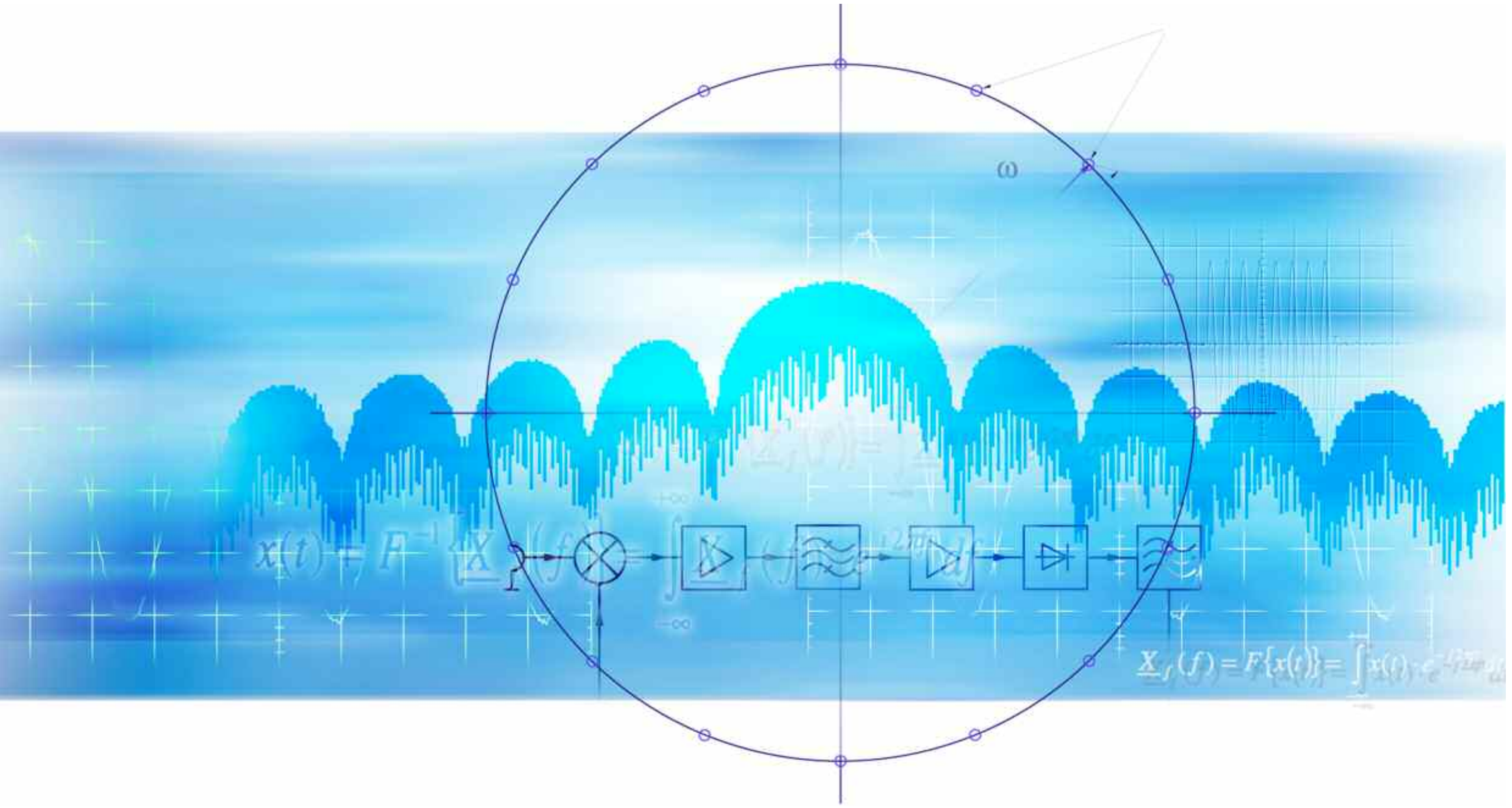
Software Manual



# 3GPP FDD User Equipment Test

## Application Firmware
## R&S® FS-K73

**1154.7252.02**

ROHDE&SCHWARZ
Test and Measurement

This Software Manual describes the following models:

R&S®FMU

R&S®FSG

R&S®FSMR

R&S®FSP

R&S®FSQ

R&S®FSU

R&S®FSUP

# Grouped Safety Messages

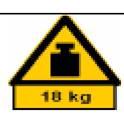
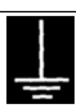
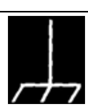
**Make sure to read through and observe the following safety instructions!**

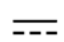
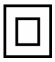
All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance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

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

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

## Symbols and safety labels

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

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

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

## Tags and their meaning

| | |
|---|---|
| DANGER | DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| WARNING | WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| CAUTION | CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. |
| NOTICE | NOTICE indicates a property damage message. |
| | In the product documentation, the word ATTENTION is used synonymously. |

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

## Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
   prescribed operating position is always with the housing floor facing down, IP protection 2X, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
   A tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.
2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.
4. If products/components are mechanically and/or thermically processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages $V_{rms}$ > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.
22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of liquids, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
    If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.
32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.
34. Prior to cleaning, disconnect the product from the AC supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluent for cellulose lacquers.

# Informaciones elementales de seguridad

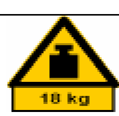
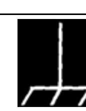
## ¡Es imprescindible leer y observar las siguientes instrucciones e informaciones de seguridad!

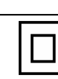
El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas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

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

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

### Símbolos y definiciones de seguridad

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

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

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

## Palabras de señal y su significado

| | |
|---|---|
| PELIGRO | Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas. |
| ADVERTENCIA | Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas. |
| ATENCIÓN | Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas. |
| AVISO | Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo. |
| | En la documentación del producto se emplea de forma sinónima el término CUIDADO. |

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

## Informaciones de seguridad elementales

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

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.
4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberán ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
6. Ciertos productos, como por ejemplo las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usuario está comprometido a valorar y señalar áreas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.
7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del producto.
9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro que es controlado su estado técnico de seguridad.
11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

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

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

## Certified Quality System

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

DQS REG. NO 001954 QM UM

### QUALITÄTSZERTIFIKAT

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

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

### CERTIFICATE OF QUALITY

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

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

### CERTIFICAT DE QUALITÉ

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

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

ROHDE&SCHWARZ

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# Customer Support

## Technical support – where and when you need it

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

## Up-to-date information and upgrades

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

## USA & Canada

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

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

## East Asia

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

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

## Rest of the World

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

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| From outside Europe | +49 89 4129 13776 |
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* 0.14 €/Min within the German fixed-line telephone network, varying prices for the mobile telephone network and in different countries.

ROHDE & SCHWARZ

1171.0200.22-02.00

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- National Websites

# Contents

## Figures

## Tables

# Contents of Manual for Application Firmware R&S FS-K73

This manual contains all information on the operation of an R&S FSP, R&S FSU, R&S FSQ or R&S FSMR equipped with Application Firmware R&S FS-K73. It includes operation via menus and the remote-control commands for the 3GPP FDD user equipment test.

The manual comprises the data sheet and 10 chapters:

**The data sheet** informs on the guaranteed specifications and the firmware characteristics.

**Chapter 1** describes how to enable the application firmware module.

**Chapter 2** describes typical examples of measurements by means of tests.

**Chapter 3** describes the measurement setup for user equipment tests.

**Chapter 4** describes the channel configurations for user equipments.

**Chapter 5** gives a schematic overview of the R&S FS-K73 control menus.

**Chapter 6** contains a detailed description of the possible user equipment test measurements as a reference for manual operation. The chapter also presents a list of remote-control commands associated with each function.

**Chapter 7** describes all remote-control commands defined for the code domain measurement. An alphabetic list of all remote-control commands and a table of softkeys with the assignment of commands are given at the end of this chapter.

**Chapter 8** contains the performance test.

**Chapter 9** contains an explanation of terms related to measured quantities of the code domain measurement.

**Chapter 10** contains the index of this operating manual.

This manual is a supplement to the R&S FSP/R&S FSU/R&S FSQ/R&S FSMR operating manual. It includes exclusively functions of Application Firmware R&S FS-K73. For all other descriptions, please refer to the spectrum analyzers operating manual.

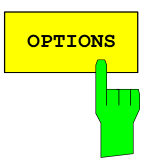
# 3GPP FDD User Equipment Test - Application Firmware R&S FS-K73

The Spectrum Analyzer R&S FSP, R&S FSU, Signal Analyzer R&S FSQ or Measuring Receiver R&S FSMR equipped with Application Firmware R&S FS-K73 perform code domain power measurements on uplink signals according to standard 3GPP (FDD mode). The application firmware is in line with standard 3GPP (Third Generation Partnership Project) with version Release 5. In addition to the code domain measurements prescribed by the standard 3GPP, the application offers measurements with predefined settings in the frequency domain, e.g. power and ACLR measurement.

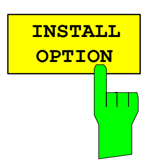
## 1 Enabling the Firmware Option

Firmware Option R&S FS-K73 is enabled in the *GENERAL SETUP* menu by entering a keyword. The keyword is delivered with the option. If the option is factory-installed, it is already enabled.

*GENERAL SETUP* menu:




The *OPTIONS* softkey opens a submenu where keywords for new firmware options (application firmware modules) can be entered. Available options are displayed in a table, which is opened when entering the submenu.




The *INSTALL OPTION* softkey activates the entry of the keyword for a firmware option.

One ore several keywords can be entered in the entry field. On entering a valid keyword, *OPTION KEY OK* is displayed on the message line and the option is entered in the *FIRMWARE OPTIONS* table.

In case of invalid keywords, *OPTION KEY INVALID* is displayed on the message line.

# 2 Getting Started

The following chapter explains basic 3GPP FDD user equipment tests by means of a setup with signal generator R&S SMIQ. It describes how operating and measurement errors can be avoided using correct presetting.
The measurement screen is presented in chapter 6 for each measurement.

Key settings are shown as examples to avoid measurement errors. Following the correct setting, the effect of an incorrect setting is shown. The following measurements are performed:

- Measurement 1: Measuring the spectrum
- Measurement 2: Measurement of spectrum emission mask
- Measurement 3: Measurement of relative code domain power
  - Setting: Setting the analyzer center frequency to the DUT frequency
  - Setting: Scrambling code of signal
- Measurement 4: Triggered measurement of relative code domain power
  - Setting: Trigger offset
- Measurement 5: Measurement of composite EVM
- Measurement 6: Measurement of peak code domain error

The measurements are performed using the following units and accessories:

- R&S Analyzer with Application Firmware R&S FS-K73: 3GPP FDD user equipment test.
- Vector Signal Generator R&S SMIQ with option R&S SMIQB45: digital standard 3GPP (options R&S SMIQB20 and R&S SMIQB11 required)
- 1 coaxial cable, 50 Ω, approx. 1 m, N connector
- 1 coaxial cable, 50 Ω, approx. 1 m, BNC connector

Conventions for displaying settings on R&S Analyzer:

| | |
|---|---|
| [***<KEY>***] | Press a key on the front panel, e.g. ***[SPAN]*** |
| *[<SOFTKEY>]* | Press a softkey, e.g. *[MARKER -> PEAK]* |
| [<nn unit>] | Enter a value and terminate by entering the unit, e.g. *[12 kHz]* |

Conventions for displaying settings on R&S SMIQ:

| | |
|---|---|
| [***<KEY>***] | Press a key on the front panel, e.g. ***[FREQ]*** |
| *<MENU>* | Select a menu, parameter or a setting, e.g. *DIGITAL STD.*<br>The menu level is marked by an indentation. |
| <*nn unit*> | Enter a value and terminate by entering the unit, e.g. *12 kHz* |

## Basic Settings in Code Domain Measurement Mode

In the default setting after PRESET, R&S Analyzer is in the analyzer mode. The following default settings of the code domain measurement are activated, provided the code domain measurement mode is selected.

Table 1 Default settings of the code domain measurement

| Parameter | Setting |
|---|---|
| Digital standard | W-CDMA 3GPP REV |
| Sweep | CONTINUOUS |
| CDP mode | CODE CHAN AUTOSEARCH |
| Trigger settings | FREE RUN |
| Trigger offset | 0 |
| Scrambling code | 0 |
| Threshold value | -60 dB |
| Symbol rate | 15 ksps |
| Code number | 0 |
| Slot number | 0 |
| I/Q branch | Q |
| Display | Screen A: CODE PWR RELATIVE<br>Screen B: RESULT SUMMARY |

## Measurement 1: Measuring the Signal Power

The measurement of the spectrum gives an overview of the 3GPP FDD signal and the spurious emissions close to the carrier.

Test setup

➢ Connect the RF output of R&S SMIQ to the RF input of R&S Analyzer (coaxial cable with N connectors).

Settings on R&S SMIQ:

***[PRESET]***
***[LEVEL:*** *0 dBm* ***]***
***[FREQ:*** *2.1175 GHz* ***]***
*DIGITAL STD*
*WCDMA/3GPP*
*SET DEFAULT*
*LINK DIRECTION UP/REVERSE*
*TEST MODELS (NOT STANDARDIZED)...*
*C+D960K*
*STATE: ON*

Settings on R&S Analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz* ***]***
***[AMPT:*** *0 dBm* ***]***
*[3G FDD UE]*
***[MEAS:*** *POWER* ***]***

## Measurement 2: Measurement of Spectrum Emission Mask

The 3GPP specification defines a measurement, which monitors the compliance with a spectral mask in a range of at least ±12.5 MHz about the 3GPP FDD carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier by means of a 30kHz filter, in the ranges far off the carrier by means of a 1MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

Test setup

➢ Connect the RF output of R&S SMIQ to the RF input of R&S Analyzer (coaxial cable with N connectors).

