -36dBm
	`"CONF:ECON:SLOT:LIM:ABS:BAS2  -17`	'Sets base #2 to -

17dBm

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

CONFigure[:MS]:ECONfigure:SLOT<0 | [1] … 7>:LIMit:ABSolute[:STATe] ON | OFF

This command specifies whether absolute limit base values should be taken into account or not upon calculation of the upper limit line(s). In default state OFF, the absolute values are ignored.

The numeric suffix at SLOT is ignored.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON:STAN:SEL  GSM900"`	'Select GSM standard
	`"CONF:ECON:SLOT:LIM:ABS  ON"`	'In addition uses absolute

values

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

CONFigure[:MS]:ECONfigure:SLOT<0 | [1] … 7>:LIMit:CLEVel   <numeric value>

This command specifies which power control level should be taken into account upon calculation of the upper limit line(s). The provided values are maintained individually for each standard and every slot.

The allowed range depends upon the GSM standard. INC/DEC work according to the absolute power assigned to the control level value. That means, that every INC will increase the nominal absolute power of the mobile even if the numerical value of the control level will decrease.

The numeric suffix at SLOT is the GSM slot number.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON:STAN:SEL  GSM1800"`	'Select GSM standard
	`"CONF:ECON:SLOT0:LIM:CLEV  30`	'Sets it to #30 (+34dBm) for
slot #0	`"CONF:ECON:SLOT7:LIM:CLEV  0`	'Sets it to #0 (+30dBm) for

slot #7

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

CONFigure:ECONfigure:SLOT<0 | [1] … 7>:LIMit:LOWer string_value

This command selects the lower limit line 'string_value' for the selected slot in the extended slot configuration mode. The numeric suffix at SLOT is the GSM slot number.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF: CONF:ECON:SLOT3:LIM:LOW 'PVTL_G' "`	
		'Use PVTL_G for slot 3.

Characteristics:	*RST value:	'PVTL_G' for slot 0
	SCPI:	device-specific

CONFigure:ECONfigure:SLOT<0 | [1] … 7>:LIMit:UPPer string_value

This command selects the upper limit line 'string_value' for the selected slot in the extended slot configuration mode. The numeric suffix at SLOT is the GSM slot number.

Example: `"INST:SEL MGSM"`   'Select GSM/EDGE application

`"CONF: CONF:ECON:SLOT3:LIM:UPP 'PVTU_G' "`
                                'Use PVTU_G for slot 3.

Characteristics: *RST value: 'PVTU_G' for slot 0
                 SCPI: device-specific

CONFigure:ECONfigure:SLOT<0 | [1] … 7>:MODulation GMSK | EDGE | OFF]

This command defines the modulation for the selected slot or defines the slot as inactive (OFF). The numeric suffix at SLOT is the GSM slot number.

Example: `"INST:SEL MGSM"`   'Select GSM/EDGE application

`"CONF:ECON:SLOT1:MOD  GMSK"` 'Slot 1 uses GSMK,
`"CONF:ECON:SLOT2:MOD  OFF"` 'Slot 2 is inactive
`"CONF:ECON:SLOT3:MOD  EDGE"` 'Slot 3 uses EDGE (8PSK)

Characteristics: *RST value: 'GMSK for slot 0, OFF for slot 1..7
                 SCPI: device-specific

CONFigure:ECONfigure:SLOT<0 | [1] … 7>:RLEVel:MODe ABS | REL | <numeric_value>]

This command defines the Reference Level Mode for the selected slot in the extended slot configuration mode. The numeric suffix at SLOT is the GSM slot number.

Example: "INST:SEL MGSM"   'Select GSM/EDGE application

`"CONF: CONF:ECON:SLOT3:RLEV:MODE ABS "`   'absolute power for slot 3

Characteristics: *RST value: REL for all slots
                 SCPI: device-specific

CONFigure:ECONfigure:SLOT<0 | [1] … 7>:RLEVel:VALue numeric_value

This command defines the reference power for the selected slot in the extended slot configuration mode. The numeric suffix at SLOT is the GSM slot number.

Example: "INST:SEL MGSM"   'Select GSM/EDGE application

`"CONF: CONF:ECON:SLOT3:RLEV:VAL 5.0"`
                                ' sets reference power for slot 3 to 5dB

Characteristics: *RST value: 0 dB for all slots
                 SCPI: device-specific

CONFigure[:MS]:ECONfigure:STANdard:SELect DYNAMIC | GSM850 | GSM900 | GSM1800 | GSM1900

This command controls the behaviour of the extended slot configuration mode. DYNAMIC uses a fixed Power vs Time limit line template. Selecting GSM850, GSM900, GSM1800 or GSM1900 (mobile station) the limit lines are calculated internally by taking into account special user settings as 'control level' and 'absolute level'.

Note: GSM850 is not supported for model R&S FSG with base system version 4.29.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON ON "`	'extended slot configuration active
	`"CONF:ECON:STAN:SEL  GSM1800"`	'chooses GSM1800
	`"CONF:ECON:SLOT0:LIM:CLEV 30`	'Sets it to #30 (+34dBm) for slot #0
	`"CONF:ECON:SLOT7:LIM:CLEV 0`	'Sets it to #0 (+30dBm) for slot #7

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

CONFigure[:MS]:ECONfigure[:STATe] ON | OFF

This command activates the extended slot configuration.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON ON "`	'extended slot configuration active

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

CONFigure:ECONfigure:TREFerence <slot_number >

This command defines slot used as trigger reference in the extended slot configuration mode.

Example:	`"INST:SEL MGSM"`	'Select GSM/EDGE application
	`"CONF:ECON:TREF 4"`	'Slot 4 is the trigger reference

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

CONFigure[:MS]:MCARrier ON | OFF

This command sets the multi carrier mode to ON or OFF.

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MCAR ON"`	'Switches on the multi carrier mode

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

CONFigure[:MS]:MTYPe GMSK | EDGE

This command selects modulation type GMSK or EDGE.
A running GSM measurement is aborted when the modulation type is changed. It has to be explicitly selected again by using one of the CONFigure commands.

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	Selects the MAC measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Starts the measurement

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

CONFigure[:MS]:PRATe 4 | 8

This command defines the number of measurement points per symbol. (rate of points per symbols).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:PRAT 8"`	'Defines the points per symbol rate to 8'

Characteristics:	*RST- value:	4
	SCPI:	device-specific
Mode:	GSM/EDGE	

CONFigure:[:MS]RESTore

This command restores the GSM/EDGE limit lines. Any modifications made to the GSM/EDGE limit lines are lost and the status upon delivery is restored.
This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:REST"`	restores the GSM/EDGE limit lines

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure[:MS]:SSEarch ON | OFF

This command toggles between active syncronization search and inactive schronizationy search. When this mode is active, the GSM/EDGE measurement software presumes that the midamble found corresponds to the preset TSC. One search type (burst or sync find) must always be active.

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:SSE OFF"`	'Switches off the SYNC SEARCH mode

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

CONFigure:BURSt Subsystem

This subsystem provides the commands for configuring the measurements in the GSM/EDGE mode (option R&S FS-K5) which are performed on individual bursts:
- Carrier Power (CPW),
- Modulation Accuracy (MAC),
- Phase-Frequency Error (PFE),
- Power vs. Time (PVT).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option R&S FS-K5
:BURSt			
:MACCuracy			
[:IMMediate		--	no query
:PFERror			
[:IMMediate]		--	no query
:POWer			
[:IMMediate]		--	no query
:PTEMplate			
:FILTer	G500 | B600		
:FRZoom	<numeric_value>		
[:IMMediate]			no query
:SELect	FULL | TOP | RISing | FALLing | FRZoom		
:TMHRes	<boolean>		

CONFigure:BURSt:MACCuracy[:IMMediate]

This command selects measurement of the modulation accuracy of the mobile or base station (MAC). When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (option R&S FS-K5) and when modulation type EDGE (CONFigure:MTYPe EDGE) is selected.

Example: `"INST MGSM"`   Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP EDGE"`   Selects modulation type EDGE (8PSK)
                  `"CONF:BURS:MACC"`   Selects the MAC measurement
                  `"SWE:COUN 20"`   Sets the number of bursts
                  `"INIT:IMM;*WAI"`   Starts the measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:PFERror[:IMMediate]

This command selects measurement of the phase and frequency error of the mobile or base station (PFE). When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when modulation type GMSK is selected (CONFigure:MTYPe GMSK).

Example: `"INST MGSM"`   Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP GMSK"`   Selects modulation type GMSK
                  `"CONF:BURS:PFER"`   Selects the PFE measurement
                  `"SWE:COUN 20"`   Sets the number of bursts
                  `"INIT:IMM;*WAI"`   Sxecutes the measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:POWer[:IMMediate]

This command selects measurement of the carrier power of the mobile or base station (CPW).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (R&S FS-K5).

Example: `"INST MGSM"`   Switches the instrument to GSM/EDGE mode
                 `"CONF:BURS:POW"`   Selects the CPW measurement
                 `"SWE:COUN 20"`   Sets the number of bursts
                 `"INIT:IMM;*WAI"`   Executes the measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:PTEMplate:FILTer G500 | B600

This command changes between the default low pass filter with 600 kHz bandwidth and the gaussian 500 kHz bandwidth filter. The later is useful for signals with steep edges.

Example: `"INST MGSM"`   Switches the instrument to GSM/EDGE mode
                 `"CONF:BURS:PTEM"`   Selects the PVT measurement
                 `"CONF:BURS:PTEM:FILT G500"` Selects the 500 kHz Gaussian filter
                 `"SWE:COUN 20"`   Sets the number of bursts
                 `"INIT:IMM;*WAI"`   Executes the measurement

Characteristics: *RST value: B600
                      SCPI: device-specific

CONFigure:BURSt:PTEMplate:FRZoom 1..(active slots - 1)

This command is available if more than one slot is active. (See `CONF:CHAN:SLOT:MULTI`).The transition number where the zoom shall be carried out can be entered. The valid range is 1..(active slots-1). The FALL/RISE ZOOM mode (See `CONF:BURS:PTEM:SEL FRZ`) must be switched on separately.