Settings on R&S SMIQ:

***[PRESET]***
***[LEVEL:*** *0 dBm* ***]***
***[FREQ:*** *2.1175 GHz* ***]***
*DIGITAL STD*
*WCDMA/3GPP*
*SET DEFAULT*
*LINK DIRECTION UP/REVERSE*
*TEST MODELS (NOT STANDARDIZED)...*
*C+D960K*
*STATE: ON*

Settings on R&S Analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz* ***]***
***[AMPT:*** *0 dBm* ***]***
*[3G FDD UE]*
***[MEAS:*** *SPECTRUM EM MASK* ***]***

Measurement on R&S Analyzer:

The following is displayed:

- Spectrum of the 3GPP FDD signal
- Limit line defined in the standard
- Information on limit line violations (passed/failed)

## Measurement 3: Measurement of Relative Code Domain Power

A code domain power measurement on one of the channel configurations is shown in the following. Basic parameters of CDP analysis are changed to demonstrate the effects of non-signal-adapted values.

Test setup

- Connect the RF output of R&S SMIQ to the input of R&S Analyzer
- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference input (REF) on the rear panel of R&S SMIQ (coaxial cable with BNC connectors).

Settings on R&S SMIQ:

***[PRESET]***
***[LEVEL:*** *0 dBm* ***]***
***[FREQ:*** *2.1175 GHz* ***]***
*DIGITAL STD*
　*WCDMA 3GPP*
　　*LINK DIRECTION UP/REVERSE*
　　*TEST MODELS (NOT STANDARDIZED)...*
　　　*C+D960K*
　　*SELECT BS/MS*
　　　*MS 1 ON*
　　　　*OVERALL SYMBOL RATE... 6*960*
　　*STATE: ON*

Settings on R&S Analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz* ***]***
***[AMPT:*** *10 dBm* ***]***
*[3G FDD UE]*
*[SETTINGS: SCRAMBLING CODE 0]*

Measurement on R&S Analyzer:

The following is displayed:
Screen A: Code domain power of signal, branch Q (channel configuration with 3 data channels on Q branch)
Screen B: Numeric results of CDP measurement

## Setting: Synchronizing the reference frequencies

The synchronization of the reference oscillators both of the DUT and analyzer strongly reduces the measured frequency error.

Test setup

- Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the rear panel of R&S SMIQ (coaxial cable with BNC connectors).

Settings on R&S SMIQ: *As for measurement 2*

Settings on R&S Analyzer:

*As for measurement 2, plus*
***[SETUP:*** *REFERENCE EXT* ***]***

Measurement on R&S Analyzer:

Frequency error The displayed frequency error should be < 10 Hz.

**The reference frequencies of the analyzer and of the DUT should be synchronized**

## Setting: Behaviour with Deviating Center Frequency Setting

In the following, the behaviour of the DUT and the analyzer with wrong center frequency setting is shown.

Settings on R&S SMIQ:

➢ Tune the center frequency of the signal generator in 0.5 kHz steps and watch the analyzer screen:

Measurement on R&S Analyzer:

- A CDP measurement on the analyzer is still possible with a frequency error of up to approx. 1 kHz. Up to 1 kHz, a frequency error causes no apparent difference in measurement accuracy of the code domain power measurement.
- Above a frequency error of 1 kHz, the probability of an impaired synchronization increases. With continuous measurements, at times all channels are displayed in blue with almost the same level.
- Above a frequency error of approx. 2 kHz, a CDP measurement cannot be performed. R&S Analyzer displays all possible codes in blue with a similar level.

Settings on R&S SMIQ:

➢ Set the signal generator center frequency again to 2.1175 GHz:
***[FREQ:*** *2.1175 GHz****]***

**The analyzer center frequency should not differ from the DUT frequency by more than 2 kHz.**

## Setting: Behaviour with Incorrect Scrambling Code

A valid CDP measurement can only be carried out if the scrambling code set on the analyzer is identical to the one of the transmitted signal.

Test setup

*SELECT BS/MS*
BS 1: ON
SCRAMBLING CODE: 0001
(the scrambling code is set to 0000 on the analyzer)

Settings on R&S SMIQ:

The CDP display shows all possible codes with approximately the same level.

Settings on R&S Analyzer:

Set scrambling code to new value:
*[SETTINGS: SCRAMBLING CODE 1]*

Measurement on R&S Analyzer:

The CDP display again shows the channel configuration.

**The scrambling code setting of the analyzer must be identical to that of the measured signal.**

## Measurement 4: Triggered Measurement of Relative Code Domain Power

If the code domain power measurement is performed without external triggering, a section of approximately 20 ms of the test signal is recorded at an arbitrary moment to detect the start of a 3GPP FDD frame in this section. Depending on the position of the frame start, the required computing time can be quite long. Applying an external (frame) trigger can reduce the computing time.

Test setup

- Connect the RF output of R&S SMIQ to the input of R&S Analyzer
- Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S Analyzer to the reference input (REF) on the rear panel of R&S SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of R&S SMIQ (TRIGOUT1 of PAR DATA).

Settings on R&S SMIQ: *As for measurement 3*

Settings on R&S Analyzer: *As for measurement 3, plus*
***[TRIG** EXTERN**]***

Measurement on R&S Analyzer: The following is displayed:

Screen A: Code domain power of signal
(channel configuration with 3 data channels on Q branch)
Screen B: Numeric results of CDP measurement

Trg to Frame: Offset between trigger event and start of 3GPP FDD frame

The repetition rate of the measurement increases considerably compared to the repetition rate of a measurement without external trigger.

## Setting: Trigger offset

A delay of the trigger event referred to the start of the 3GPP FDD frame can be compensated by modifying the trigger offset.

Settings on R&S Analyzer: *MEAS SETTINGS TRIGGER OFFSET 100 µs]*

Measurement on R&S Analyzer: The parameter Trg to Frame in the numeric results table (screen B) changes:
*Trg to Frame -100 µs*

**A trigger offset compensates analog delays of the trigger event.**

## Measurement 5: Measurement of Composite EVM

The 3GPP specification prescribes the composite EVM measurement as the average square deviation of the total signal:
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

Test setup

- Connect the RF output of R&S SMIQ to the input of R&S Analyzer
- Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S Analyzer to the reference input (REF) on the rear panel of R&S SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of R&S SMIQ (TRIGOUT1 of PAR DATA).

Settings on R&S SMIQ:

***[PRESET]***
***[LEVEL:*** *0 dBm**]***
***[FREQ:*** *2.1175 GHz**]***
*DIGITAL STD*
*LINK DIRECTION UP / REVERSE*
*TEST MODELS (NOT STANDARDIZED)...*
*C+D960K*
*SELECT BS/MS*
*MS 1 ON*
*OVERALL SYMBOL RATE... 6*960*
*STATE: ON*

Settings on R&S Analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz**]***
***[REF:*** *10 dBm**]***
*[3G FDD UE]*
***[TRIG*** *EXTERN**]***
*[RESULTS COMPOSITE EVM]*

Measurement on R&S Analyzer:

The following is displayed:
Screen A: Code domain power of signal, branch Q
(channel configuration with 3 data channels on branch Q)
Screen B: Composite EVM (EVM for total signal)

## Measurement 6: Measurement of Peak Code Domain Errors

The peak code domain error measurement is defined in the 3GPP specification for FDD signals.
An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The difference of the two signals is projected onto the classes of the different spreading factors. The peak code domain error measurement is obtained by summing up the symbols of each difference signal slot and searching for the maximum error code.

Test setup

- Connect the RF output of R&S SMIQ to the input of R&S Analyzer
- Connect the reference input (EXT REF IN/OUT) on the rear panel of R&S Analyzer to the reference input (REF) on the rear panel of R&S SMIQ (coaxial cable with BNC connectors).
- Connect the external trigger input on the rear panel of R&S Analyzer (EXT TRIG GATE) to the external trigger output on the rear panel of R&S SMIQ (TRIGOUT1 of PAR DATA).

Settings on R&S SMIQ:

***[PRESET]***
***[LEVEL:*** *0 dBm* ***]***
***[FREQ:*** *2.1175 GHz* ***]***
*DIGITAL STD*
*WCDMA 3GPP*
*LINK DIRECTION UP / REVERSE*
*TEST MODELS (NOT STANDARDIZED)...*
*C+D960K*
*SELECT BS/MS*
*MS 1 ON*
*OVERALL SYMBOL RATE... 6*960*
*STATE: ON*

Settings on R&S Analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz* ***]***
***[REF:*** *0 dBm* ***]***
*[3G FDD UE]*
***[TRIG*** *EXTERN* ***]***
*[RESULTS PEAK CODE DOMAIN ERR]*
*SPREAD FACTOR 256*

Measurement on R&S Analyzer:

The following is displayed:

Screen A: Code domain power of signal, branch Q
(channel configuration with 3 data channels on branch Q)

Screen B: Peak code domain error (projection of the error onto the class with spreading factor 256

# 3 Setup for User Equipment Tests

***Caution:***

*Before turning the instrument on, the following conditions must be fulfilled:*

- *Instrument covers are in place and all fasteners are tightened.*
- *Fan openings are free from obstructions.*
- *Signal levels at the input connectors are all below specified maximum values.*
- *Signal outputs are correctly connected and not overloaded.*

***Non-compliance with these instructions may cause damage to the instrument****.*

This section describes how to set up the analyzer for 3GPP FDD user equipment tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, the application firmware module must be properly installed following the instructions given in chapter 1 of the present manual.

## Standard Test Setup

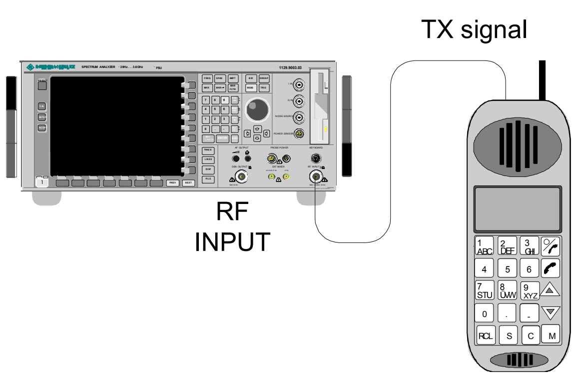



Fig. 1 UE test setup

- Connect antenna output (or TX output) of UE to RF input of the analyzer via a power attenuator of suitable attenuation.

  The following values are recommended for the external attenuator to ensure that the RF input of the analyzer is protected and the sensitivity of the analyzer is not reduced too much.

| Max. power | Recommended ext. attenuation |
|---|---|
| ≥ 55 to 60 dBm | 35 to 40 dB |
| ≥ 50 to 55 dBm | 30 to 35 dB |
| ≥ 45 to 50 dBm | 25 to 30 dB |
| ≥ 40 to 45 dBm | 20 to 25 dB |
| ≥ 35 to 40 dBm | 15 to 20 dB |
| ≥ 30 to 35 dBm | 10 to 15 dB |
| ≥ 25 to 30 dBm | 5 to 10 dB |
| ≥ 20 to 25 dBm | 0 to 5 dB |
| < 20 dBm | 0 dB |

- For signal measurements at the output of two-port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN/OUT*).

  To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on user equipments. A rubidium frequency standard may be used for instance as a reference source.

- If the user equipment is provided with a trigger output, connect this output to the rear trigger input of the analyzer (*EXT TRIG GATE*).

## Presetting

- Enter external attenuation (REF LVL OFFSET)
- Enter reference level
- Enter center frequency
- Set the trigger
- Select standard and measurement

# 4 3GPP FDD Channel Configurations

The possible channel configurations for the mobile station signal are limited by 3GPP. Only two different configurations for data channels DPDCH are permissible according to the specification. In addition to these two channel configurations the transmission of channel HS-DPCCH is permissible for operating the mobile station in mode HSDPA. For this reason, the R&S FS-K73 checks for these channel configurations only during the automatic channel search. Therefore, channels whose parameters do not correspond to one of these configurations are not automatically detected as active channels.

The two possible channel configurations are summarized below:

Table 2 Channel configuration 1: DPCCH and 1 DPDCH

| **Channel type** | **Number of channels** | **Symbol rate** | **Spreading code(s)** | **Mapping to component** |
|---|---|---|---|---|
| DPCCH | 1 | 15 ksps | 0 | Q |
| DPDCH | 1 | 15 ksps – 960 ksps | [spreading-factor / 4] | I |

Table 3 Channel configuration 2: DPCCH and up to 6 DPDCH

| **Channel type** | **Number of channels** | **Symbol rate** | **Spreading code(s)** | **Mapping to component** |
|---|---|---|---|---|
| DPCCH | 1 | 15 ksps | 0 | Q |
| DPDCH | 1 | 960 ksps | 1 | I |
| DPDCH | 1 | 960 ksps | 1 | Q |
| DPDCH | 1 | 960 ksps | 3 | I |
| DPDCH | 1 | 960 ksps | 3 | Q |
| DPDCH | 1 | 960 ksps | 2 | I |
| DPDCH | 1 | 960 ksps | 2 | Q |

Table 4 Channel configuration 3: DPCCH, up to 6 DPDCH and 1 HS-DPCCH

The channel configuration is as above in table 4-2. On HS-DPCCH is added to each channel table..

| **Number of DPDCH** | **Symbol rate all DPDCH** | **Symbol rate HS-DPCCH** | **Spreading code HS-DPCCH** | **Mapping to component (HS-DPCCH)** |
|---|---|---|---|---|
| 1 | 15 – 960 ksps | 15 ksps | 64 | Q |
| 2 | 1920 ksps | 15 ksps | 1 | I |
| 3 | 2880 ksps | 15 ksps | 32 | Q |
| 4 | 3840 ksps | 15 ksps | 1 | I |
| 5 | 4800 ksps | 15 ksps | 32 | Q |
| 6 | 5760 ksps | 15 ksps | 1 | I |

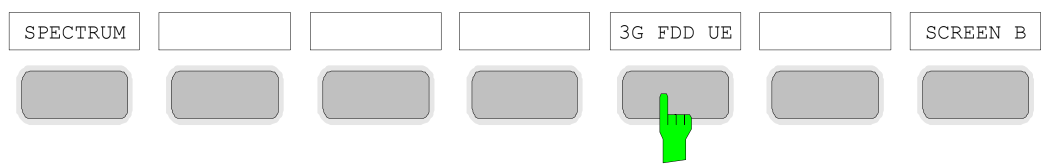
Table 5 Channelization code of HS-DPCCH

| **Nmax-dpdch (as defined in subclause 4.2.1)** | **Channelization code $C_{ch}$** |
|---|---|
| 1 | $C_{ch,256,64}$ |
| 2,4,6 | $C_{ch,256,1}$ |
| 3,5 | $C_{ch,256,32}$ |