Example: `"INST MGSM"`   Switches the instrument to GSM/EDGE mode
                 `"CONF:BURS:PTEM"`   Selects the PVT measurement
                 `"CONF:CHAN:SLOT:MULT ACT3sync1"` Selects 3 active slots
                 `"CONF:BURS:PTEM:SEL FRZ"`   Selects Fall/Rise Zoom Mode
                 `"CONF:BURS:PTEM:FRZ 2"`   Zoom to transition number 2
                 `"SWE:COUN 20"`   Sets the number of bursts
                 `"INIT:IMM;*WAI"`   Executes the measurement

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

CONFigure:BURSt:PTEMplate[:IMMediate]

This command selects measurement of power of the mobile or base station vs. time (PVT).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:BURS:PTEM"`	Selects the PVT measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:BURSt:PTEMplate:SELect FULL | TOP | RISing | FALLing | FRZoom

This command defines the burst section to be measured.

FULL	: full burst
RISing	: rising edge
FALLing	: falling edge
TOP	: top high resolution, top of burst with smaller display range and therefore higher resolution on y-axis (power axis)
FRZoom	: fall/rise zoom mode, zoom between transitions

This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:BURS:PTEM"`	Selects the PVT measurement
	`"CONF:BURS:PTEM:SEL TOP"`	Selects the top high resolution mode
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the measurement

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

CONFigure:BURSt:PTEMplate:TMHRes ON | OFF

This command is available if the external trigger is selected and the PVT is running in FULL BURST MODE. In this mode the power versus time works with a higher sampling rate.

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:BURS:PTEM"`	Selects the PVT measurement
	`"CONF:BURS:PTEM:SEL FULL"`	Selects the full burst mode
	`"TRIG:SYNC:ADJ:EXT 100us"`	Selects the external trigger with 100µs offset
	`"CONF:BURS:PTEM:TMHR ON"`	Switches on the time meas high res mode
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the measurement

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

CONFigure:SPECtrum Subsystem

This subsystem provides the commands for configuring the measurements in the in the GSM/EDGE Analyzer mode (R&S FS-K5) used to determine the power of the spectral contributions due to modulation and switching:
- spectrum due to modulation (MOD)
- spectrum due to transients (TRA).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option R&S FS-K5
:SPECtrum			
:MODulation			
[:IMMediate]	--	--	no query
:LIST			
:AVERage			
:TYPE	LINear | LOGarithmic	--	
:SWITching			
[:IMMediate]	--	--	no query
:LIMit	ABSolute | RELative		
:TYPE	PEAK | RMS		

CONFigure:SPECtrum:MODulation[:IMMediate]

This command selects measurement of the spectrum due to modulation (MOD).

The overview measurement in the frequency domain is directly started with command `INITate[:IMMediate]`, the list measurement in the time domain with command `READ:SPECtrum:MODulation[:ALL]?`.

When the measurement is started the analyzer is automatically set to single sweep. This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:MOD"`	Selects the MOD measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the overview measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:SPECtrum:MODulation:LIST:AVERage:TYPE   LINear | LOGarithmic

This command toggles between linear and logarithmic (default) averaging in the modulation spectrum list measurement. In LIN mode voltages are averaged. In LOG mode levels.

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:MOD:LIST:AVER:TYPE LIN"`	
		'Switches linear averaging in the modulation spectrum list measurement.
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the overview measurementh

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

CONFigure:SPECtrum:SWITching[:IMMediate]

This command selects measurement of the spectrum due to switching transients (TRA).

The overview measurement in the frequency domain is directly started with command `INITate[:IMMediate]`, the list measurement in the time domain with command `READ:SPECtrum:MODulation[:ALL]?`.

When the measurement is started the analyzer is automatically set to single sweep. This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:
`"INST MGSM"` Switches the instrument to GSM/EDGE mode
`"CONF:SPEC:SWIT"` Selects the TRA measurement
`"SWE:COUN 20"` Sets the number of bursts
`"INIT:IMM;*WAI"` Executes the overview measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

CONFigure:SPECtrum:SWITching:LIMit ABSolute | RELative

This command selects the mode of limit check of the measurement of the spectrum due to switching transients (TRA). Default is the test against the absolute (ABSolute) limit line `TRAU_G` or `TRAU_E` depending on the modulation type (GSM/EDGE).
If the limit type RELative is selected, the relative limit line `TRRU_G` or. `TRRU_E` depending on the modulation type (GSM/EDGE) is used for the check.
For the relative measurement exists the necessary reference measurement `READ:SPEC:SWIT` which determines the reference power.
This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:
`"INST MGSM"` 'Switches the instrument to GSM MS mode
`"CONF:SPEC:SWIT"` 'Selects the TRA measurement
`"CONF:SPEC:SWIT:LIM REL"` 'Selects relative measurement type
`"SWE:COUN 20"` 'Sets the number of bursts
`"READ:SPEC:SWIT:REF?"` 'Starts the reference measurement
`"INIT:IMM;*WAI"` 'Executes the overview measurement

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

CONFigure:SPECtrum:SWITching:TYPE

This command selects if the reference measurement uses the predefined peak hold method or if it uses the RMS method. In RMS mode the reference value is internally determined via the power versus time measurement (PVT). In that case further parameters like modulation type and trainings sequence must be set correctly. Otherwise SYNC NOT FOUND messages may occur.
This function is available since version 3.70.

Example:
`"INST MGSM"` 'Switches the instrument to GSM MS mode
`"CONF:SPEC:SWIT"` 'Selects the TRA measurement
`"CONF:SPEC:SWIT:LIM REL"` 'Selects relative measurement type
`"CONF:SPEC:SWIT:TYPE RMS"` 'Selects RMS mode
`"SWE:COUN 20"` 'Sets the number of bursts
`"READ:SPEC:SWIT:REF?"` 'Starts the reference measurement
`"INIT:IMM;*WAI"` 'Executes the overview measurement

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

CONFigure:SPURious Subsystem

This subsystem provides commands for configuring the measurements in the GSM/EDGE (R&S FS-K5) Analyzer mode used for measuring the power of spurious emissions (SPU).

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			Option R&S FS-K5
:SPURious			
[:IMMediate]	--	--	no query

CONFigure:SPURious[:IMMediate]

This command selects measurement of spurious emissions (SPU).

When the measurement is started the analyzer is automatically set to single sweep.
This command is only available in GSM/EDGE mode (R&S FS-K5)

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPUR"`	Selects the SPU measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"INIT:IMM;*WAI"`	Executes the overview measurement

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

This command is an event and is therefore not assigned a query and has no *RST value.

DISPlay Subsystem

DISPlay:FORMat   SINGle | SPLit

> ***Note :***   *This command is not available in GSM/EDGE mode. For GSM/EDGE mode, the display is always set to FULL SCREEN.*

DISPlay[:WINDow<1|2>]:SELect

> ***Note :***   *This command is not available in GSM/EDGE mode.*
> *In GSM/EDGE mode, the display is always set to FULL SCREEN, which corresponds to SCREEN A and thus to* `WINDow1. WINDow1` *is automatically selected when the GSM/EDGE mode is activated with command* `INSTrument:SELect:MGSM.`

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

> ***Note :***   *This command is not available in GSM/EDGE mode.*

FETCh Subsystem

The FETCh subsystem contains commands for reading out results of complex measurement tasks like those provided by the GSM/EDGE mode (R&S FS-K5). The FETCh subsystem is closely linked to the functions of the CONFigure and READ subsystems, where the measurement sequences are configured, the measurements are started and their results are queried.

FETCh:BURSt Subsystem

This subsystem provides the commands for reading out results of measurements in GSM/EDGE (option R&S FS-K5) Analyzer mode, which are performed on individual bursts without starting the measurement by themselves: Phase-Frequency Error (PFE), Modulation Accuracy (MAC), Power vs Time (PVT),

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			
:BURSt			
:FERRor			
:AVERage?	--	Hz	query only
:MAXimum?	--	Hz	query only
:IQIMbalance			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:IQOFfset			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:MACCuracy			
:FREQuency			
:AVERage?	--	Hz	query only
:MAXimum?	--	Hz	query only
:IQIMbalance			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:IQOFfset			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:OSUPpress			
:AVERage?	--	dB	query only
:MAXimum?	--	dB	query only
:PEAK			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:PERCentile			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:RMS			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:PERRor			
:RMS			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PEAK			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PTEMplate			
:REFerence?			query only
:ECONfigure			
[:IMMediate]?			query only
:TRGS			
:AVERage?	--	s	query only
:MAXimum?	--	s	query only
:MINimum?	--	s	query only

FETCh:BURSt:FERRor:AVERage?

This command reads out the average of the frequency error measurement taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:FERR:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:FERRor:MAXimum?

This command reads out the maximum of the frequency error measurement taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:FERR:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQIMbalance:AVERage?

This command reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:IQIM:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQIMbalance:MAXimum?

This command reads out the maximum of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:
`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
`"CONF:BURS:PFER"`	'Selects the PFE measurement
`"SWE:COUN 20"`	'Sets the number of bursts
`"INIT:IMM;*WAI"`	'Executes the measurement
`"FETC:BURS:IQIM:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQOFfset:AVERage?

This command reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:
`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
`"CONF:BURS:PFER"`	'Selects the PFE measurement
`"SWE:COUN 20"`	'Sets the number of bursts
`"INIT:IMM;*WAI"`	'Executes the measurement
`"FETC:BURS:IQOF:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:IQOFfset:MAXimum?

This command reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:
`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
`"CONF:BURS:PFER"`	'Selects the PFE measurement
`"SWE:COUN 20"`	'Sets the number of bursts
`"INIT:IMM;*WAI"`	'Executes the measurement
`"FETC:BURS:IQOF:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:FREQuency:AVERage?

This command reads out the average of the frequency error measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
                  `"CONF:BURS:MACC"`   'Selects the MAC measurement
                  `"SWE:COUN 20"`   'Sets the number of bursts
                  `"INIT:IMM;*WAI"`   'Starts the measurement
                  `"FETC:BURS:MACC:FREQ:AVER?"` Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:FREQuency:MAXimum?

This command reads out the maximum of the frequency error measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
                  `"CONF:BURS:MACC"`   'Selects the MAC measurement
                  `"SWE:COUN 20"`   'Sets the number of bursts
                  `"INIT:IMM;*WAI"`   'Starts the measurement
                  `"FETC:BURS:MACC:FREQ:MAX?"` 'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?

This command reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
                  `"CONF:BURS:MACC"`   'Selects the MAC measurement
                  `"SWE:COUN 20"`   'Sets the number of bursts
                  `"INIT:IMM;*WAI"`   'Starts the measurement
                  `"FETC:BURS:MACC:IQIM:AVER?"` 'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?

This command reads out the maximum of the IQ imbalance measurement in % taken over the
selected number of bursts..
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when
measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
              `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
              `"CONF:BURS:MACC"`   'Selects the MAC measurement
              `"SWE:COUN 20"`   'Sets the number of bursts
              `"INIT:IMM;*WAI"`   'Starts the measurement
              `"FETC:BURS:MACC:IQIM:MAX?"`   'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQOFfset:AVERage?

This command reads out the average of the IQ DC-Offset measurement in % taken over the
selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when
measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
              `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
              `"CONF:BURS:MACC"`   'Selects the MAC measurement
              `"SWE:COUN 20"`   'Sets the number of bursts
              `"INIT:IMM;*WAI"`   'Starts the measurement
              `"FETC:BURS:MACC:IQOF:AVER?"`   'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?

This command reads out the maximum of the IQ DC-Offset measurement in % taken over the
selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when
measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
              `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
              `"CONF:BURS:MACC"`   'Selects the MAC measurement
              `"SWE:COUN 20"`   'Sets the number of bursts
              `"INIT:IMM;*WAI"`   'Starts the measurement
              `"FETC:BURS:MACC:IQOF:MAX?"`   'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:OSUPpress:AVERage?

This command reads out the average of the original offset supression measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:OSUP:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:OSUPpress:MAXimum?

This command reads out the maximum of the original offset supression measurement taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:OSUP:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PEAK:AVERage?

This command reads out the average of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:PEAK:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PEAK:MAXimum?

This command reads out the maximum of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.

This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:PEAK:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PERCentile:AVERage?

This command reads out the average of the 95% percentile measurement taken over the selected number of bursts.

This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:PERC:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:PERCentile:MAXimum?

This command reads out the maximum of the 95% percentile measurement taken over the selected number of bursts.

This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Starts the measurement
	`"FETC:BURS:MACC:PERC:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:RMS:AVERage?

This command reads out the average of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                 `"CONF:MTYP EDGE"`   'Selects the modulation type EDGE (8PSK)
                 `"CONF:BURS:MACC"`   'Selects the MAC measurement
                 `"SWE:COUN 20"`   'Sets the number of bursts
                 `"INIT:IMM;*WAI"`   'Starts the measurement
                 `"FETC:BURS:MACC:RMS:AVER?"`   'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:MACCuracy:RMS:MAXimum?

This command reads out the maximum of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (see
`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                 `"CONF:MTYP EDGE"`   'Selects modulation type EDGE (8PSK)
                 `"CONF:BURS:MACC"`   'Selects the MAC measurement
                 `"SWE:COUN 20"`   'Sets the number of bursts
                 `"INIT:IMM;*WAI"`   'Starts the measurement
                 `"FETC:BURS:MACC:RMS:MAX?"`   'Queries the result

Characteristics: *RST value: --
                       SCPI: device-specific
If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:PEAK:AVERage?

This command reads out the average of the PEAK measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                 `"CONF:MTYP GMSK"`   'Selects the modulation type GMSK
                 `"CONF:BURS:PFER"`   'Selects the PFE measurement
                 `"SWE:COUN 20"`   'Sets the number of bursts
                 `"INIT:IMM;*WAI"`   'Executes the measurement
                 `"FETC:BURS:PERR:PEAK:AVER?"`   Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:PEAK:MAXimum?

This command reads out the maximum of the PEAK measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PERR:PEAK:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:RMS:AVERage?

This command reads out the average of the RMS measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulations type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurements
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PERR:RMS:AVER?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PERRor:RMS:MAXimum?

This command reads out the maximum of the RMS measurement of the phase error taken over the selected number of bursts.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurements
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PERR:RMS:MAX?"`	'Queries the result

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PTEMplate:REFerence?

This command reads out the results of the premeasurement of power vs. time (PVT). The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>
<Level1>:   measured level
<Level2>:   level corrected by means of the bandwidth
<RBW>:   bandwidth

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see `:CONFigure:BURSt:PTEMplate`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                       `"CONF:MTYP GMSK"`   'Selects the modulation type GMSK
                       `"CONF:BURS:PTEM"`   'Selects the PVT measurement
                       `"READ:BURS:PTEM:REF?"`   'Executes the premeasurement
                       `"FETC:BURS:PTEM:REF?"`   'Queries the result

Result: 43.2,43.2,1000000

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:BURSt:PTEMplate:REFerence:ECONfigure[:IMMediate]?

This command reads out the result of the pre-measurement of power vs time in the extended slot configuration mode.The result is output as a list of partial result strings for all active slots separated by ',' in the following (ASCII) format:

<slot number>,<Level1>,<Level2>,<RBW>,

<slot number>,<Level1>,<Level2>,<RBW>

<Level1>:   measured level

<Level2>:   level corrected by means of the bandwidth

<RBW>:   bandwidth

This command is only available in GSM/EDGE mode when measurement of the power vs. time is selected and the extended slot configuration mode.

Example: `"FETC:BURS:PTEM:REF:ECON?"`   'Read the result of the premeasurement

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

FETCh:BURSt:PTEMplate:TRGS:AVERage?

> This command reads out the average of the absolute time between external trigger and begin of the
> first symbol of the trainings sequence (midamble) in s over the selected number of bursts. (TRGS:
> <u>TR</u>i<u>G</u>ger to <u>S</u>tart symbol of midamble)
> This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the
> power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST
> (default) or TOP HIGH RESOLUTION must be selected.
> (see: `CONFigure:BURSt:PTEMplate:SELect`)
> The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PTEM:TRGS:AVER?"`	'Queries the result

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

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

FETCh:BURSt:PTEMplate:TRGS:MAXimum?

> This command reads out the maximum of the absolute time between external trigger and begin of
> the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
> (TRGS: <u>TR</u>i<u>G</u>ger to <u>S</u>tart symbol of midamble)
> This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the
> power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST
> (default) or TOP HIGH RESOLUTION must be selected.
> (see: `CONFigure:BURSt:PTEMplate:SELect`)
> The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PTEM:TRGS:MAX?"`	'Queries the result

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

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

FETCh:BURSt:PTEMplate:TRGS:MINimum?

This command reads out the minimum of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts. (TRGS: TRiGger to Start symbol of midamble)

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) and TIME MEAS HIGH RES must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect / TMHR`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"CONF:BURS:PTEM:TMHR ON"`	'Switches Time Meas High Resolution on
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"INIT:IMM;*WAI"`	'Executes the measurement
	`"FETC:BURS:PTEM:TRGS:MIN?"`	'Queries the result

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

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

FETCh:PTEMplate Subsystem

Note: *This subsystem has been included only for reasons of compatibility with FSE-K10.*
            It is replaced by the command `FETCh:BURSt:PTEMplate:REFerence?`*.*
            For a detailed description see command `FETCh:BURSt:PTEMplate:REFerence?`*.*

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			Option R&S FS-K5
:PTEMplate			
:REFerence?	--	--	query only

FETCh:SPECtrum Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM/EDGE (R&S FS-K5) mode, used to measure the power of the spectral contributions due to modulation and switching without first restarting a new measurement.
Spectrum due to modulation(MOD)
Spectrum due to transient (TRA)

COMMAND	PARAMETER	UNIT	COMMENT
FETCh			Option R&S FS-K5
:SPECtrum			
:MODulation			
[:ALL?]	ARFCn	--	query only
:REFerence?	--	--	query only
:SWITching			
[:ALL?]	--	--	query only

FETCh:SPECtrum:MODulation[:ALL]?   ARFCn

This command reads out the result of the measurement of the modulation spectrum of the mobile or base station.

Parameter: ARFCn::= ARFCN $\pm$ 1.8 MHz

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the parts between '[...]' denote a partial result string that can be repeated n times.

<Index>:   0,   if the partial result string characterizes a measurement range

                  current number <>0,
                        if the partial result string characterizes a single
                        limit excess.
<Freq1>:   Start frequency of the measurement range or
                  frequency where the limit line is exceeded
<Freq2>:   Start frequency of the measurement range or
                  frequency exceeding the measurement range. The value of
                  <Freq2> is equal to the value of <Freq1>, if either the
                  measurement is performed in the time domain or if the
                  partial result string contains a limit excess.
<Level>:   Measured maximum level of the partial range or

	measured level at the test point.
\<Limit\>:	Limit in the partial range or at the test point
\<Abs/Rel\>:	ABS \<Level\> and \<Limit\> are in absolute units (dBm)
	REL \<Level\> and \<Limit\> are in relative units (dB)
\<Status\>:	Result of the limit check in character data form:
	PASSED no limit exceeded
	FAILED limit exceeded
	MARGIN margin exceeded
	EXC limit excess marked as an exception

The frequencies \<Freq1\> and \<Freq2\> are always absolute, i. e. not referred to the carrier frequency.

This command is only available in GSM/EDGE mode (R&S FS-K5) and when modulation spectrum measurement is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:MOD"`	Selects the MOD measurement
	`"READ:SPEC:MOD:REF?"`	Executes the premeasurement and queries the result
	`"READ:SPEC:MOD?"`	Executes the measurement in the time domain and queries the result
	`"FETC:SPEC:MOD? ARFCn"`	Queries the result of the measurement in the time domain without starting a new measurement

Result:	`0,890E6,915E6,-87.4,-108.0,ABS,FAILED,`
	`1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,`
	`2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED`

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:SPECtrum:MODulation:REFerence?

This command reads out the results of the premeasurement of modulation due to spectrum measurement.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:
<Level1>,<Level2>,<RBW>

<Level1>:	measured level
<Level2>:	level corrected by means of the bandwidth
<RBW>:	bandwidth

This command is only available in GSM/EDGE mode (R&S FS-K5) and when the measurement of the modulation due to spectrum is selected (see :CONFigure:SPECtrum:MODulation).

Example:	"INST MGSM"	Switches the instrument to GSM/EDGE mode
	"CONF:SPEC:MOD"	Selects the MOD measurement
	"READ:SPEC:MOD:REF?"	Executes the premeasurement and queries the result
	"FETC:SPEC:MOD:REF?"	Queries the result of the premeasurement without starting a new measurement

Result:	35.2,43.2,30000

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

FETCh:SPECtrum:SWITching[:ALL]?

This command reads out the result of the measurement of the transient spectrum of the mobile or base station.

The result is output as a list of partial result strings separated by ',' as for the command
FETCh:SPECtrum:MODulation[:ALL]?.

This command is only available in GSM/EDGE mode (R&S FS-K5) and when modulation spectrum measurement is selected (see :CONFigure:SPECtrum:SWITching).