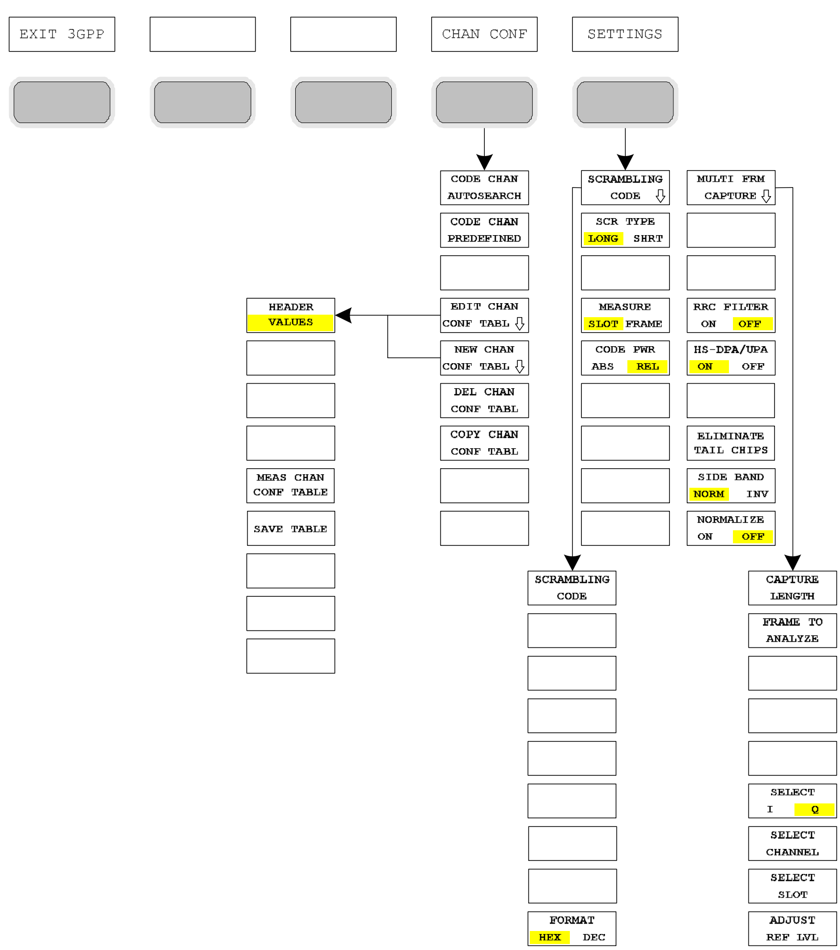
# 5 Menu Overview

Application Firmware Module R&S FS-K73 (3GPP FDD user equipment test) extends the analyzer by the code domain measurement mode for 3GPP FDD standard. Additional softkeys are available which allow overview measurements in the analyzer mode.

The R&S FS-K73 application is started by a click on the 3G FDD UE hotkey:




The main settings of the code domain power measurements can be directly selected via the hotkey bar that changes after the application has been started.
When one of the *CHAN CONF*, *SETTINGS*, *RESULTS* hotkeys is selected, the measurement is automatically switched to the Code Domain Power measurement mode.
If the *EXIT 3GPP* hotkey is selected, R&S FS-K73 is exited. The hotkey bar of the basic unit is displayed again.



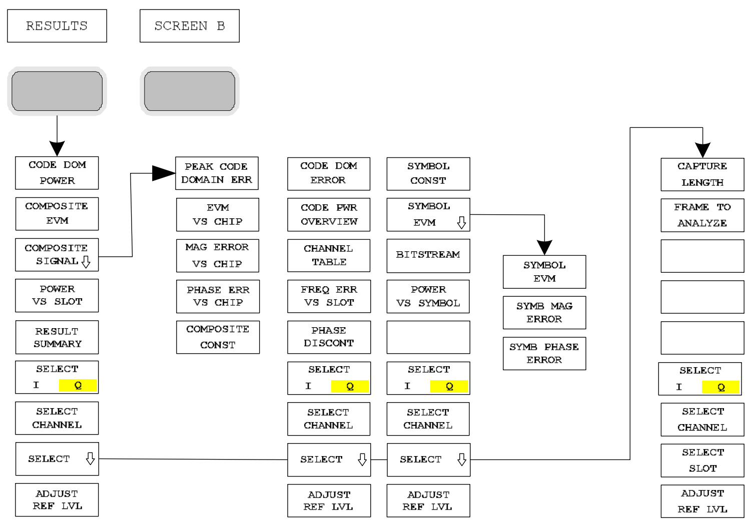



Fig. 2 Overview of menus of code domain power

The measurements available in R&S FS-K73 can be selected by means of the MEAS key:

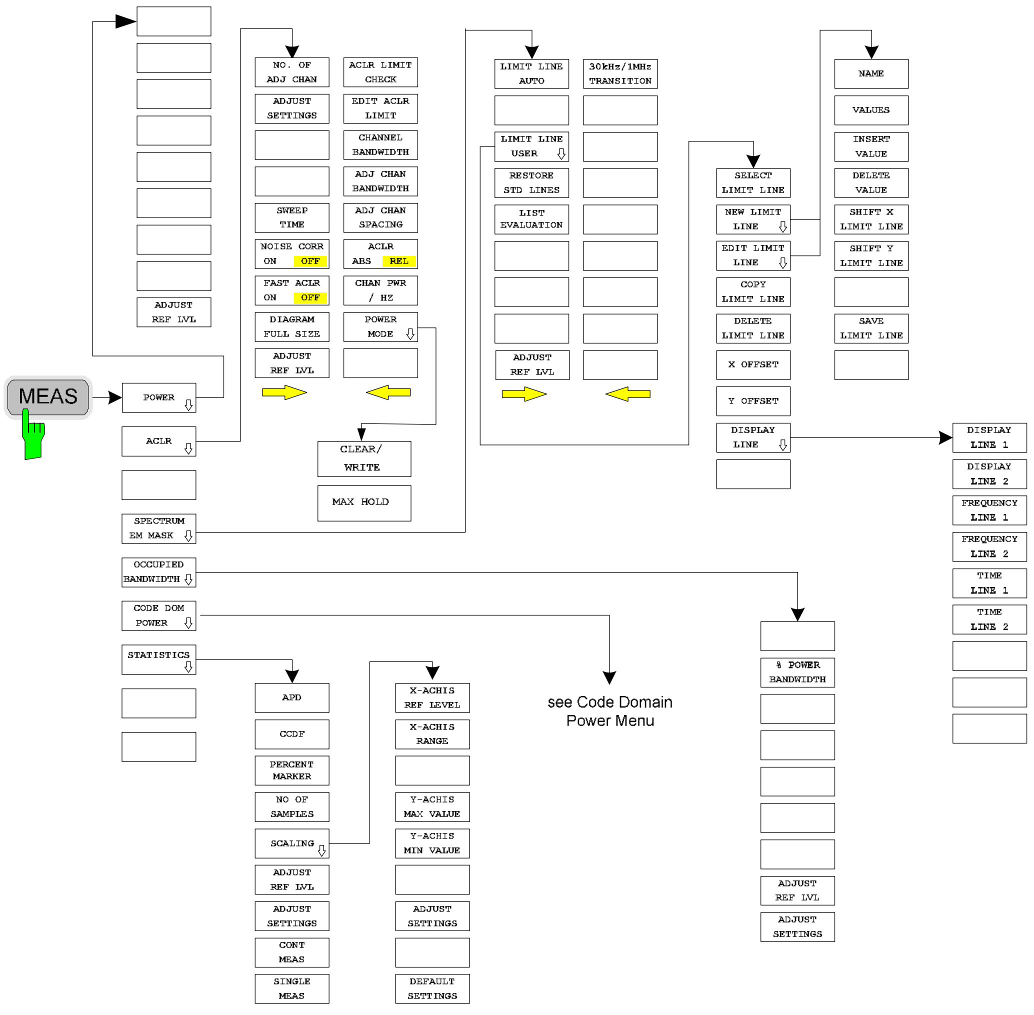



Fig. 3 Overview of menus

# 6 Configuration of 3GPP FDD Measurements

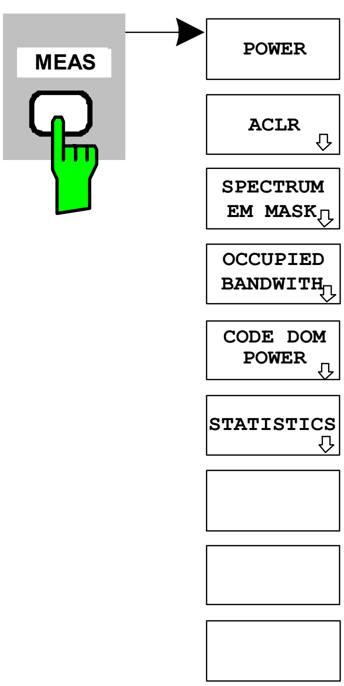
The most important parameters for the 3GPP FDD user equipment tests are summarized in the menu of key *MEAS* and are explained below using the softkey functions.

The *CODE DOM POWER* softkey activates the code domain measurement mode and opens the submenus for setting the measurement. A change of the hotkey labels after the application has been started ensures that the most important parameters of the CDP (code domain power) measurements are directly accessible via the hotkey bar.

The softkeys *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH* and *STATISTICS* activate user equipment tests in the analyzer or vector analyzer mode. Pressing the associated softkey performs the settings required by 3GPP specifications. A subsequent modification of settings is possible.

The other menus of the spectrum analyzer correspond to the menus of these modes and are described in the operating manual of the main unit.

*CONFIGURATION MODE* menu

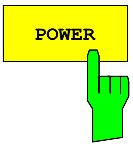



The *MEAS* key opens a submenu for setting the various measurement modes of option R&S FS-K73:

- *POWER activates the channel power measurement with defined settings in the analyzer mode.*
- *ACLR activates the adjacent channel power measurement with defined settings in the analyzer mode.*
- *SPECTRUM EM MASK compares the signal power in different carrier offset ranges with the maximum values specified by 3GPP.*
- *OCCUPIED BANDWIDTH activates the measurement of the occupied bandwidth (analyzer mode).*
- *CODE DOM POWER activates the code domain measurement mode and opens another submenu for selecting and configuring the parameters. All other menus of the spectrum analyzer are adapted to the functions of the code domain measurement mode.*
- *STATISTICS evaluates the signal with regard to its statistical characteristics (distribution function of the signal amplitudes).*

## Measurement of Channel Power

Key *MEAS*




The *POWER* softkey activates measurement of the 3GPP FDD signal channel power.

The R&S Analyzer measures the unweighted RF signal power in a bandwidth of:

$$f_{BW} = 5\,MHz \geq (1+\alpha)\cdot 3.84\,MHz \approx 4.7\,MHz \quad | \quad \alpha = 0.22$$

The power is measured in zero span mode using a digital channel filter of 5 MHz in bandwidth. According to the 3GPP standard, the measurement bandwidth (5 MHz) is slightly larger than the minimum required bandwidth of 4.7 MHz. The bandwidth is displayed numerically below the screen.

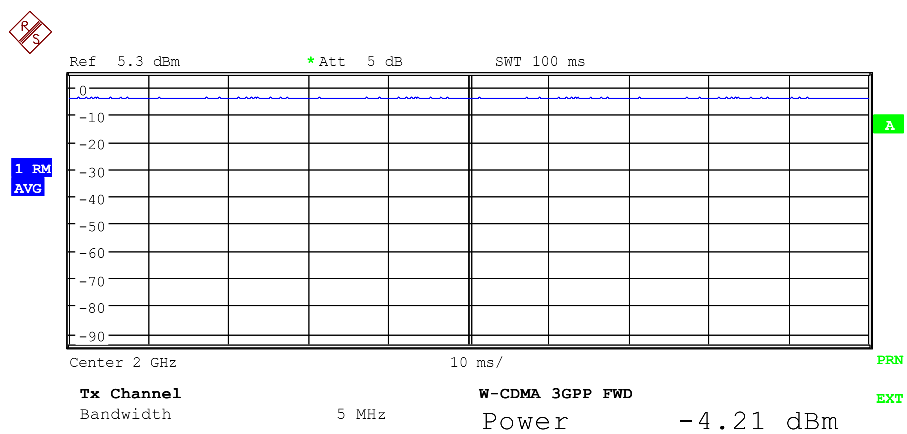



Fig. 4 Power measurement in the 3.84 MHz transmission channel using a 5 MHz channel filter.

Pressing the softkey activates the analyzer mode with defined settings:

| | | |
|---|---|---|
| SYSTEM PRESET | | |
| After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset; Center Frequency, Frequency Offset; Input Attenuation, Mixer Level; All trigger settings | | |
| CHAN PWR / ACP | CP / ACP ON | |
| CP / ACP STANDARD | W-CDMA 3GPP REV | |
| CP / ACP CONFIG | NO. OF ADJ CHAN | 0 |

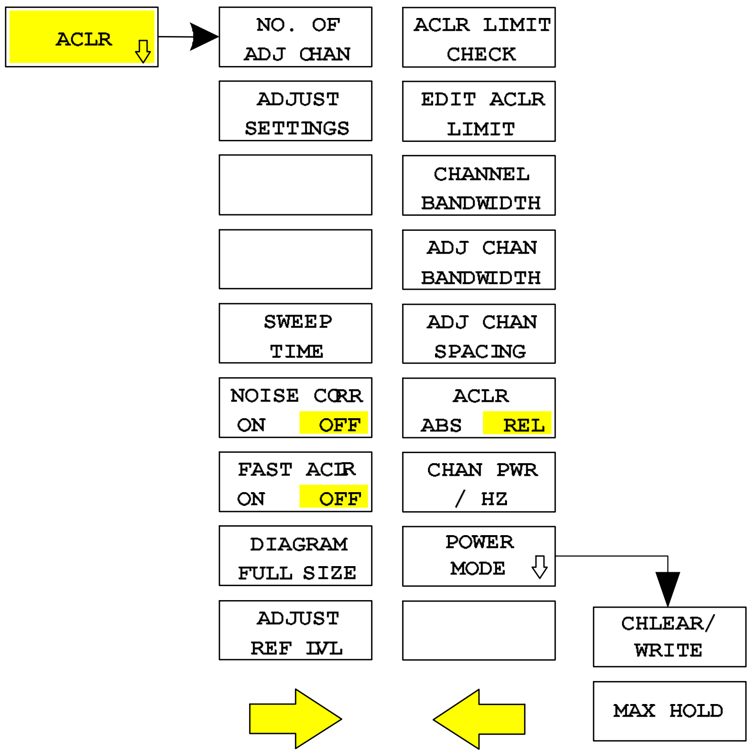
Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE bus command: `CONF:WCDP:MEAS POW`

Query of results: `CALC:MARK:FUNC:POWer:RES? CPOW`

## Measurement of Adjacent-Channel Power - ACLR

Key *MEAS*




The *ACLR* softkey activates the adjacent-channel power measurement in the default setting according to 3GPP specifications (Adjacent Channel Leakage Power Ratio).