Example:	"INST MGSM"	Switches the instrument to GSM/EDGE mode
	"CONF:SPEC:SWIT"	Selects the TRA measurement
	"READ:SPEC:SWIT?"	Executes the measurement in the time domain and queries the result
	"FETC:SPEC:SWIT?"	Queries the result without starting a new measurement

Result:	0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,
	1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,
	2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED
	0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED

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

If no measurement has been performed yet, a query error results.
This command is an event and is therefore not assigned a query and has no *RST value.

INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers. The measurement windows are assigned to INSTrument1 (screen A) and INSTrument2 (screen B).

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument<1|2>			
[:SELect]	SANalyzer | MGSM		Option R&S FS-K5
:NSELect	1 | 5		Option R&S FS-K5

INSTrument<1|2>[:SELect] SANalyzer | MSGM

Parameter:	SANalyzer:	Spectrum analyzer mode
	MGSM:	GSM/EDGE analyzer for mobile and base station tests
Example:	`"INST SAN"`	Switches the instrument to spectrum analyzer mode
Characteristics:	*RST value:	SANalyzer
	SCPI:	conforming

Changeover to MGSM is only possible with firmware application GSM/EDGE (R&S FS-K5) installed.

Notes on GSM/EDGE mode:

- *After switchover to the GSM/EDGE mode, a measurement has to be selected by means of a CONFigure command.*

- *After switchover to the GSM/EDGE mode, the modulation mode (GMSK or EDGE) selected last is active.*

- *If the analyzer is set to external trigger on switchover to GSM/EDGE mode, the 'Extern' GSM trigger is used. If the Analyzer trigger source is 'RF POWER trigger' the GSM trigger 'RF POWER' is selected.*

- *When switching from GSM/EDGE mode to Analyzer mode, the GSM trigger setting is maintained, i.e. IF power if 'IF Power' was set before, RF power if 'RF Power' was set before and external trigger, if 'Extern' was set before.*

INSTrument<1|2>:NSELect 1 | 5

Parameter:	1:	Spectrum analyzer mode
	5:	GSM/EDGE analyzer for mobile and base station tests
Example:	`"INST:NSEL 1"`	Switches the instrument to spectrum analyzer mode.
Characteristics:	*RST value:	1
	SCPI:	conforming

Changeover to MGSM is only possible with firmware application GSM/EDGE (R&S FS-K5) installed.

For notes on GSM/EDGE mode see above.

READ Subsystem

The READ subsystem contains commands for starting complex measurement tasks such as those provided in the GSM/EDGE mode (FSE-K5), and for querying the results subsequently. The READ subsystem is closely linked to the functions of the CONFigure and FETCh subsystems, where the measurement sequences are configured or the results are queried without restarting a new measurement.

READ:AUTO - Subsystem

This subsystem contains commands for starting automatic measurement routines for the GSM/EDGE mode (R&S FS-K5). The analyzer will automatically being adjusted to the input signal.

COMMAND	PARAMETERS	UNIT	COMMENT
READ			Option R&S FS-K5
:AUTO			
:LEVTime?	--		query only

READ:AUTO:LEVTime?

This command starts a measurement sequence which automatically adjusts the level and trigger timing of the input signal to the analyzer. Preconditions are a correct setting of center frequency and a correct choice of the GSM trigger source to be utilised. (refer to command `TRIG:SEQ:SYNC:ADJ`; 0 sec should be used for the time between trigger and begin of slot)

The result is read out as a list of partial ASCII result strings separated by ',' in the following format:
<status>,<signal power>,<time from trigger to begin of slot>,<trigger level>,<reserved>

<status>:	status:	PASSED	measurement successful, result figures are valid
		FAILED	measurement failed, result figures are invalid
			error (e.g. no carrier) can be read out of the status reporting system
<signal power>	signal power	dBm	(reference level is automatically set 3 dB above the signal power)
<time trigger to virtual begin of slot>	s		correction value for the time offset between the currently active GSM trigger and beginning of the slot.
<trigger level>		dBm/V	trigger level of the currently active GSM trigger, for IF/RF the units are dBm, for external trigger the unit is Volts
<reserved>			always 0, for future use

After the automatic sequence a GSM measurement must be selected again with the command
`CONFigure`.
The premeasurement for power vs. time is executed implicitly within the sequence.
For modulation spectrum measurement the premeasurement must be executed again.
This command is only available in GSM/EDGE mode (R&S FS-K5).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	Selects modulation type GMSK
	`"FREQ:CENT 890.2E6"`	Sets the center frequency
	`"TRIG:SYNC:ADJ:EXT 0s"`	Selects GSM external triggerl
	`"READ:AUTO:LEVTime?"`	Executes the measurement and queries the result
	Result:	PASSED,8.3,6.15E-005,1.4,0

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt Subsystem

This subsystem provides the commands for starting measurements in the GSM/EDGE Analyzer mode (option R&S FS-K5), which are performed on individual bursts and for reading out the results subsequently:
Phase-Frequency Error (PFE), Modulation Accuracy (MAC), Power vs. Time (PVT)

COMMAND	PARAMETER	UNIT	COMMENT
READ			
:BURSt			
:FERRor			
:AVERage?	--	Hz	query only
:MAXimum?	--	Hz	query only
:IQIMbalance			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:IQOFfset			
:AVERage?	--	%	query only
:MAXimum?	--	%	query only
:MACCuracy			
:FREQuency			
:AVERage?		Hz	query only
:MAXimum?		Hz	query only
:IQIMbalance			
:AVERage?		%	query only
:MAXimum?		%	query only
:IQOFfset			
:AVERage?		%	query only
:MAXimum?		%	query only
:OSUPpress			
:AVERage?		dB	query only
:MAXimum?		dB	query only
:PEAK			
:AVERage?		%	query only
:MAXimum?		%	query only
:PERCentile			
:AVERage?		%	query only
:MAXimum?		%	query only
:RMS			
:AVERage?		%	query only
:MAXimum?		%	query only
:PERRor			
:RMS			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PEAK			
:AVERage?	--	deg	query only
:MAXimum?	--	deg	query only
:PTEMplate			
:REFerence			
:ECONfigure	--	--	
[:IMMediate?]			query only
[:IMMediate?]			query only
:TRGS			
:AVERage?	--	s	query only
:MAXimum?	--	s	query only
:MINimum?	--	s	query only
:REFerence			
[:IMMediate?]		--	query only

READ:BURSt:FERRor:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the measurement of the frequency error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:FERR:AVER?"`	'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:FERRor:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the measurement of the frequency error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:FERR:MAX?"`	'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQIMbalance:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                      `"CONF:MTYP GMSK"`   'Selects modulation type GMSK
                      `"CONF:BURS:PFER"`   'Selects the PFE measurement
                      `"SWE:COUN 20"`   'Sets the number of bursts
                      `"READ:BURS:IQIM:AVER?"`   'Executes the measurement and queries the
                                                  'result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQIMbalance:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ imbalance measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                      `"CONF:MTYP GMSK"`   'Selects modulation type GMSK
                      `"CONF:BURS:PFER"`   'Selects the PFE measurement
                      `"SWE:COUN 20"`   'Sets the number of bursts
                      `"READ:BURS:IQIM:MAX?"`   'Executes the measurement and queries the
                                                  'result

Characteristics: *RST value: --
                      SCPI: device-specific
This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQOFfset:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:IQOF:AVER?"`	'Executes the measurement and queries the 'result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:IQOFfset:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:IQOF:MAX?"`	'Executes the measurement and queries the 'result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:FREQuency:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the frequency error measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                     `"CONF:MTYP EDGE"`   Selects the modulation type EDGE (8PSK)
                     `"CONF:BURS:MACC"`   Selects the MAC measurement
                     `"SWE:COUN 20"`   Sets the number of bursts
                     `"READ:BURS:MACC:FREQ:AVER?"` Starts the measurement and reags out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:FREQuency:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the frequency error measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                     `"CONF:MTYP EDGE"`   'Selects the modulation type EDGE (8PSK)
                     `"CONF:BURS:MACC"`   'Selects the MAC measurement
                     `"SWE:COUN 20"`   'Sets the number of bursts
                     `"READ:BURS:MACC:FREQ:MAX?"` 'Starts the measurement and reads out the result.

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQIMbalance:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
               `"CONF:MTYP EDGE"`   'Selects the modulation type EDGE (8PSK)
               `"CONF:BURS:MACC"`   'Selects the MAC measurement
               `"SWE:COUN 20"`   'Sets the number of bursts
               `"READ:BURS:MACC:IQIM:AVER?"` 'Starts the measurement and reags out
                                             'the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQIMbalance:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
               `"CONF:MTYP EDGE"`   'Selects the modulation type EDGE (8PSK)
               `"CONF:BURS:MACC"`   'Selects the MAC measurement
               `"SWE:COUN 20"`   'Sets the number of bursts
               `"READ:BURS:MACC:IQIM:MAX?"` 'Starts the measurement and reads out
                                            'the result.

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQOFfset:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:IQOF:AVER?"`	'Starts the measurement and reags out
		'the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:IQOFfset:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the IQ DC-Offset measurement in % taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:IQOF:MAX?"`	'Starts the measurement and reads out
		'the result.

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:OSUPpress:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the original offset suppression measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	Sets the number of bursts
	`"READ:BURS:MACC:OSUP:AVER?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:OSUPpress:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the original offset suppression measurement taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:OSUP:MAX?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PEAK:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode	`"INST MGSM"`	'Switches the instrument to GSM/EDGE
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:PEAK:AVER?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PEAK:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the PEAK-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example: mode	`"INST MGSM"`	'Switches the instrument to GSM/EDGE
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:PEAK:MAX?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PERCentile:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the 95% percentile measurement taken over the selected number of bursts. When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:PERC:AVER?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:PERCentile:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the 95% percentile measurement taken over the selected number of bursts. When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:PERC:MAX?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:RMS:AVERage?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the average of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected (`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:RMS:AVER?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:MACCuracy:RMS:MAXimum?

This command starts the measurement of the modulation accuracy of the base station or mobile and reads out the maximum of the RMS-measurement of the error vector magnitude taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the modulation accuracy measurement can be then queried without restart of the measurement via the `:FETCh:BURSt`-subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available with GSM/EDGE Analyzer (option R&S FS-K5) and when measurement of the modulation accuracy is selected
(`CONFigure:BURSt:MACCuracy[:IMMediate]`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP EDGE"`	'Selects the modulation type EDGE (8PSK)
	`"CONF:BURS:MACC"`	'Selects the MAC measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:MACC:RMS:MAX?"`	'Starts the measurement and reads out the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:PEAK:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the PEAK measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PERR:PEAK:AVER?"`	'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:PEAK:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the PEAK-measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer automatically is set to single sweep.
Further results of the PFE measurement can be then queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PERR:PEAK:MAX?"`	
		'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:RMS:AVERage?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the average of the RMS measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects modulation type GMSK
	`"CONF:BURS:PFER"`	'Selects the PFE measurement
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PERR:RMS:AVER?"`	
		'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PERRor:RMS:MAXimum?

This command starts the measurement of the phase and frequency error (PFE) of the base station or mobile and reads out the maximum of the RMS measurement of the phase error taken over the selected number of bursts.
When the measurement is started the analyzer is automatically set to single sweep.
Further results of the PFE measurement can then be queried without restart of the measurement via the `:FETCh:BURSt` subsystem.
An ongoing measurement can be aborted via the command `ABORt`.

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the phase/frequency error is selected (see `:CONFigure:BURSt:PFERror`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP GMSK"`   'Selects modulation type GMSK
                  `"CONF:BURS:PFER"`   'Selects the PFE measurement
                  `"SWE:COUN 20"`   'Sets the number of bursts
                  `"READ:BURS:PERR:RMS:MAX?"`   'Executes the measurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PTEMplate:REFerence:ECONfigure[:IMMediate]?

This command start the pre-measurement of power vs time and reads out the result in the extended slot configuration mode .The result is output as a list of partial result strings for all active slots separated by ',' in the following (ASCII) format:

<slot number>,<Level1>,<Level2>,<RBW>,

<slot number>,<Level1>,<Level2>,<RBW>

<Level1>:   measured level
<Level2>:   level corrected by means of the bandwidth
<RBW>:   bandwidth

This command is only available in GSM/EDGE mode when measurement of the power vs. time is selected and the extended slot configuration mode.

Example: `"READ:BURSt:PTEM:REF:ECON?"` 'read the result

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

READ:BURSt:PTEMplate:REFerence[:IMMediate]?

This command starts the premeasurement of power vs. time and reads out the results.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>:   measured level

<Level2>:   level corrected by means of the bandwidth

<RBW>:   bandwidth

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see `:CONFigure:BURSt:PTEMplate`).

Example: `"INST MGSM"`   'Switches the instrument to GSM/EDGE mode
                  `"CONF:MTYP GMSK"`   'Selects modulation type GMSK
                  `"CONF:BURS:PTEM"`   'Selects the PVT measurement
                  `"READ:BURS:PTEM:REF?"`   'Executes the measurement and queries the result
                  Result: 43.2,43.2,600000

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:BURSt:PTEMplate:TRGS:AVERage?

This command starts the measurement of Power vs Time (PVT) of the base station or mobile and reads out the average of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
(TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'Select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PTEM:TRGS:AVER?"`	'Executes the measurement and queries the result

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

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

READ:BURSt:PTEMplate:TRGS:MAXimum?

This command starts the measurement of Power vs Time (PVT) of the base station or mobile and reads out the maximum of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
(TRGS: TRiGger to Start symbol of midamble)
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) or TOP HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'Select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PTEM:TRGS:MAX?"`	'Executes the measurement and queries the result

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

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

READ:BURSt:PTEMplate:TRGS:MINimum?

This command starts the measurement of Power vs Time (PVT) of the base station or mobile and reads out the minimum of the absolute time between external trigger and begin of the first symbol of the trainings sequence (midamble) in s over the selected number of bursts.
(TRGS: <u>TR</u>i<u>G</u>ger to <u>S</u>tart symbol of midamble)
This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see: `CONFigure:BURSt:PTEMplate`). In addition FULL BURST (default) and TIME MEAS HIGH RESOLUTION must be selected.
(see: `CONFigure:BURSt:PTEMplate:SELect / TMHR`)
The GSM Trigger must be set to extern. (see: `TRIG:SEQ:SYN:ADJ:EXT`)

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"TRIG:SEQ:SYNC:ADJ:EXT 0S"`	'Select GSM Trigger extern
	`"CONF:BURS:PTEM"`	'Selects power vs. time (PVT)
	`"CONF:BURS:PTEM:TMHR ON"`	'Switches Time Meas High Resolution on
	`"SWE:COUN 20"`	'Sets the number of bursts
	`"READ:BURS:PTEM:TRGS:MIN?"`	'Executes the measurement and queries the result

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

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

READ:BURSt:REFerence[:IMMediate]?

This command starts the premeasurement of power vs. time and returns the measured level in dBm.

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the power vs. time is selected (see :`CONFigure:BURSt:PTEMplate`).

Note:
This command has been included only for reasons of compatibility with FSE-K10.
Instead of this command, the command `READ:BURSt:PTEMplate:REFerence[IMMediate]?`
should be used, whose output format conforms to that of the premeasurement query commands.
For a detailed description see command `READ:BURSt:PTEMplate:REFerence [IMMediate]?.*

Example:	`"INST MGSM"`	'Switches the instrument to GSM/EDGE mode
	`"CONF:MTYP GMSK"`	'Selects the modulation type GMSK
	`"CONF:BURS:PTEM"`	'Selects the PVT measurement
	`"READ:BURS:REF?"`	'Executes the premeasurement and queries the result

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum Subsystem

This subsystem provides the commands for starting measurements in the GSM/EDGE mode (R&S FS-K5), which are used to measure the power of the spectral components due to modulation and switching, and for reading out the results subsequently.
Measurement of spectrum due to modulation (MOD)
Measurement of spectrum due to transients (TRA)

COMMAND	PARAMETER	UNIT	COMMENT
READ			Option R&S FS-K5
:SPECtrum			
:MODulation			
[:ALL?]	--	--	query only
:REFerence			
[:IMMediate?]	--	--	query only
:SWITching			
[:ALL?]	--	--	query only
:REFerence			
[:IMMediate?]			

READ:SPECtrum:MODulation[:ALL]?

This command starts the measurement of the modulation spectrum of the base station or mobile and reads out the result. The measurement is performed in the frequency range ARFCN $\pm$ 1.8 MHz.

The result is read out as a list of partial ASCII result strings separated by ',' in the following format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the part set in '[...]' characterizes a partial result string which can be repeated n times.

<Index>:   0,   if the partial result string characterizes a
                                measurement range.
                    current number <>0,
                                if the partial result string characterizes a
                                single limit excess.
<Freq1>:   Start frequency of the measurement range or frequency where
                    the limit is exceeded.
 <Freq2>:   Stop frequency of the measurement range or frequency where
                    the measured range is exceeded. The value of <Freq2> is
                    equal to the value of <Freq1>, if either the measurement is
                    performed in the time domain or the partial result string contains
                    a limit excess.
<Level>:   Measured maximum level of the partial range or measured level
                    at the test point.
<Limit>:   Limit in the partial range or at the test point.
<Abs/Rel>:   ABS <Level> and <Limit> are in absolute units (dBm)
                    REL <Level> and <Limit> are in relative units (dB)
<Status>:   Result of the limit check in character data form:
                    PASSED no limit exceeded
                    FAILED   limit exceeded
                    MARGIN margin exceeded
                    EXC   limited excess characterized as an exception

The frequencies <Freq1> and <Freq2> are always absolute and not referred to the carrier frequency.

An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE mode (R&S FS-K5) option and when modulation spectrum measurement is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:MOD"`	Selects the MOD measurement
	`"READ:SPEC:MOD:REF?"`	Executes the premeasurement and queries the result.
	`"READ:SPEC:MOD?"`	Executes the measurement in the time domain and queries the result.

Result:	`0,890E6,915E6,-87.4,-108.0,ABS,FAILED,`
	`1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,`
	`2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED`

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

Mode:	GSM/EDGE

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:MODulation:REFerence[:IMMediate]?

This command starts the premeasurement of the modulation due to spectrum measurement and reads out the result.

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>:	measured level
<Level2>:	level corrected by means of the bandwidth
<RBW>:	bandwidth

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the modulation due to spectrum is selected (see `:CONFigure:SPECtrum:MODulation`).

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:MOD"`	Selects the MOD measurement
	`"READ:SPEC:MOD:REF?"`	Executes the premeasurement and queries the result.

Result:	35.2,43.2,30000

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

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:SWITching[:ALL]?

This command starts the measurement of the transient spectrum of the mobile or base station and reads out the result.

The result is read out as a list of partial ASCII result strings separated by ',' in the format used for `READ:SPECtrum:MODulation[:ALL]?`

An ongoing measurement can be aborted via the command `ABORt`.
This command is only available in GSM/EDGE Analyzer mode (R&S FS-K5) and when the spectrum due to switching measurement is selected (see `:CONFigure:SPECtrum:SWITCHing`)

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"CONF:SPEC:SWIT"`	Selects the TRA measurement
	`"READ:SPEC:SWIT?"`	Executes the measurement in the time domain and queries the result.
Result:	`0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,`	
	`1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,`	
	`2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED`	
	`0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED`	
Characteristics:	*RST value: --	
	SCPI: device-specific	

This command is an event and is therefore not assigned a query and has no *RST value.

READ:SPECtrum:SWITching:REFerence[:IMMediate]?

This command starts the premeasurement of the modulation due to switching transients (TRA) measurement and reads out the result.

This premeasurement is only necessary if the limit type is relative.
(See command `CONF:SPEC:SWIT:LIM`)

The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>:	measured level
<Level2>:	level corrected by means of the bandwidth (RBW is fix 300 kHz, therfore identical to the measured level.)
<RBW>:	bandwidth, fix 300 kHz

This command is only available in GSM/EDGE mode (R&S FS-K5) and when measurement of the modulation due to swithcing transients is selected (see `:CONFigure:SPECtrum:SWITching`).

Example:	`"INST MGSM"`	'Switches the instrument to GSM MS mode
	`"CONF:SPEC:SWIT"`	'Selects the TRA measurement
	`"CONF:SPEC:SWIT:LIM REL"`	'Selects relative mode
	`"SWE:COUN 20"`	'Selects number of bursts
	`"READ:SPEC:SWIT:REF?"`	'Executes the premeasurement and queries 'the result.
Result:	`43.2,43.2,300000`	
Characteristics:	*RST value: --	
	SCPI: device-specific	

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

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.