The instrument measures the channel power and the relative power of adjacent channels and of the next channels. The results are displayed below the screen.

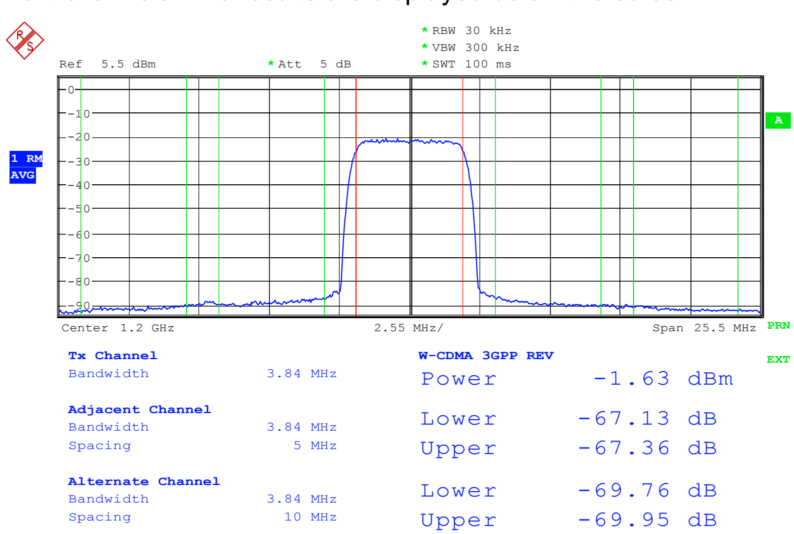



Fig. 5 Adjacent-channel power measurement of a 3GPP FDD user equipment.

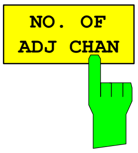
Pressing the softkey activates the analyzer mode with defined settings:

| | | |
|---|---|---|
| SYSTEM PRESET | | |
| After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset<br>Center Frequency, Frequency Offset<br>Input Attenuation, Mixer Level<br>All trigger settings | | |
| CHAN PWR / ACP | CP / ACP ON | |
| CP / ACP STANDARD | W-CDMA 3GPP REV | |
| CP / ACP CONFIG | NO. OF ADJ CHAN | 2 |

Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE bus command: `CONF:WCDP:MEAS ALCR`

Query of results: `CALC:MARK:FUNC:POW:RES? ACP`




The *NO. OF ADJ CHAN* softkey activates the entry of the number ±n of adjacent channels to be considered in the adjacent-channel power measurement.
Numbers from 0 to 12 can be entered.

The following measurements are performed depending on the number of the channels.

0 Only the channel power is measured.

1 The channel power and the power of the upper and lower adjacent channel are measured.

2 The channels power, the power of the upper and lower adjacent channel and of the next higher and lower channel (alternate channel 1) are measured.

3 The channel power, the power of the upper and lower adjacent channel, the power of the next higher and lower channel (alternate channel 1) and of the next but one higher and lower adjacent channel (alternate channel 2) are measured.

With higher numbers the procedure is expanded accordingly.

IEC/IEEE bus command: `:SENS:POW:ACH:ACP 2`

Result: `:SENS:POW:ACH:ACP?`

This increased number of adjacent channels is implemented through all the relevant settings such as:

*ACLR LIMIT CHECK*

```
CALC:LIM:ACP:ACH:RES?
CALC:LIM:ACP:ALT1..11:RES?
```

*EDIT ACLR LIMITS*

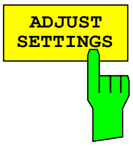
```
CALC:LIM:ACP:ACH:STAT ON
CALC:LIM:ACP:ACH:ABS –10dBm,-10dBm
CALC:LIM:ACP:ACH:ABS:STAT ON
CALC:LIM:ACP:ALT1..11 0dB,0dB
CALC:LIM:ACP:ALT1..11:STAT ON
CALC:LIM:ACP:ALT1..11:ABS –10dBm,-10dBm
CALC:LIM:ACP:ALT1..11:ABS:STAT ON
```

*ADJ CHAN BANDWIDTH*

```
SENS:POW:ACH:BWID:ALT1..11 30kHz
```

*ADJ CHAN SPACING*

```
SENS:POW:ACH:SPAC:ALT1..11 4MHz
```




The *ADJUST SETTINGS* softkey automatically optimizes analyzer settings for the selected power measurement (see below). All analyzer settings relevant for power measurements within a specific frequency range (channel bandwidth) are optimally set depending on the channel configuration (channel bandwidth, channel spacing).

- Frequency span:

  The frequency span must cover at least all the channels that are to be considered.
  When the channel power is measured, the span is set to twice the channel bandwidth.
  The setting of the span for adjacent-channel power measurements depends on the channel spacing and the channel bandwidth of the adjacent channel with the largest distance from the transmission channel, ADJ, ALT1 or ALT2 .

- Resolution bandwidthRBW ≤ 1/40 of channel bandwidth
- Video bandwidth VBW ≥ 3 x RBW
- Detector RMS detector

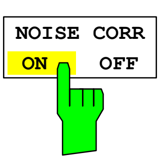
The trace math and trace averaging functions are switched off.
The reference level is not influenced by *ADJUST SETTINGS.* It can be separately adjusted with *ADJUST REF LVL.*

The adjustment is only carried out once; if necessary, the instrument settings can be changed later.

IEC/IEEE bus command: `SENS:POW:ACH:PRES ACP|CPOW|OBW`

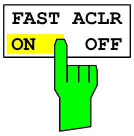

The *SWEEP TIME* softkey activates entry of the sweep time. When the RMS detector is used, a longer sweep time yields more stable results.
This setting is identical with the *SWEEP TIME MANUAL* setting in the *BW* menu.

IEC/IEEE bus command: `SWE:TIM <value>`




The *NOISE CORR ON/OFF* softkey switches on correction of measurement results due to the residual instrument noise. When the softkey is switched on, the first step is to measure the residual instrument noise. The measured noise is then deducted from the power in the observed channel.
Each time the measurement frequency, the resolution bandwidth, the measurement time or the level settings are changed, noise correction is switched off. To repeat the residual noise measurement with the new settings, the softkey must be pressed again.

IEC/IEEE bus command: `SENS:POW:NCOR ON`




The *FAST ACLR* softkey toggles between measurement in line with the IBW method (FAST ACLR OFF) and measurement in the time domain (FAST ACLR ON).

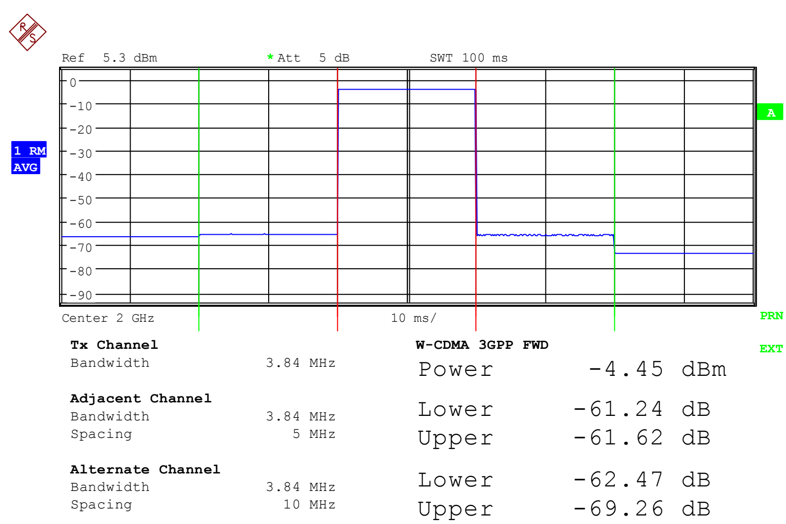
With *FAST ACLR ON* selected, the power is measured in the various channels in the time domain. The R&S Analyzer sets its center frequency to the different channel center frequencies one after the other, and then measures the power at these frequencies with the set measurement time (= sweep time/number of measured channels). Suitable RBW filters are automatically used for the selected standard and frequency offset (root raised cosine at WCDMA).

The RMS detector is used for correct power measurement. Software correction factors are not required in this case.

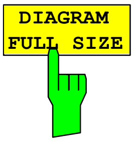
Measured values are output in the form of a table; the power of the useful channel is specified in dBm and the power of the adjacent channels in dBm *(ACLR ABS)* or dB *(ACLR REL)*.

The selected sweep time (= measurement time) depends on the desired reproducibility of measurement results. The longer the selected sweep time, the better the reproducibility of results, because, in this case, the power is measured over a longer period of time.

As a rule of thumb, it can be assumed that approx. 500 uncorrelated values are required for a reproducibility value of 0.5 dB (99% of the measurement is within 0.5 dB of the true measured value). Measured values are considered uncorrelated if their time spacing corresponds to the reciprocal of the measurement bandwidth.

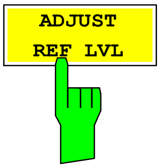



IEC/IEEE bus command: `SENS:POW:HSP ON`



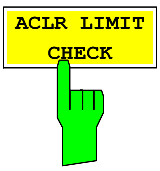

The *DIAGRAM FULL SIZE* softkey switches the diagram to full screen size.

IEC/IEEE bus command: –




The *ADJUST REF LVL* softkey adapts the reference level of the R&S Analyzer to the measured channel power. This ensures that the settings for RF attenuation and reference level are optimally adapted to the signal level so that the R&S Analyzer is not overdriven or that the dynamic range is not reduced by an S/N ratio that is too low.
Since the measurement bandwidth for adjacent-channel power measurements is clearly narrower than the signal bandwidth, the signal path can be overdriven although the measured trace is definitely below the reference level.

IEC/IEEE bus command: `SENS:POW:ACH:PRES:RLEV`




The *ACLR LIMIT CHECK* softkey switches limit check for the ACLR measurement on or off.

IEC/IEEE bus command: `:CALC:LIM:ACP ON`

Query of LIMIT CHECK results for
Adjacent channel: `CALC:LIM:ACP:ACH:RES?`
Alternate channel <1 to 2>: `CALC:LIM:ACP:ALT<1..2>:RES?`

Result format:
Left sideband `[PASSED,FAILED]`
Right sideband `[PASSED,FAILED]`


*EDIT ACLR LIMIT* opens a table with limits for the ACLR measurement. The standard-specific default values are entered with the *ADJUST SETTINGS* softkey.

| ACP LIMITS | | | | |
|---|---|---|---|---|
| CHAN | RELATIVE LIMIT CHECK | | ABSOLUTE LIMIT CHECK | |
| | VALUE | ON | VALUE | ON |
| ADJ | -55 dBc | √ | 0 dBm | |
| ALT1 | -70 dBc | √ | 0 dBm | |
| ALT2 | 0 dBc | | 0 dBm | |

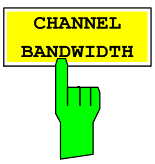
The following rules apply for limit values:

- A limit value can be defined for each of the adjacent channels. The limit value applies to the upper and the lower adjacent channel.
- A relative limit value and/or an absolute limit can be defined. The check can be activated separately for the two limit values.
- Compliance with active limit values is checked irrespective of whether absolute or relative limits are specified or whether the measurement itself is performed with absolute levels or a relative level ratio. If the two checks are active and the higher one of the two levels is exceeded, the respective value will be marked.

**Note:** *Measured values violating the limit are printed in red and preceded by a red asterisk.*

IEC/IEEE bus command:

```
CALC:LIM:ACP ON
CALC:LIM:ACP:ACH 0dB,0dB
CALC:LIM:ACP:ACH:STAT ON
CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm
CALC:LIM:ACP:ACH:ABS:STAT ON
CALC:LIM:ACP:ALT1 0dB,0dB
CALC:LIM:ACP:ALT1:STAT ON
CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm
CALC:LIM:ACP:ALT1:ABS:STAT ON
CALC:LIM:ACP:ALT2 0dB,0dB
CALC:LIM:ACP:ALT2:STAT ON
CALC:LIM:ACP:ALT2:ABS -10dBm,-10dBm
CALC:LIM:ACP:ALT2:ABS:STAT ON
```



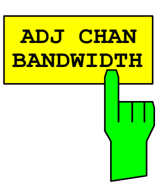

The *CHANNEL BANDWIDTH* softkey activates the entry of the channel bandwidth for the transmission channel.

The useful channel bandwidth is generally defined by the transmission method. In the WCDMA default setting, measurements are performed with a channel bandwidth of 3.84 MHz.

When measuring according to the IBW method (*FAST ACP OFF),* the channel bandwidth is marked by two vertical lines to the left and right of the screen center. It can thus be visually checked whether the entire power of the signal to be measured is within the selected channel bandwidth.

With the time domain method (*FAST ACP ON),* the measurement is performed in zero span. The channel limits are not marked in this case. The R&S Analyzer offers all available channel filters for selecting the channel bandwidth. Deviating channel bandwidths cannot be set. If deviating channel bandwidths are required, the IBW method should be used.

IEC/IEEE bus command: `SENS:POW:ACH:BWID 3.84MHz`




The ADJ *CHAN BANDWIDTH* softkey opens a table where the channel bandwidths for the adjacent channels can be defined.

| ACP CHANNEL BW | |
|---|---|
| CHAN | BANDWIDTH |
| ADJ | 3.84 MHz |
| ALT1 | 3.84 MHz |
| ALT2 | 3.84 MHz |

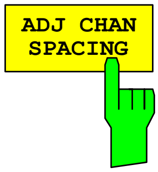
When measuring according to the IBW method (FAST ACP OFF), the bandwidths of the different adjacent channels are to be entered numerically. Since all adjacent channels often have the same bandwidth, the other channels ALT1 and ALT2 are set to the bandwidth of the adjacent channel on entering the adjacent-channel bandwidth (ADJ). Thus only one value needs to be entered in case of equal adjacent channel bandwidths. The same holds true for the ALT2 channels (alternate channels 2) when the bandwidth of the ALT1 channel (alternate channel 1) is entered.

***Note:*** *The bandwidths can be selected independently from each other by overwriting the table from top to bottom.*

With the time domain method (FAST ACP ON), the adjacent-channel bandwidths are selected from the list of available channel filters. For deviating adjacent-channel bandwidths, the IBW method should be used.

IEC/IEEE bus command:

```
SENS:POW:ACH:BWID:ACH 3.84MHz
SENS:POW:ACH:BWID:ALT1 3.84MHz
SENS:POW:ACH:BWID:ALT2 3.84MHz
```



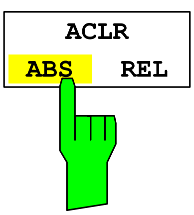

The ADJ *CHAN SPACING* softkey opens a table for defining the channel spacings.

| ACP CHANNEL SPACING | |
|---|---|
| CHAN | SPACING |
| ADJ | 5 MHz |
| ALT1 | 10 MHz |
| ALT2 | 15 MHz |

Since all adjacent channels often have the same distance to each other, the entry of the adjacent-channel spacing (ADJ) causes channel spacing ALT1 to be set to twice and channel spacing ALT2 to three times the adjacent-channel spacing. Thus only one value needs to be entered in case of equal channel spacing. The same holds true for the ALT2 channels when the bandwidth of the ALT1 channel is entered.

***Note:*** *The channel spacings can be set separately by overwriting the table from top to bottom.*

IEC/IEEE bus command: `SENS:POW:ACH:SPAC:ACH 5MHz`
`SENS:POW:ACH:SPAC:ALT1 10MHz`
`SENS:POW:ACH:SPAC:ALT2 15MHz`




The *CP/ACP ABS/REL* softkey (channel power absolute/relative) switches between absolute and relative power measurement in the channel.

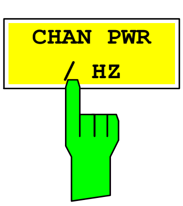
*ACLR ABS* The absolute power in the transmission channel and in the adjacent channels is displayed in the unit of the y-axis, e.g. in dBm.

*ACLR REL* In case of adjacent-channel power measurements (*NO. OF ADJ CHAN* > 0), the level of the adjacent channels is displayed relative to the level of the transmission channel in dBc.

With linear scaling of the y-axis, the power of the new channel is displayed relative to the reference channel ($CP/CP_{ref}$). With dB scaling, the logarithmic ratio 10lg ($CP/CP_{ref}$) is displayed.

Relative channel power measurement can thus also be used for universal adjacent-channel power measurements. Each channel can be measured individually.

IEC/IEEE bus command: `SENS:POW:ACH:MODE ABS`




The *CHAN PWR / HZ* softkey switches between the measurement of the total power in the channel and the power measurement with reference to 1 Hz bandwidth.

The conversion factor is $10 \cdot \lg \frac{1}{\text{Channel} \cdot \text{Bandwidth}}$.

IEC/IEEE bus command: `CALC:MARK:FUNC:POW:RES:PHZ ON|OFF`

For manual setting of the test parameters different from the settings made with *ADJUST SETTINGS* the following should be observed:

Frequency span

The frequency span has to cover at least all channels to be measured.
For channel power measurement this is the channel bandwidth.
If the frequency span is large compared to the frequency section (or frequency sections) under test, only a few pixels are available to be measured.

Resolution bandwidth (RBW)

To ensure both an acceptable measurement speed and the required selection (to suppress spectral components outside the channel to be measured, especially of the adjacent channels), the resolution bandwidth must not be selected too small or too large. As a general approach, the resolution bandwidth is to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be selected if the spectrum within the channel to be measured and around it has a flat characteristic.

Video bandwidth (VBW)

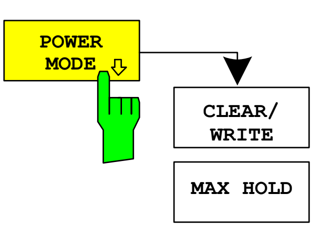
For a correct power measurement, the video signal must not be limited in bandwidth. A restricted bandwidth of the logarithmic video signal would cause signal averaging and thus result in a too low indication of the power (-2.51 dB at very low video bandwidths). The video bandwidth should therefore be selected at least three times the resolution bandwidth.

The *ADJUST SETTINGS* softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows:

$VBW \geq 3 \times RBW$.

Detector

The *ADJUST SETTINGS* softkey selects the RMS detector.
The RMS detector is selected since it correctly indicates the power irrespective of the characteristics of the signal to be measured. In principle, the sample detector would be possible as well. Due to the limited number of trace pixels used to calculate the power in the channel, the sample detector would yield less stable results. Averaging, which is often performed to stabilize the measurement results, leads to a too low-level indication and should therefore be avoided. The reduction in the displayed power depends on the number of averages and the signal characteristics in the channel to be measured.



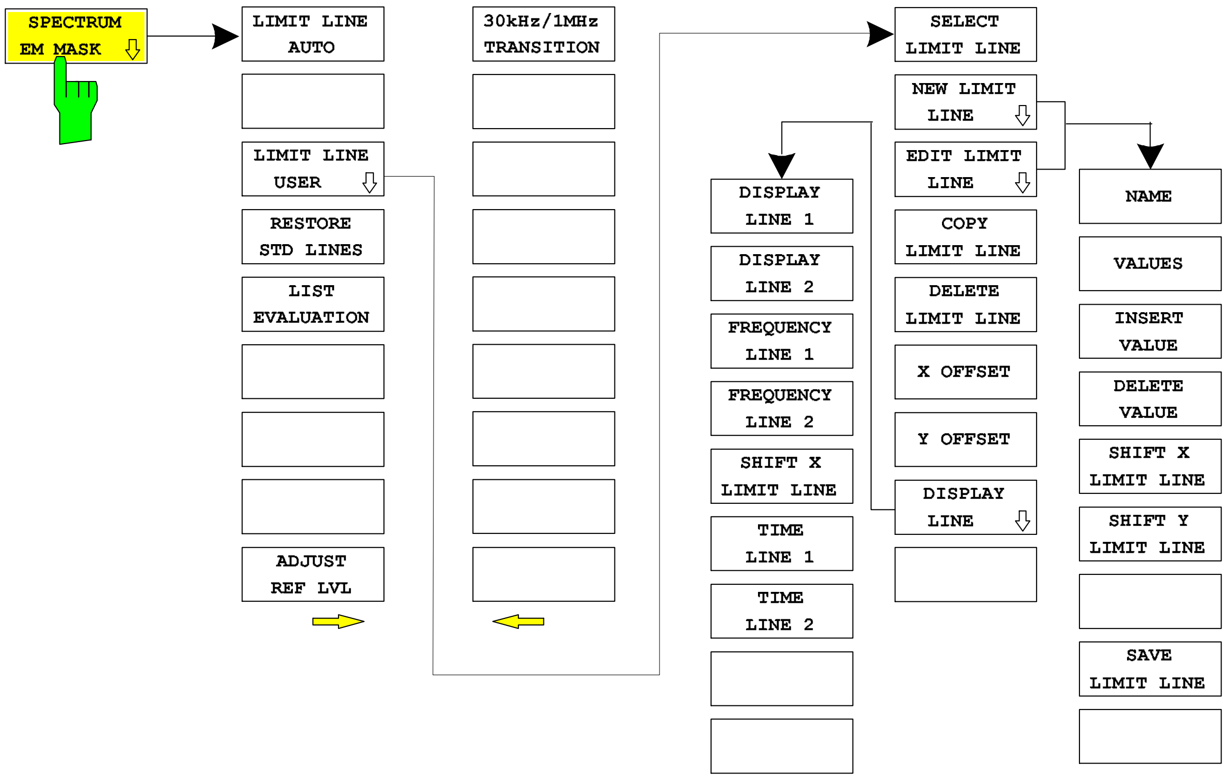

The POWER MODE submenu allows you to change between the normal (*CLEAR/WRITE*) and the MAX HOLD power mode. In the *CLEAR/WRITE* mode the channel power and the adjacent channel powers are calculated directly from the current trace. In *MAX HOLD* mode, the power values are still derived from the current trace, but they are compared with a maximum algorithm to the previous power value. The greater value is retained.

IEC/IEEE bus command:

`CALC:MARK:FUNC:POW:MODE WRIT|MAXH`

## Signal Power Check – SPECTRUM EM MASK

Key *MEAS*




The *SPECTRUM EM MASK* softkey starts the determination of the power of the 3GPP FDD signal in defined offsets from the carrier and compares the power values with a spectral mask specified by 3GPP.

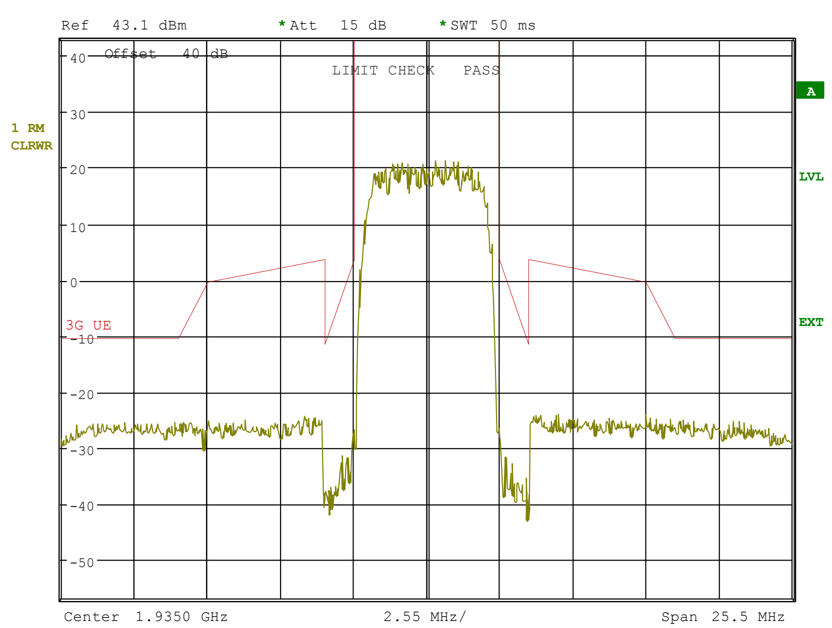


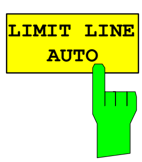

Fig. 6 Measurement of Spectrum Emission Mask.

Pressing the softkey activates the analyzer mode with defined settings:

| | | |
|---|---|---|
| SYSTEM PRESET | | |
| After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset<br>Center Frequency, Frequency Offset<br>Input Attenuation, Mixer Level<br>All trigger settings | | |
| CHAN PWR / ACP | CP / ACP ON | |
| CP / ACP STANDARD | W-CDMA 3GPP REV | |
| CP / ACP CONFIG | NO. OF ADJ CHAN | 0 |
| SPAN | | 25.5 MHz |
| BW | SWEEP TIME MANUAL | 50 ms |

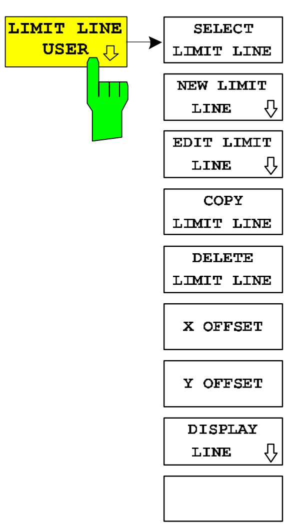
IEC/IEEE bus command: `:CONF:WCDPower:MEAS ESP`

Query of results: `:CALC:LIM:FAIL?` and visual evaluation




The *LIMIT LINE AUTO* softkey automatically calculates the limit line according to power determined in the useful channel. If the measurement is carried out in *CONTINUOUS SWEEP* and the channel power changes from sweep to sweep, this can result in the limit line being continuously redrawn.
The softkey is activated when the spectrum emission mask measurement is entered.

IEC/IEEE bus command: `CALC:LIM:ESP:MODE AUTO`




The *LIMIT LINE USER* softkey activates the input of user-defined limit lines. The softkey opens the menus of the limit line editor that are known from the basic unit.
The following limit line settings are useful for user equipment tests:
Trace 1, Domain Frequency, X-Scaling relative, Y-Scaling absolute, Spacing linear, Unit dBm
In contrast to the predefined limit lines supplied with the analyzer which correspond to the standard specifications, the user-defined limit line can be specified for the entire frequency range (±12.5 MHz from carrier) either relatively (referred to the channel power) or absolutely.

IEC/IEEE bus command: see

Table of Softkeys with Assignment of IEC/IEEE Commands

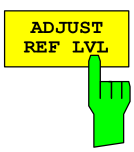

The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the state they were in when the unit was delivered. This prevents inadvertent overwriting of the standard lines.

IEC/IEEE bus command: `CALC:LIM:ESP:REST`


The softkey *LIST EVALUATION* reconfigures the SEM output to a split screen. In the upper half the trace with the limit line is shown. In the lower half the peak value list is shown. For every range of the spectrum emission defined by the standard the peak value is listed. For every peak value the frequency, the absolute power, the relative power to the channel power and the delta limit to the limit line is shown. As long as the delta limit is negative, the peak value is below the limit line. A positive delta indicates a failed value. The results are then colored in red, and a star is indicated at the end of the row, for indicating the fail on a black and white printout.
If the list evaluation is active, the peak list function is not available.