SENSe:BANDwidth Subsystem

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

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT. The bandwidth is automatically set according to standard GSM.*

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO <numeric_value>

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution]:TYPE NORMal | FFT | CFILter | RRC

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW.*

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo 1Hz...10MHz

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

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

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

[SENSe<1|2>:]BANDwidth|BWIDth:VIDeo:RATio 0.01...1000

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT.*

SENSe:CORRection Subsystem

Note :   *The commands of this subsystem are not available in GSM/EDGE mode.*

SENSe:DETector Subsystem

Note :   *Detectors APEAK and QPEak are not available for GSM/EDGE measurements MAC, PFE and PVT.*

SENSe:FREQuency Subsystem

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK SPAN | RBW | OFF

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT*

[SENSe<1|2>:]FREQuency:CENTer:STEP:LINK:FACTor 1 ... 100 PCT

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE and PVT*

[SENSe<1|2>:]FREQuency:SPAN $0 .. f_{max}$

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:SPAN:FULL

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:STARt $0 .. f_{max}$

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:STOP $0 .. f_{max}$

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]FREQuency:MODE CW | FIXed | SWEep

> *Note:*   *This command is not available for GSM/EDGE measurements MAC, PFE, PVT, CPW and SPU*

SENSe:LIST Subsystem

> *Note:*   *The commands of this subsystem are not available for GSM/EDGE measurements MAC, PFE and PVT*

SENSe:MPOWer Subsystem

Note: *The commands of this subsystem are not available for GSM/EDGE measurements MAC, PFE and PVT*

SENSe:POWer Subsystem

Note :   *The commands of this subsystem are not available in GSM/EDGE mode.*

SENSe:SWEep Subsystem

[SENSe<1|2>:]SWEep:TIME   2.5 ms to 16000 s (frequency domain) | 1 μs to 16000 s (time domain)

    Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

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

    Note: *This command is not available for GSM/EDGE measurements MAC, PFE, PVT and CPW*

[SENSe<1|2>:]SWEep:EGATe...

    Note: *The commands of this node are not available for GSM/EDGE measurements MAC, PFE, PVT, CPW, TRA and SPU.*

STATus Subsystem

The STATus subsystem contains the commands for the status reporting system. *RST does not influence the status registers. The STATus:QUEStionable:SYNC register comprises information about sync and burst events (see below).

STATus:QUEStionable:SYNC[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:SYNC register. Readout deletes the contents of the EVENt section.

Example: `"STAT:QUES?"`

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

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register. Readout does not delete the contents of the CONDition section.

Example: `"STAT:QUES:COND?"`

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

STATus:QUEStionable:SYNC:ENABle   0 to 65535

This command sets the bits of the ENABle section of the STATus:QUEStionable: SYNC register. The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

Example: `"STAT:QUES:ENAB 65535"`

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

Modes: all

STATus:QUEStionable:SYNC:PTRansition   0 to 65535

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 0 to 1 for the transitions of the CONDition bit.

Example: `"STAT:QUES:PTR 65535"`

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

STATus:QUEStionable:SYNC:NTRansition   0 to 65535

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 1 to 0 for the transitions of the CONDition bit.

Example: `"STAT:QUES:NTR 65535"`

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

General Trace Commands

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>.

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

Characteristics: *RST value: -
                    SCPI: conforming

Return values:

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

The returned values are scaled in the current level unit. In ASCII format, a list of values separated by commas is returned (Comma Separated Values = CSV). The number of measurement points is 501 for R&S FSP, 625 for R&S FSU/FSQ.

If the transmission takes place using the 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 return string:

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

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

    with

#	Head marker of binary data stream
4	ASCII byte stating the length of the subsequent lengthcounter, here 4
2004/2500	Number of data bytes, here 2004 (FSP) / 2500 (FSU/FSQ)
<meas value x>	4 byte floating point measurement values

Saving and recalling:

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 (ASCCII FILE EXPORT) are exported with the command "`MMEM:STORe:TRACe`".

Transfer format:

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

SPECTRUM mode (span > 0 and zero span):

501 (FSP)/ 625 (FSU/FSQ) results are output in the unit selected for display.

Note: *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.

GSM/EDGE Analyzer:

In power vs. time (PVT) measurement in the FULL BURST or TOP HIGH RESOL mode the number of results depends on the number of active slots (from the multislot command CONF:CHAN:SLOT:MULT) and it depends also on the points per symbol rate (from command CONF:CHAN:PRAT).

	4 points per symbol	8 points per symbol
1 active slot	868 results	1736 results
2 active slots	1492 results	2984 results
3 active slots	2116 results	4232 results
4 active slots	2740 results	5480 results
8 active slots	5240 results	10480 results

With firmware version V2.60/3.60 the precision of the multislot samples and limit checking is enhanced. Therfore the amount of samples for a PVT trace has changed as follows

	4 points per symbol	8 points per symbol
1 active slot	868 results unchainged	1736 results unchainged
2 active slots	1492 results unchainged	2984 results unchainged
3 active slots	2120 results	4240 results
4 active slots	2744 results	5488 results
8 active slots	5244 results	10488 results

In phase-frequency error (PFE) measurement the number of results depends on the points per symbol rate (from command CONF:CHAN:PRAT).

4 points per symbol	8 points per symbol
588 results	1176 results

In error vector magnitude (MAC) measurement the number of results depends on the points per symbol rate (from command CONF:CHAN:PRAT).

4 points per symbol	8 points per Symbol
568 results	1136 results

The other GSM measurements traces are of the length as in standard SPECTRUM mode. This is also valid for the PVT measurement in FALLING, RISING and FALL/RISE ZOOM mode.

TRACe:IQ Subsystem

Note : *The commands of this subsystem are not available in GSM/EDGE mode.*

TRIGger Subsystem

Notes: - *When entering the option GSM/EDGE Analyzer (with `INST:SEL MGSM`), the following GSM Trigger selection is made:*
If the Analyzer trigger source is 'IF POWER trigger' the GSM trigger 'IF POWER' is selected.
If the Analyzer trigger source is 'Extern trigger' the GSM trigger 'Extern' is selected.
If the Analyzer trigger source is 'RF POWER trigger' the GSM trigger 'RF POWER' is selected.
Otherwise the (default) GSM Trigger' 'IF POWER' is selected.

- *When switching from GSM/EDGE mode to Analyzer mode, the GSM/EDGE trigger setting is maintained, i.e. IF power if 'IF Power' was set before, RF power if 'RF Power' was set before and external trigger, if 'Extern' was set before.*

COMMAND	PARAMETER	UNIT	COMMENT
TRIGger<1|2>			
[:SEQuence]			
:SOURce	IMMediate | EXTernal | VIDeo | IFPower		
:SYNChronize			Option R&S FS-K5
:ADJust			
:EXTernal	<numeric_value>	s	
:IFPower	<numeric_value>	s	
:IMMediate			
:RFPower	<numeric_value>	s	Option FSP-B6

TRIGger<1|2>[:SEQuence]:SOURce IMMediate | EXTernal | VIDeo | IFPower

Note : *This command is not available in GSM/EDGE mode. The trigger source is selected with commands `TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:....`*

TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal -460µs...8s

This command is a combination of 2 commands:

For one, the 'Extern' GSM trigger is selected. For all GSM measurements requiring a trigger signal and for which an external trigger is possible, the EXTernal trigger setting is used. If an external trigger is not possible, the IMMediate trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)

For another, the correction value for the time offset of the external trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.

This command is available only if GSM/EDGE Analyzer (R&S FS-K5) application firmware is installed.

Example: "INST MGSM"   Switches the instrument to GSM/EDGE mode
              "TRIG:SYNC:ADJ:EXT 200us" Selects 'Extern' GSM trigger and a GSM trigger offset of 200 µs between the external trigger and the beginning of the slot.

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

TRIGger[:SEQuence]:SYNChronize:ADJust:IMMediate

This command selects the FREE RUN GSM trigger. The FREE RUN trigger is very useful in conjunction with R&S FSQ base band inputs if no external trigger is available and IF power triggering is not possible because of unbursted signals.

Note: Please be aware that some triggering is necessary for most of the GSM measurements. If FREE RUN is used e.g. the CPW measurement does not any longer deliver useful results. IQ measurements (PVT, PFE & MAC) are working without a problem because of burst and/or sync search.

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"TRIG:SYNC:ADJ:IMM"`	Selects 'Free Run' GSM trigger
Characteristics:	*RST value: -	
	SCPI: device-specific	

TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower -460µs...8s

This command is a combination of 2 commands:
For one, the 'IF Power' GSM trigger is selected. For all GSM measurements for which an IF power trigger is possible, the `IFPower` trigger setting is used. If an IF power trigger is not possible, the `IMMediate` trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)
For another, the correction value for the time offset of the IF power trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.
This command is available only if GSM/EDGE Analyzer application firmware (R&S FS-K5) is installed.

Example:	`"INST MGSM"`	Switches the instrument to GSM/EDGE mode
	`"TRIG:SYNC:ADJ:IFP 20us"`	Selects 'IF Power' GSM trigger and a GSM trigger offset of 20 µs between the IF power trigger and the beginning of the slot
Characteristics:	*RST value: 0s	
	SCPI: device-specific	
Mode:	GSM/EDGE	

TRIGger[:SEQuence]:SYNChronize:ADJust:RFPower -460µs...8s

This command is a combination of 2 commands:
For one, the 'RF Power' GSM trigger is selected. For all GSM measurements for which an RF power trigger is possible, the `RFPower` trigger setting is used. If an RF power trigger is not possible, the `IMMediate` trigger setting is used (see table of triggers in section "Trigger and Time References" in Chapter 1.)
For another, the correction value for the time offset of the RF power trigger from the beginning of the first active slot is defined (GSM trigger offset, see section "Trigger and Time References" in Chapter 1).
This correction value is needed in order to establish an exact time reference between the trigger event and the beginning of the slot if there is no midamble triggering. The correction value for the DUT in question can be determined in the *GENERAL SETTINGS* menu with the *TRIGGER OFFSET* softkey.
This command is available only if GSM/EDGE Analyzer application firmware (R&S FS-K5) is installed and if the option FSP-B6 (TV- and RF-Trigger) is available.

| **Example:** | `"INST MGSM"` | Switches the instrument to GSM/EDGE mode |
| | `"TRIG:SYNC:ADJ:RFP 20us"` | Selects 'RF Power' GSM trigger and a GSM trigger offset of 20 µs between the RF power trigger and the beginning of the slot |

Characteristics: *RST value: 0s
                  SCPI: device-specific
Mode: GSM/EDGE

UNIT Subsystem

UNIT<1|2>:POWer DBM | DBPW | WATT | DBUV | DBMV | VOLT | DBUA | AMPere | V | A | W

Note: *This command is not available in GSM/EDGE mode. In GSM/EDGE mode, the unit is fixed, i.e. dBm (for power measurements) or deg (for phase error measurements).*

Table of Softkeys and Hotkeys with IEC/IEEE-Bus Command Assignment

Hotkey GSM/EDGE

```
┌──────────┐
│ GSM/EDGE │
└──────────┘
```

```
┌──────────┐
│ GENERAL  │
│ SETTINGS │
└──────────┘
```

```
    ┌──────────┐
    │ REF LEVEL│          DISPlay[:WINDow<1>]:TRACe<1 to 3>:Y[:SCALe]:RLEVel   -130dBm to 30dBm
    └──────────┘
```

```
    ┌──────────┐
    │ EXTERNAL │          DISPlay[:WINDow<1>]:TRACe<1 to 3>:Y[:SCALe]:RLEVel:OFFSet <num_value>
    │  ATTEN   │
    └──────────┘
```

```
    ┌──────────┐
    │   AUTO   │          READ:AUTO:LEVTime?
    │LEVEL&TIME│
    └──────────┘
```

```
    ┌──────────┐
    │ TRIGGER  │          --  (for remote control, the GSM trigger offset has to be set with commands
    │  OFFSET  │              TRIGger[:SEQuence]:SYNChronize:ADJust:...)
    └──────────┘
```

```
    ┌──────────┐
    │ TRIGGER  │          INSTrument[:SELect] MGSM
    │ FREE RUN │          TRIGger[:SEQuence]:SYNChronize:ADJust:IMMediate
    └──────────┘
```

```
    ┌──────────┐
    │ TRIGGER  │          INSTrument[:SELect] MGSM
    │  EXTERN  │          TRIGger[:SEQuence]:SYNChronize:ADJust:EXTernal -460µs to 8s
    └──────────┘
```

```
    ┌──────────┐
    │ TRIGGER  │          INSTrument[:SELect] MGSM
    │ IF POWER │          TRIGger[:SEQuence]:SYNChronize:ADJust:IFPower  -460µs to 8s
    └──────────┘
```

```
    ┌──────────┐
    │ TRIGGER  │          INSTrument[:SELect] MGSM
    │ RF POWER │          TRIGger[:SEQuence]:SYNChronize:ADJust:RFPower  -460µs to 8s
    └──────────┘          (with option FSP-B6 only)
```

```
    ┌──────────┐
    │  NO. OF  │          [SENSe<1>:]SWEep:COUNt  0 to 32767
    │  BURSTS  │
    └──────────┘
```

```
    ┌──────────┐
    │IF/RF RWR │             TRIGger1:SEQuence:SYNChronize:IQPower 0 | 1
    │AS IQ TRIG│
    └──────────┘
```

```
┌──────────┐
│  DEMOD   │
│ SETTINGS │
└──────────┘
```

```
    ┌──────────┐
    │  SELECT  │          INSTrument[:SELect] MGSM
    │ MIDAMBLE │          CONFigure:CHANnel:TSC  0 to 7 | USER
    └──────────┘
```

```
    ┌──────────┐
    │ SET USER │          INSTrument[:SELect] MGSM
    │ MIDAMBLE │          CONFigure:CHANnel:TSC:USER <string>
    └──────────┘
```

```
    ┌──────────┐
    │BURST FIND│          INSTrument[:SELect] MGSM
    └──────────┘          CONFigure:BSEarch ON | OFF
```

```
    ┌──────────┐
    │ SYNC FIND│          INSTrument[:SELect] MGSM
    └──────────┘          CONFigure:SSEarch ON | OFF
```

MULTISLOT	CONFigure:CHANnel:SLOT:MULTi ACT1SYNC1 | ACT2SYNC1 | ACT2SYNC2 | ACT3SYNC1 | ACT3SYNC2 | ACT3SYNC3 | ACT4SYNC1 | ACT4SYNC2 | ACT4SYNC3 | ACT4SYNC4 | ACT8SYNC1 | ACT8SYNC2 | ACT8SYNC3 | ACT8SYNC4 | ACT8SYNC5 | ACT8SYNC6 | ACT8SYNC7 | ACT8SYNC8
AUTO LEVEL&TIME	READ:AUTO:LEVTime?
POINT/SYMB 4 8	CONFigure:PRATe 4 | 8
MODULATION GMSK EDGE	CONFigure:MTYPe GMSK | EDGE
MULTI CARRIER	CONFigure:MCARrier ON | OFF
STANDARD – (DYNAMIC)	CONFigure[:MS]:ECONfigure:STANdard:SELect DYNAMIC | GSM900 | GSM1800 | GSM1900
EXT CONF ON OFF	CONFigure[:MS]:ECONfigure[:STATe] ON | OFF
EXT CONF TABLE	CONFigure[:MS]:ECONfigure:LSLot[:STATe] <Boolean> CONFigure[:MS]:ECONfigure:LSLot:VALue <numeric_value>,<numeric_value> CONFigure[:MS]:ECONfigure:MREFerence <numeric_value> CONFigure[:MS]:ECONfigure:OFRame <Boolean> CONFigure[:MS]:ECONfigure:TREFerence <numeric_value> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:MODulation GMSK | EDGE | OFF CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:RLEVel:MODE AUTO | ABS | REL | <numeric_value> <numeric_value> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:RLEVel:VALue CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:ABSolute <numeric_value> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:ABSolute[:STATe] CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:ABSolute:BASE<1|2> <string> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:CLEVel <string> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:LOWer <string> CONFigure[:MS]:ECONfigure:SLOT<num {0-7}>:LIMit:UPPer <string>
BURST FIND THRESHOLD	CONFigure:BSTHreshold <numeric_value>

MODULATION ACCURACY	INSTrument[:SELect] MGSM CONFigure:MTYPe EDGE CONFigure:BURSt:MACCuracy[:IMMediate] SWEep:COUNt \<num_value> INITiate:IMMediate; *WAI

Query of result:
```
FETCh:BURSt:MACCuracy:RMS:AVERage?
FETCh:BURSt:MACCuracy:RMS:MAXimum?
FETCh:BURSt:MACCuracy:PEAK:AVERage?
FETCh:BURSt:MACCuracy:PEAK:MAXimum?
FETCh:BURSt:MACCuracy:OSUPress:AVERage?
FETCh:BURSt:MACCuracy:OSUPress:MAXimum?
FETCh:BURSt:MACCuracy:PERCentile:AVERage?
FETCh:BURSt:MACCuracy:PERCentile:MAXimum?
FETCh:BURSt:MACCuracy:FREQuency:AVERage?
FETCh:BURSt:MACCuracy:FREQuency:MAXimum?
FETCh:BURSt:MACCuracy:IQOFfset:AVERage?
FETCh:BURSt:MACCuracy:IQOFfset:MAXimum?
FETCh:BURSt:MACCuracy:IQIMbalance:AVERage?
FETCh:BURSt:MACCuracy:IQIMbalance:MAXimum?
```

PHASE/FREQ ERROR	INSTrument[:SELect] MGSM CONFigure:MTYPe GMSK CONFigure:BURSt:PFERror[:IMMediate] SWEep:COUNt \<num_value> INITiate:IMMediate; *WAI

Query of result:
```
FETCh:BURSt:PERRor:RMS:AVERage?
FETCh:BURSt:PERRor:RMS:MAXimum?
FETCh:BURSt:PERRor:PEAK:AVERage?
FETCh:BURSt:PERRor:PEAK:MAXimum?
FETCh:BURSt:FERRor:AVERage?
FETCh:BURSt:FERRor:MAXimum?
FETCh:BURSt:IQOFfset:AVERage?
FETCh:BURSt:IQOFfset:MAXimum?
FETCh:BURSt:IQIMbalance:AVERage?
FETCh:BURSt:IQIMbalance:MAXimum?
```

CARRIER POWER	INSTrument[:SELect] MGSM CONFigure:MTYPe GMSK | EDGE CONFigure:BURSt:POWer[:IMMediate] SWEep:COUNt \<num_value> INITiate:IMMediate; *WAI

Query of result:
```
CALCulate:MARKer:FUNCtion:SUMMary:MEAN:RESult?
CALCulate1:LIMit1:NAME 'CPWU_G' | 'CPWU_E'
CALCulate1:LIMit2:NAME 'CPWL_G' | 'CPWU_E'
CALCulate1:LIMit1:FAIL?
CALCulate1:LIMit2:FAIL?
```

POWER VS TIME	INSTrument[:SELect] MGSM CONFigure:MTYPe GMSK | EDGE CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect FULL SWEep:COUNt <num_value> READ:BURSt:PTEMplate:REFerence[:IMMediate]? (premeasurement) INITiate:IMMediate; *WAI

Query of result:
       FETCh:BURSt:PTEMplate:TRGS:AVERage?
       FETCh:BURSt:PTEMplate:TRGS:MAXimum?
       CALCulate1:LIMit1:NAME 'PVTU_G' \| 'PVTU_E'
       CALCulate1:LIMit2:NAME 'PVTL_G' \| 'PVTL_E'
       CALCulate1:LIMit1:FAIL?
       CALCulate1:LIMit2:FAIL?

Notes: - *For setting* CONFigure:BURSt:PTEMplate:SELect FULL *and* TOP, *the carrier power (CPW) can be queried via command*
        CALCulate:MARKer:FUNCtion:SUMMary:MEAN:RESult?
     - *In the case of multislot measurements, a digit is appended to the name of the limit line to indicate the number of active slots., e.g.. PVT_E4. In Access Burst Mode _AB must be added..*

FULL BURST	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect FULL
RISING EDGE	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect RISing
FALLING EDGE	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect FALLing
TOP HIGH RESOL	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect TOP
FALL/RISE ZOOM	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:CHANnel:SLOT:MULTi ACT3sync1 CONFigure:BURSt:PTEMplate:SELect FRZoom CONFigure:BURSt:PTEMplate:FRZoom 2
TIME MEAS HIGH RESOL	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:SELect FULL TRIGger1:SYNChronize:ADJust:EXTernal 100us CONFigure:BURSt:PTEMplate:TMHRes ON
FILTER BW 500K 600K	INSTrument[:SELect] MGSM CONFigure:BURSt:PTEMplate[:IMMediate] CONFigure:BURSt:PTEMplate:FILTer G500
START REF MEAS	INSTrument[:SELect] MGSM CONFigure:MTYPe GMSK | EDGE CONFigure:BURSt:PTEMplate[:IMMediate] READ:BURSt:PTEMplate:REFerence[:IMMediate]?