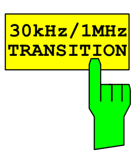
IEC/IEEE bus command: `CALC1:PEAK:AUTO ON | OFF`

With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on.




The *ADJUST REF LVL* softkey adjusts the analyzer reference level to the total signal power measured.
The softkey becomes active after the first sweep has been terminated with the measurement of the occupied bandwidth and the total signal power is known.
The adjustment of the reference level ensures that the instrument signal path is not overdriven and that the dynamic range is not limited by a reference level that is too low.

IEC/IEEE bus command: `SENS:POW:ACH:PRES:RLEV`

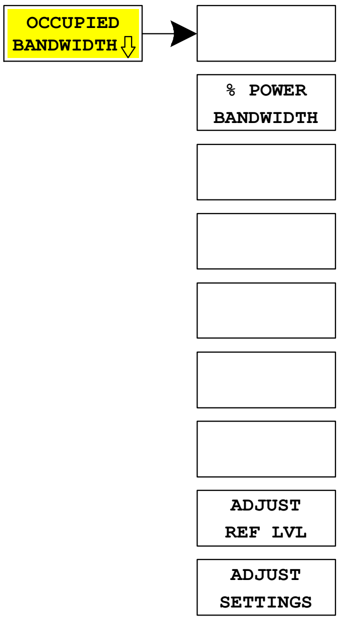



The *30kHz/1MHz TRANSITION* lsoftkey specifies the offset frequency at which the resolution bandwidth is changed between 30 kHz and 1 MHz.
The default value is 3.5 MHz.

IEC/IEEE bus command: `CALC2:LIM:ESP:TRAN 3 MHz`

## Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

Key *MEAS*




The *OCCUPIED BANDWIDTH* activates the measurement of the bandwidth of the signal.

The occupied bandwidth is defined as the bandwidth in which 99% of the total transmitter power is contained. The percentage of the signal power to be included in the bandwidth measurement can be changed. The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen.

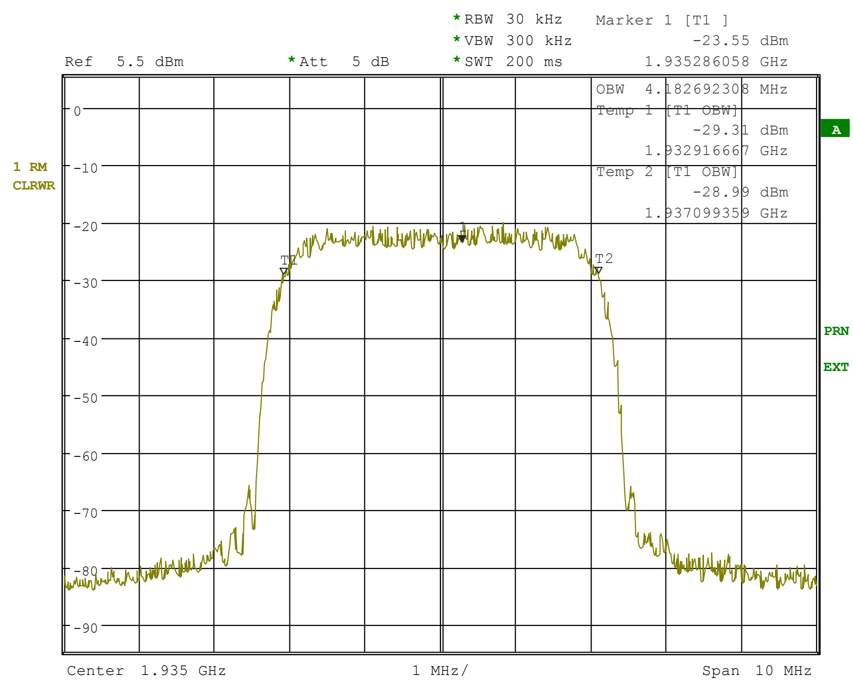


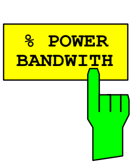

Fig. 7 Measurement of occupied bandwidth.

Pressing the softkey activates the analyzer mode with defined settings:

| | | |
|---|---|---|
| SYSTEM PRESET | | |
| After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset<br>Center Frequency, Frequency Offset<br>Input Attenuation, Mixer Level<br>All trigger settings | | |
| OCCUPIED BANDWITH | | |
| TRACE 1 | DETECTOR | RMS |

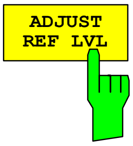
IEC/IEEE bus command: `CONF:WCDP:MEAS OBAN`

Query of results: `CALC:MARK:FUNC:POW:RES? OBAN`



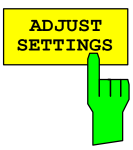

The *% POWER BANDWIDTH* softkey opens the entry of the percentage of power related to the total power in the displayed frequency range which defines the occupied bandwidth (percentage of total power).
The valid range of values is 10% to 99.9%.

IEC/IEEE bus command: `SENS:POW:BWID 99PCT`




The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small S/N ratio.
Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

IEC/IEEE bus command: `SENS:POW:ACH:PRES:RLEV`




The *ADJUST SETTINGS* softkey automatically optimizes the instrument settings for the selected power measurement (see below).
All instrument settings relevant for a power measurement within a specific frequency range (channel bandwidth) are optimized for the selected channel configuration (channel bandwidth, channel spacing):

- Frequency span:

  The frequency span has to cover at least all channels to be considered.
  When measuring the channel power, 2 x channel bandwidth is set as span.
  The setting of the span during adjacent-channel power measurement is dependent on the channel spacing and channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 with the largest distance from the transmission channel.

- Resolution bandwidth RBW $\leq$ 1/40 of channel bandwidth
- Video bandwidth VBW $\geq 3 \times$ RBW
- Detector RMS detector

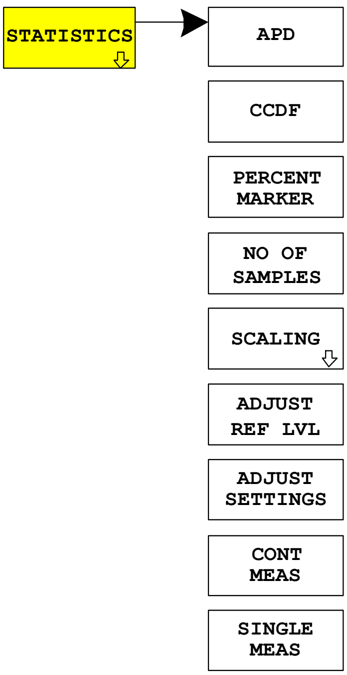
Trace math and trace averaging functions are switched off.
The reference level is not influenced by *ADJUST SETTINGS*. It can be separately adjusted with *ADJUST REF LVL.*

The adjustment is carried out only once; if necessary, the instrument settings can be changed later.

IEC/IEEE bus command: `SENS:POW:ACH:PRES OBW`

## Measurement of Signal Statistics

Key *MEAS*




The *STATISTICS* softkey starts a measurement of the distribution function of the signal amplitudes (complementary cumulative distribution function). The measurement can be switched to amplitude power distribution (APD) by means of the menu softkeys.

For the purposes of this measurement, a signal section of settable length is recorded continuously in the zero span, and the distribution of the signal amplitudes is evaluated. The record length and display range of the CCDF can be set using the softkeys of the menu. The amplitude distribution is displayed logarithmically as a percentage of the amount by which a particular level is exceeded, beginning with the average value of the signal amplitudes.

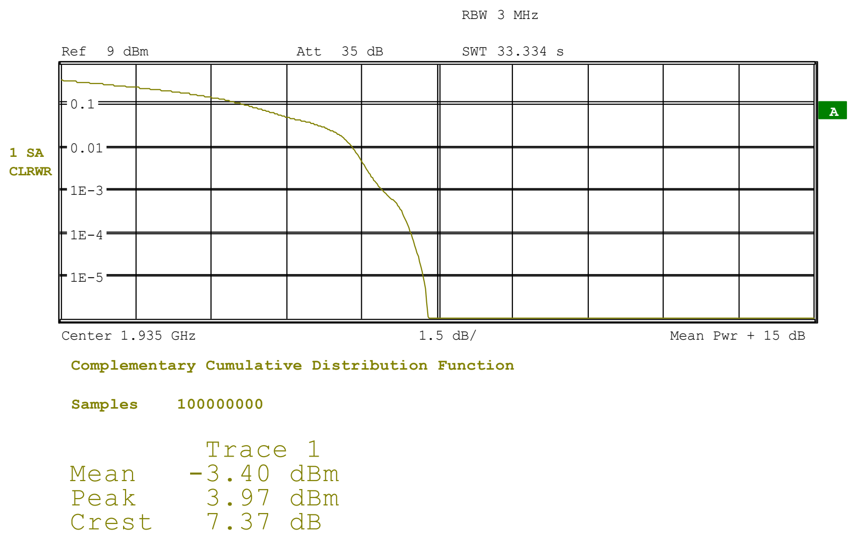



Fig. 8 CCDF of 3GPP FDD signal.

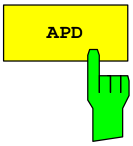
Pressing the softkey activates the analyzer mode with defined settings:

| | | |
|---|---|---|
| SYSTEM PRESET | | |
| After PRESET the following user-specific settings are restored and so the adaptation to the DUT is maintained: Reference Level , Reference Level Offset; Center Frequency, Frequency Offset; Input Attenuation, Mixer Level; All trigger settings | | |
| SIGNAL STATISTIC | | |
| TRACE1 | DETECTOR | SAMPLE |
| BW | RES BW MANUAL | 10 MHz |
| | VIDEO BW MANUAL | 5 MHz |

Starting from these settings, the instrument can be operated in all functions available in the analyzer mode, i.e. all test parameters can be adapted to the requirements of the specific measurement.

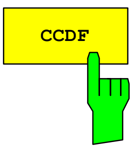
IEC/IEEE bus command: `:CONF:WCDP:MEAS CCDF`
or
`:CALCu:STAT:CCDF ON`

Query of results: `CALC:MARK:X?`




The *APD ON/OFF* softkey switches on the amplitude probability distribution function.
When the APD function is switched on, the CCDF function is switched off automatically.

IEC/IEEE bus command: `CALC:STAT:APD ON`

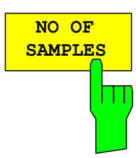



The *CCDF ON/OFF* softkey switches on the complementary cumulative distribution function.
When the CCDF function is switched on, the APD function is switched off automatically.

IEC/IEEE bus command: `CALC:STAT:CCDF ON`

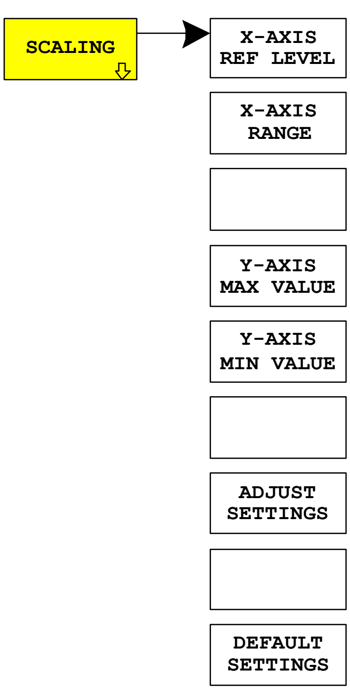

If the CCDF function is active, the *PERCENT MARKER* softkey allows to position marker 1 by entering a probability value. Thus, the power that is exceeded with a given probability can be determined very easily.
If marker 1 is in the switched-off state, it will be switched on automatically.

IEC/IEEE bus command: `CALC:MARK:Y:PERC 0...100%`




*NO OF SAMPLES* softkey sets the number of power measurements taken into account for the statistics.
Please note that the overall measurement time is influenced by the number of samples selected as well as by the resolution bandwidth set up for the measurement as the resolution bandwidth directly influences the sampling rate.

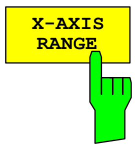
IEC/IEEE bus command: `CALC:STAT:NSAM <value>`




The *SCALING* softkey opens a sub menu that allows changing the scaling parameters for both the x- and the y-axis.

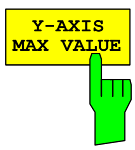

The *X-AXIS REF LEVEL* softkey changes the level settings of the instrument and sets the maximum power to be measured.
The function is identical to softkey *REF LEVEL* in menu *AMPT*.
For the *APD* function this value is mapped to the right diagram border. For the *CCDF* function there is no direct representation of this value on the diagram as the x-axis is scaled relatively to the *MEAN POWER* measured.

IEC/IEEE bus command: CALC:STAT:SCAL:X:RLEV <value>



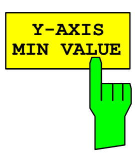

The *X-AXIS RANGE* softkey changes the level range to be covered by the statistics measurement selected.
The function is identical to softkey *RANGE LOG MANUAL* in menu *AMPT*.

IEC/IEEE bus command: CALC:STAT:SCAL:X:RANG <value>



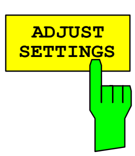

The *Y-AXIS MAX VALUE* softkey defines the upper limit of the displayed probability range.
Values on the y-axis are normalized which means that the maximum value is 1.0. As the y-axis scaling has a logarithmic axis the distance between max and min value must be at least one decade.

IEC/IEEE command: CALC:STAT:SCAL:Y:UPP <value>



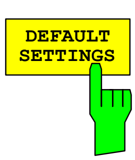

The *Y-AXIS MIN VALUE* softkey defines the lower limit of the displayed probability range.
As the y-axis scaling has a logarithmic axis the distance between max and min value must be at least one decade. Valid values are in the range 0 < value < 1.