Query of result is included in READ command

MODULATION SPECTRUM	

```
FREQUENCY
  SWEEP
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:MODulation:REFerence[:IMMediate]? (premeasurement)
INITiate:IMMediate; *WAI
```

Query of result:
```
        CALCulate1:LIMit1:NAME 'MODU_G' | 'MODU_E'
        CALCulate1:LIMit1:FAIL?
```

```
 START
  LIST
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:MODulation:REFerence[:IMMediate]? (premeasurement)
READ:SPECtrum:MODulation[:ALL]?
```

Query of result is included in READ commands

```
  LIST
 RESULTS
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
FETCh:SPECtrum:MODulation:REFerence?
FETCh:SPECtrum:MODulation[:ALL]? ARFCn
```

```
 START
REF MEAS
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:MODulation[:IMMediate]
READ:SPECtrum:MODulation:REFerence[:IMMediate]?
```

Query of result is included in READ command.

```
TRANSIENT
SPECTRUM
```

```
FREQUENCY
  SWEEP
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
SWEep:COUNt <num_value>
INITiate:IMMediate; *WAI
```

Query of result:
```
        CALCulate1:LIMit1:NAME 'TRAU_G' | 'TRAU_E'
        CALCulate1:LIMit1:FAIL?
```

```
 START
  LIST
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
SWEep:COUNt <num_value>
READ:SPECtrum:SWITching[:ALL]?
```

Query of result is included in READ command

```
  LIST
 RESULTS
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
FETCh:SPECtrum:SWITching[:ALL]?
```

```
REF POWER
PEAK  RMS
```
```
INSTrument[:SELect] MGSM
CONFigure:MTYPe GMSK | EDGE
CONFigure:SPECtrum:SWITching[:IMMediate]
CONFigure:SPECtrum:SWITching:LIMit ABSolute | RELative
CONFigure:SPECtrum:SWITching:TYPE PEAK | RMS
SWEep:COUNt <num_value>
READ:SPECtrum:SWITching:REFerence[:IMMediate]? (premeas., only LIM REL)
INITiate:IMMediate; *WAI
FETCh:SPECtrum:SWITching[:ALL]?
```

```
  LIMIT          INSTrument[:SELect] MGSM
ABS   REL        CONFigure:MTYPe GMSK | EDGE
                 CONFigure:SPECtrum:SWITching[:IMMediate]
                 CONFigure:SPECtrum:SWITching:LIMit ABSolute | RELative
                 SWEep:COUNt <num_value>
                 READ:SPECtrum:SWITching:REFerence[:IMMediate]? (premeas., only LIM REL)
                 INITiate:IMMediate; *WAI
                 FETCh:SPECtrum:SWITching[:ALL]?
```

```
  START          INSTrument[:SELect] MGSM
REF MEAS         CONFigure:MTYPe GMSK | EDGE
                 CONFigure:SPECtrum:SWITching[:IMMediate]
                 CONFigure:SPECtrum:SWITching:LIMit RELative | ABSolute
                 READ:SPECtrum:SWITching:REFerence[:IMMeadiate]?
```

```
 SPURIOUS        INSTrument[:SELect] MGSM
                 CONFigure:MTYPe GMSK | EDGE
                 CONFigure:SPURious[:IMMediate]
                 SWEep:COUNt <num_value>
                 INITiate:IMMediate; *WAI
```

Query of result:
```
     CALCulate:MARKer ON
     CALCulate:MARKer:MAXimum
     CALCulate:MARKer:MAXimum:NEXT
      (the marker marks the peak spurious))
     CALCulate:MARKer:X?;Y?
```

LINES Key

```
 RESTORE         INSTrument[:SELect] MGSM
GSM LINES        CONFigure:RESTore
```

Status Reporting Registers for GSM/EDGE Measurements

Overview of Status Registers

& = logical AND

⊕ = logical OR of all bits

STATus:OPERation

15	not used
14	
13	
12	
11	
10	
9	
8	HCOPy in progress
7	
6	
5	
4	
3	
2	
1	
0	CALibrating

STATus:QUEStionable:ACPLimit

15	not used
14	
13	ALT2 LOWer FAIL (Screen B)
12	ALT2 UPPer FAIL (Screen B)
11	ALT1 LOWer FAIL (Screen B)
10	ALT1 UPPer FAIL (Screen B)
9	ADJ LOWer FAIL (Screen B)
8	ADJ UPPer FAIL (Screen B)
7	
6	
5	ALT2 LOWer FAIL (Screen A)
4	ALT2 UPPer FAIL (Screen A)
3	ALT1 LOWer FAIL (Screen A)
2	ALT1 UPPer FAIL (Screen A)
1	ADJ LOWer FAIL (Screen A)
0	ADJ UPPer FAIL (Screen A)

STATus:QUEStionable:SYNC

15	not used
14	
13	
12	
11	
10	
9	
8	
7	
6	
5	
4	
3	CARRier overload (Screen A)
2	No carrier (Screen A)
1	SYNC not found (Screen A)
0	BURSt not found (Screen A)

SRQ

7 RQS/MSS
6
5 ESB
4 MAV
3
2
1
0

SRE   STB

STATus:QUEStionable

15	not used
14	
13	
12	ACPLimit
11	SYNC
10	LMARgin
9	LIMit
8	CALibration (= UNCAL)
7	
6	
5	FREQuency
4	TEMPerature
3	POWer
2	
1	
0	

STATus:QUEStionable:LMARgin <1|2>

Screen A   Screen B

15	not used	15
14		14
13		13
12		12
11		11
10		10
9		9
8		8
7	LMARgin 8 FAIL	7
6	LMARgin 7 FAIL	6
5	LMARgin 6 FAIL	5
4	LMARgin 5 FAIL	4
3	LMARgin 4 FAIL	3
2	LMARgin 3 FAIL	2
1	LMARgin 2 FAIL	1
0	LMARgin 1 FAIL	0

STATus:QUEStionable:LIMit <1|2>

Screen A   Screen B

15	not used	15
14		14
13		13
12		12
11		11
10		10
9		9
8		8
7	LIMit 8 FAIL	7
6	LIMit 7 FAIL	6
5	LIMit 6 FAIL	5
4	LIMit 5 FAIL	4
3	LIMit 4 FAIL	3
2	LIMit 3 FAIL	2
1	LIMit 2 FAIL	1
0	LIMit 1 FAIL	0

PPE

IST flag

Error/event queue   Output buffer   ESE   ESR

7	Power on
6	User Request
5	Command Error
4	Execution Error
3	Device Dependent Error
2	Query Error
1	
0	Operation Complete

STATus:QUEStionable:FREQuency

15	not used
14	
13	
12	
11	
10	LO UNLocked (screen B)
9	
8	
7	
6	
5	
4	
3	
2	
1	LO UNLocked (screen A)
0	OVEN COLD

STATus:QUEStionable:POWer

15	not used
14	
13	
12	
11	
10	IF_OVerload (screen B)
9	UNDerload (screen B)
8	OVERload (screen B)
7	
6	
5	
4	
3	
2	IF_OVerload (screen A)
1	UNDerload (screen A)
0	OVERload (screen A)

Fig 3-1   Overview of Status Registers

STATus:QUEStionable Register

This register comprises information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be queried by commands `STATus:QUEStionable:CONDition?` and `STATus:QUEStionable[:EVENt]?`.
For GSM/EDGE mode (R&S FS-K5), the sum bit number 11 is defined.

Table 3-1   Meaning of bits in STATus:QUEStionable register

Bit No.	Meaning
0 to 2	These bits are not used.
3	**POWer** This bit is set if a questionable power occurs (see also section "STATus:QUEStionable:POWer Register").
4	**TEMPerature** This bit is set if a questionable temperature occurs.
5	**FREQuency** The bit is set if a frequency is questionable (see also section "STATus:QUEStionable:FREQuency Register").
6 to 7	These bits are not used.
8	**CALibration** The bit is set if a measurement is performed uncalibrated ($\hat{=}$ label "UNCAL").
9	**LIMit** (device-dependent) This bit is set if a limit value is violated (see also section STATus:QUEStionable:LIMit Register).
10	**LMARgin** (device-dependent) This bit is set if a margin is violated (see also section STATus:QUEStionable:LMARgin Register).
11	**SYNC** (device-dependent) This bit is set if, in measurements or premeasurements in GSM/EDGE mode, synchronization to midamble fails or no burst is found. This bit is also set if, in premeasurements in GSM/EDGE mode, the result differs too strongly from the expected value (see also "STATus:QUEStionable:SYNC Register").
12	**ACPLimit** (device-dependent) This bit is set if a limit for the adjacent channel power measurement is violated (see also section "STATus:QUEStionable:ACPLimit Register").
13 to 14	These bits are not used.
15	This bit is always 0.

STATus-QUEStionable:SYNC Register

This register is used only with GSM/EDGE mode. It contains information about sync and bursts not found, and about premeasurement results exceeding or falling short of expected values.
The bits can be queried with commands "STATus:QUEStionable:SYNC:CONDition?" and "STATus:QUEStionable:SYNC[:EVENt]?".

Table 3-2   Meaning of bits in STATus:QUEstionable:SYNC register

Bit No.	Meaning
0	**BURSt not found (screen A)** This bit is set if no burst is found in the measurements/premeasurements for phase/frequency error (PFE) or carrier power versus time (PVT) in GSM/EDGE mode. If a burst is found in these measurements/premeasurements, the bit is reset.
1	**SYNC not found (screen A)** This bit is set if the synchronization sequence (training sequence) of the midamble is not found in the measurements/premeasurements for phase/frequency error (PFE) or carrier power versus time (PVT) in GSM/EDGE mode. If the synchronization sequence (training sequence) of the midamble is found in these measurements/premeasurements, the bit is reset.
2	**No carrier (screen A)** This bit is set if, in GSM/EDGE mode, the level value determined in the premeasurements for carrier power versus time (PVT) and spectrum due to modulation is too low. The bit is reset at the beginning of the premeasurement (see also Chapter 2, description of the named premeasurements).
3	**Carrier overload (screen A)** This bit is set if, in GSM/EDGE mode, the level value determined in the premeasurements for carrier versus time (PVT) and spectrum due to modulation is too high. The bit is reset at the beginning of the premeasurement (see also Chapter 2, description of the named premeasurements).
4-14	Not used.
15	This bit is always 0.

Index

Note: *The softkeys are listed alphebetically under the keyword "Softkey".*