IEC/IEEE bus command: CALC:STAT:SCAL:Y:LOW <value>




The *ADJUST SETTINGS* softkey optimizes the level settings of the analyzer according to the measured peak power in order to gain maximum sensitivity of the instrument.
The level range is adjusted according to the measured difference between peak and minimum power for APD measurement and peak and mean power for CCDF measurement in order to obtain maximum power resolution.
Additionally the probability scale is adapted to the selected number of samples.

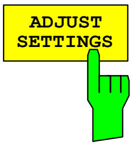
IEC/IEEE bus command: CALC:STAT:SCAL:AUTO ONCE




The *DEFAULT SETTINGS* softkey resets the x- and y-axis scaling to their PRESET values.

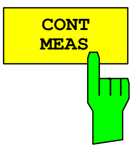
| | |
|---|---|
| x-axis reference level: | -20 dBm |
| x-axis range APD: | 100 dB |
| x-axis range CCDF: | 20 dB |
| y-axis upper limit: | 1.0 |
| y-axis lower limit: | 1E-6 |

IEC/IEEE bus command: CALC:STAT:PRES



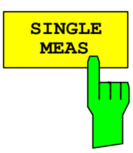

The *ADJUST SETTINGS* softkey optimizes the level settings of the analyzer according to the measured peak power in order to gain maximum sensitivity of the instrument.
The level range is adjusted according to the measured difference between peak and minimum power for APD measurement and peak and mean power for CCDF measurement in order to obtain maximum power resolution.
Additionally the probability scale is adapted to the selected number of samples.

IEC/IEEE bus command: `CALC:STAT:SCAL:AUTO ONCE`




The *CONT MEAS* softkey starts collecting a new sequence of sample data and calculating the APD or CCDF curve depending on the selected measurement. The next measurement is started automatically as soon as the indicated number of samples has been reached ("CONTinuous MEASurement").

IEC/IEEE bus command: `INIT:CONT ON;`
`INIT:IMM`




The *SINGLE MEAS* softkey starts collecting a new sequence of sample data and calculating the APD or CCDF curve depending on the selected measurement. At the beginning of the measurement previously obtained measurement results are discarded.

IEC/IEEE bus command: `INIT:CONT OFF;`
`INIT:IMM`

## Code Domain Measurements on 3GPP FDD Signals

Application Firmware R&S FS-K73 provides the peak code domain error measurement, an EVM measurement of the total signal (composite EVM), prescribed by the 3GPP standard, as well as the code domain power measurement of assigned and unassigned codes. In addition, the symbols demodulated in a slot, the decided bits or the EVM symbol can be displayed for an active channel.

Two signal recording modes are available with Application Firmware R&S FS-K73, depending on the spectrum analyzer on which the firmware is run:

- With Spectrum Analyzer R&S FSP, a section of approx. 2 ms is recorded. This section is searched for the beginning of an arbitrarily selected slot of the 3GPP FDD signal. All analyses are carried out for this slot only. This cuts processing time by a factor of ten compared with the analysis of a complete frame, i.e. it saves approx. 90% processing time.
- With Spectrum Analyzers R&S FSU or R&S FSQ, the user can choose between slot analysis (recording length approx. 2 ms) and frame analysis (recording length approx. 20 ms without multi frame capture), see *MEASURE SLOT/FRAME* softkey. In the latter case, the recorded signal section is searched for the beginning of a 3GPP FDD frame. Starting at the beginning of such a frame, 15 consecutive slots are analyzed. Frame analysis offers additional display modes compared with slot analysis:

  | | |
  |---|---|
  | *POWER VERSUS SLOT*: | display of channel power over complete frame |
  | *COMPOSITE EVM*: | display of composite EVM over all slots of a frame |
  | *PEAK CODE DOMAIN ERR*: | display of peak code domain error over all slots of a frame |

The two signal recording modes are described jointly in the following. For each softkey/each display mode it is stated to what recording mode it applies (slot or frame analysis). In figures, frame analysis is shown always. The two recording modes can be selected on the spectrum analyzers as follows:

| | |
|---|---|
| Slot analysis (result length one slot): | Spectrum Analyzer R&S FSP or<br>Spectrum Analyzer R&S FSU or R&S FSQ with *MEASURE SLOT* |
| Frame analysis (result length one frame): | Spectrum Analyzer R&S FSU or R&S FSQ with *MEASURE FRAME* |

Application firmware R&S FS-K73 offers two different ways of representing the code domain power measurement:

- Representation of all code channels

  Option R&S FS-K73 displays the power of all occupied code channels in a bar graph. The X-axis is scaled for the highest code class or the highest spreading factor (256). Code channels with a lower spreading factor occupy correspondingly more channels of the highest code class. The power of the code channel is always correctly measured in accordance with the actual power of the code channel. Unused code channels are assumed to belong to the highest code class and displayed accordingly. The displayed power of an unused code channel therefore corresponds to the power of a channel with the spreading factor 256 at the respective code position.
  To simplify identification, used and unused channels are displayed in different colours. Used channels are yellow, unused channels are blue.
- The measured power always refers to one slot. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.
- Representation of channel power versus slots of a 3GPP FDD signal frame (result length one frame only)

  In this case the power of a selectable code channel is indicated versus a frame. The power is always measured within one slot of the selected channel. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

The measurements symbol EVM, symbol constellation diagram and bitstream are always referred to one slot of the selected channel.

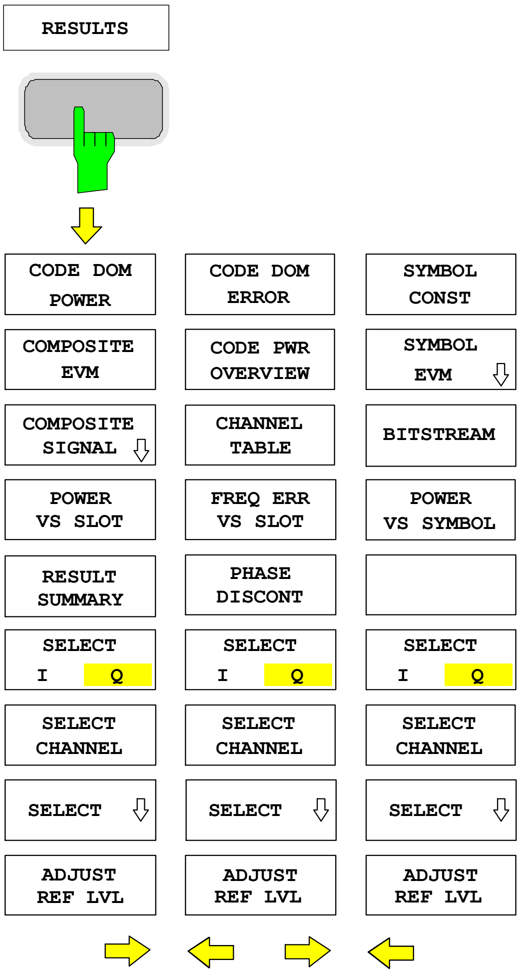
The composite EVM and peak code domain error measurements are always referred to the total signal.
For code domain power (CDP) measurements, the display is operated in the SPLIT SCREEN mode. Only those display modes having the codes of the class with the highest spreading factor as basis for the x-axis are permitted in the upper part of the screen, all other display modes are assigned to the lower part of the screen.

For code domain power measurement, R&S FS-K73 expects the Dedicated Physical Control Channel (DPCCH) to be part of the signal.

There are two modes for the CDP analysis. In the *CODE CHAN AUTOSEARCH* mode, R&S FS-K73 performs an automatic search for active channels in the whole code domain. The channel search is based on the power of the channels and on a signal/noise ratio that should not be exceeded within the channel. In the *CODE CHAN PREDEFINED* mode, the user can define the active channels contained in the signal via tables that can be selected and edited.

## Display modes – *RESULTS* hotkey

Hotkey *RESULTS*




The *RESULTS* hotkey opens a submenu for setting the display mode. The main menu contains the most important display modes as well as the measurements specified by the 3GPP standard for fast access, whereas the side menus contain more detailed display modes.

The following display modes are available:

CODE DOM POWER

Code domain power with relative or absolute scaling *(scaling depends on Toggle Key SETTINGS → CODE PWR ABS / REL)*

COMPOSITE EVM

(Square difference between test signal and ideal reference signal *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

COMPOSITE SIGNAL

Opens a submenu for display modes that refer to the composite signal (e.g. PEAK CODE DOMAIN ERROR). *(Parts of the displays frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

POWER VS SLOT

Power of the selected channel versus all slots of a 3GPP FDD signal frame. *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

RESULT SUMMARY

Tabular result display

CODE DOM ERROR

Projection of the error between the test signal and the ideal reference signal onto Code Class 8 (CC8) and subsequent averaging using the CC8 symbols of the selected channel slot of the difference signal. The error power is related to the total power of the selected slot and displayed for each code number of CC8.

CODE PWR OVERVIEW

Code domain power (I and Q component simultaneously)

CHANNEL TABLE

Display of channel occupation table

FREQ ERR VS SLOT

Display of frequency error versus slot. *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

PHASE DISCONT

Display of phase discontinuity versus slot . *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

POWER VS SYMBOL

Display of symbol power at the selected slot

SYMBOL CONST
Display of constellation diagram

SYMBOL EVM
Display of error vector magnitude diagram

BITSTREAM
Display of decided bits

SELECT I/Q
The displayed component of the signal can be selected.

SELECT CHANNEL
By entering a channel number (*SELCT CHANNEL* softkey) in the modes *CODE DOM POWER or CHANNEL TABLE,* it is possible to mark a channel for more detailed display modes

POWER VS SLOT
RESULT SUMMARY
POWER VS SYMBOL
SYMBOL CONST
SYMBOL EVM
BITSTREAM

SELECT
Opens a submenu for entering display configuration parameters (e.g. slot selection)

SELECT SLOT: *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME).* In the following display modes, a slot can be marked by entering a slot number using the *SELECT SLOT* softkey:

*POWER VS SLOT*
*PEAK CODE DOMAIN ERROR*
*COMPOSITE EVM*
*FREQ ERR VS SLOT*
*PHASE DISCONT*

The following measurement results are displayed for the selected slot:

*CODE DOMAIN POWER*
*RESULT SUMMARY*
*CODE DOMAIN ERROR POWER*
*CHANNEL TABLE*
*POWER VS SYMBOL*
*SYMBOL CONST*
*SYMBOL EVM*
*BITSTREAM*

ADJUST REF LVL
Optimal matching of the reference level to the signal level can be achieved.

Above the diagram, the most important measurement settings, which form the basis of the display modes, are summarized:

```
Code Power Relative                    SR 960 ksps
                                       Chan 2 / Q
CF 1.935 GHz       Slot #  0           Meas Int Slot
```

Fig. 9 Indication of measurement parameters

The different elements are:

1st column:

| | |
|---|---|
| Code Power Relative: | Name of selected display mode |
| {empty} | |
| CF 1.935 GHz: | Center frequency of signal |

2nd column:

{empty}

{empty}

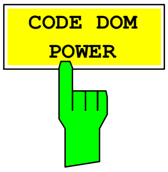
Slot # 0: Slot number (value of *SELECT SLOT* softkey)

This value is only displayed at a result length of one frame. The entry is coupled with the softkey *SLOT RES HALF / FULL*: If *SLOT RES FULL* is chosen, values will be from 0 to 14. At *SLOT RES HALF* values will be from 0 to 29 while the caption turns from Slot # to HSlot #.

3rd column:

| | |
|---|---|
| SR 960 ksps: | Symbol rate of selected channel |
| Chan 2 / Q: | Spreading code of selected channel |
| Meas Int Slot: | Measurement interval for graphical displays (see *MEAS INT HALF / FULL* softkey) |

***Note:*** *For the peak code domain error display mode, the indication of the symbol rate is replaced by the indication of the spreading factor onto which the error is projected (see PEAK CODE DOMAIN ERR softkey)*




The *CODE DOM POWER* softkey selects the code domain power display mode.

The scaling of the displayed result depends on the softkey SETTINGS → CODE PWR ABS / REL. In case of a relative display (REL), the power of the channels is referenced to the total power of the selected slot. The values are specified in dB. In case of a absolute display (ABS), the absolute power values are specified in dBm.

The measurement interval for determining the power of the channels depends on the value of softkey *SLOT RES HALF / FULL*: For *SLOT RES FULL* the measurement interval is one complete slot (2560 chips), while for *SLOT RES HALF* the length of the measurement interval turns to one half slot (1280 chips). The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

In the *CODE CHAN AUTOSEARCH* mode, a data channel is designated as active if its power has a minimum value compared to the total power of the signal and if a minimum signal/noise ratio is maintained within the channel.
In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

The received pilot symbols of the DPCCH are compared to the prescribed pilot symbols of the 3GPP standard. If some of these pilot symbols are not equal to the symbols of the 3GPP standard a message "INCORRECT PILOT" is displayed.

By entering a channel number (see *SELECT CHANNEL* softkey) it is possible to mark a channel for more detailed display modes. The marked channel is shown in red. The whole channel is marked if it is an assigned channel, and only the entered code is marked in the case of an unassigned code.
The display mode for the path of representation and the slot can be varied using the *SELECT I/Q* and *SELECT SLOT* (frame analysis only) softkeys.
Selecting other display modes (e.g. SYMBOL CONSTELLATION) for unassigned codes is possible but not useful since the results are not valid.
The figure shows the relative CDP representation of the Q path for 3 data channels that are active in this path.

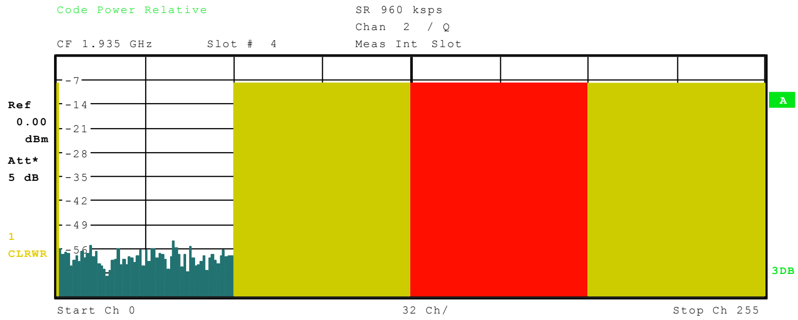
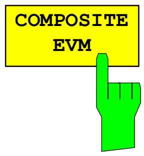



Fig. 10 Code domain power, branch Q

IEC/IEEE bus command:

```
:CALC1:FEED "XPOW:CDP"
:CALC1:FEED "XPOW:CDP:ABS"
:CALC1:FEED "XPOW:CDP:RAT"
```




The *COMPOSITE EVM* softkey selects the composite EVM display mode according to 3GPP specification. The softkey is only valid if one frame of the 3GPP signal is analyzed.

During the composite EVM measurement, the square root of the squared errors between the real and imaginary parts of the test signal and an ideal reference signal (EVM referred to the total signal) is determined. Composite EVM thus is a measurement of the composite signal.

The measurement result consists of one composite EVM measurement value per slot or half slot, depending on the value of softkey *SLOT RES HALF / FULL*. For *SLOT RES FULL*, this results in a total of 15 values to be displayed for composite EVM. For *SLOT RES HALF* the number of values displayed will turn to 30. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized, the difference between the measurement and reference signal and the composite EVM is very high.

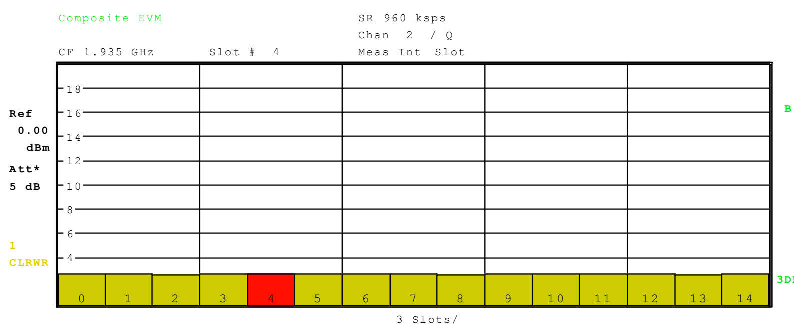
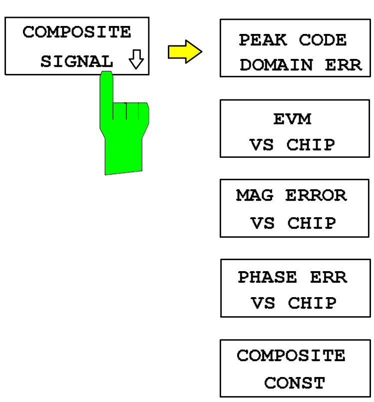



Fig. 11 Display of composite EVM

IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:MACC"`




The *COMPOSITE SIGNAL* softkey opens a submenu for evaluation dispays of the compsite WCDMA signal versus time. Different measurements are supported:

PEAK CODE DOMAIN ERR

Projection of the error between the test signal and the ideal reference signal onto Code Class 8 and subsequent summation using the symbols of each slot of the difference signal. *(Frame mode only reference to SETTINGS → MEASURE SLOT / FRAME)*

EVM VS CHIP

Square root of square difference between received signal and reference signal at chip level, displayed for each chip.

MAG ERROR VS CHIP

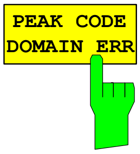
Difference between the amplitude of the received signal and the reference signal at chip level, displayed for each chip.

PHASE ERR VS CHIP

Phase difference between the received signal vector and the reference signal vector at chip level, displayed for each chip.

COMPOSITE CONST

Constellation diagram of received signal (scrambled chips):




The *PEAK CODE DOMAIN ERR* softkey selects the peak code domain error display mode. The softkey is only valid if one frame of the 3GPP signal is analyzed.

In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal is projected onto spreading factor 256. This spreading factor can be changed via a table that is shown after the *PEAK CODE DOMAIN ERR* softkey has been pressed. The spreading factor the signal is projected onto is indicated within the measurement parameters shown above the peak code domain error diagram.

The measurement result consists of one peak code domain error measurement value per slot or half slot, depending on the value of softkey *SLOT RES HALF / FULL*. For *SLOT RES FULL*, this results in a total of 15 values to be displayed for peak code domain error. For *SLOT RES HALF* the number of values displayed will turn to 30. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.

Only the channels recognized as active are used to generate the ideal reference signal for the peak code domain error. If an assigned channel is not recognized, the difference between the measurement and reference signal is very high. R&S FS-K73 consequently indicates a peak code domain error that is too high.

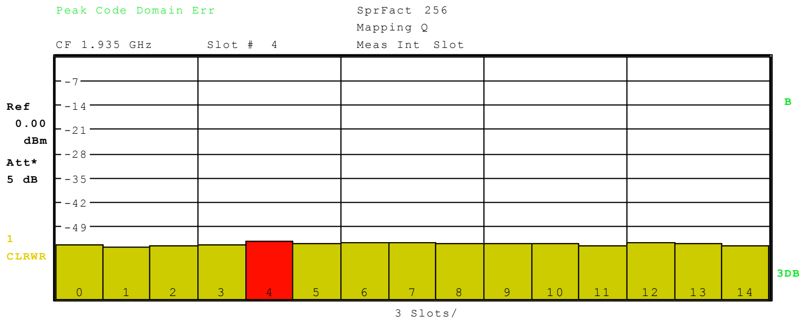
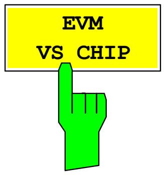



Fig. 12 Display of Peak code domain error

IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:ERR:PCD"`




The *EVM VS CHIP* activates the Error Vector Magnitude (EVM) versus chip display. In case of *SLOT RES FULL* (see softkey *SLOT RES HALF / FULL*), the EVM is displayed for all chips of the slected slot, in case of *SLOT RES HALF*, EVM is displayed for the chips of one half slot. The selected slot / halfslot can be varied by the *SELECT SLOT* softkey. Possible entries for the *SELECT SLOT* softkey are 0 to 14 for *SLOT RES FULL* and 0 to 29 for *SLOT RES HALF*.

The EVM is calculated to be the root of the squared difference between the received and reference signal. The reference signal is estimated out of the channel configurations of all active channels. The EVM is given in percent referred to the square root of the mean power of the reference signal.

$$EVM_k = \sqrt{\frac{|s_k - x_k|^2}{\frac{1}{N}\sum_{n=0}^{N-1}|x_n|^2}} \cdot 100\% \quad | \quad N = 2560 \quad | \quad k \in [0 \ldots (N-1)]$$

where:

| | | |
|---|---|---|
| $EVM_k$ | - | vector error of the chip EVM of chip number k |
| $s_k$ | - | complex chip value of received signal |
| $x_k$ | - | complex chip value of reference signal |
| k | - | index number of the evaluated chip |
| n | - | index number for mean power calculation of reference signal. |
| N | - | number of chips at each CPICH slot |

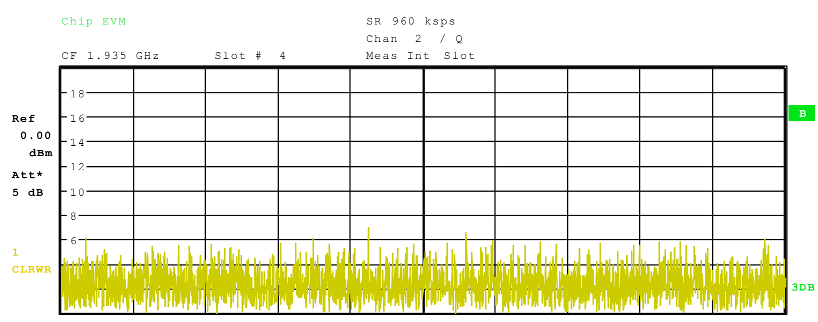


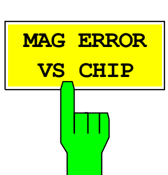

Fig. 13 Display of chip EVM

IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:CHIP:EVM"`

Query of result: `:TRACe:DATA? TRACe2`

Unit: [%]

Range: [0 % ... 100 %]




The *MAG ERROR VS CHIP* softkey activates the Magnitude Error versus chip display. In case of *SLOT RES FULL* (see softkey *SLOT RES HALF / FULL*), the magnitude error is displayed for all chips of the slected slot, in case of *SLOT RES HALF*, magnitude error is displayed for the chips of one half slot. The selected slot / halfslot can be varied by the *SELECT SLOT* softkey. Possible entries for the *SELECT SLOT* softkey are 0 to 14 for *SLOT RES FULL* and 0 to 29 for *SLOT RES HALF*.

The magnitude error is calculated to be the difference between the magnitudes of the received and reference signal. The reference signal is estimated out of the channel configurations of all active channels. The magnitude error is given in percent referred to the square root of the mean power of the reference signal.

$$MAG_k = \frac{|s_k| - |x_k|}{\sqrt{\frac{1}{N}\sum_{n=0}^{N-1}|x_n|^2}} \cdot 100\% \quad | \quad N = 2560 \quad | \quad k \in [0 \ldots (N-1)]$$

where:
- $MAG_k$ - magnitude error of chip number k
- $s_k$ - complex chip value of received signal
- $x_k$ - complex chip value of reference signal
- k - index number of the evaluated chip
- n - index number for mean power calculation of reference signal
- N - number of chips at each CPICH slot

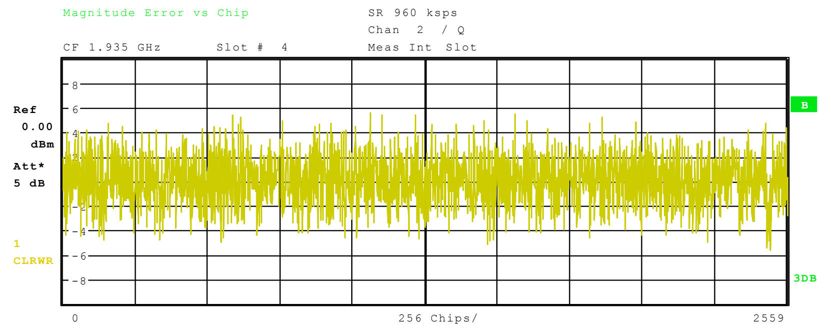


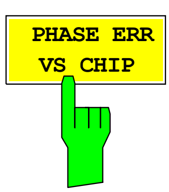

Fig. 14 Display of magnitude error versus chip

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:CHIP:MAGNitude"`

Query of result: `:TRACe:DATA? TRACe2`

UNIT: [%]

Range: [-100% … 100%]




The *PHASE ERROR VS CHIP* softkey activates the Phase Error versus chip display. In case of *SLOT RES FULL* (see softkey *SLOT RES HALF / FULL*), the phase error is displayed for all chips of the slected slot, in case of *SLOT RES HALF*, the phase error is displayed for the chips of one half slot. The selected slot / halfslot can be varied by the *SELECT SLOT* softkey. Possible entries for the *SELECT SLOT* softkey are 0 to 14 for *SLOT RES FULL* and 0 to 29 for *SLOT RES HALF*.

The phase error is calculated to be the difference between the phases of the received and reference signal. The reference signal is estimated out of the channel configurations of all active channels. The magnitude error is given in grad ranging from -180° to 180°.

$$PHI_k = \varphi(s_k) - \varphi(x_k) \quad | \quad N = 2560 \quad | \quad k \in [0 \ldots (N-1)]$$

where:
- $PHI_k$ - phase error of chip number k
- $s_k$ - complex chip value of received signal
- $x_k$ - complex chip value of reference signal
- k - index number of the evaluated chip
- N - number of chips at each CPICH slot
- $\varphi(x)$ - phase calculation of a complex value

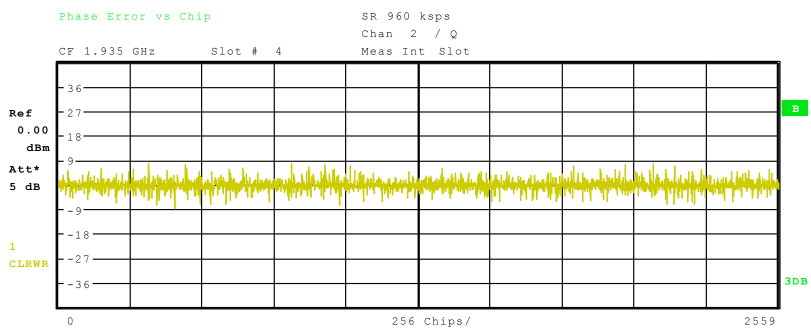


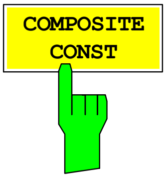

Fig. 15 Display of phase error versus chip

IEC/IEEE bus command: `:CALCulate2:FEED "XTIM:CDP:CHIP:PHASe"`

Query of result: `:TRACe:DATA? TRACe2`

UNIT: [°]

Range: [-180° … 180°]




The *COMPOSITE CONST* softkey selects the display of the constellation diagram for the chips of all channels. The displayed constellation points are normalized to the square root of the total power.

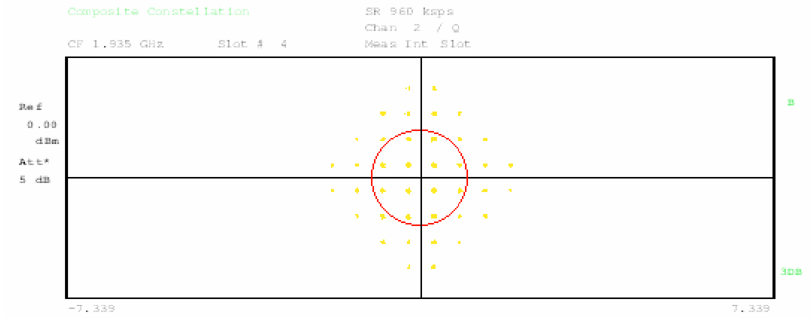
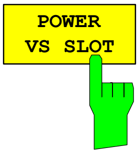



Fig. 16 Display of composite constellation diagram (scrambled chips)

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:COMP:CONS"`

Query of result:: `TRACe:DATA? TRACe2`

Output: Liste der I/Q-Werte aller Chips pro Slot
Format: $Re_1,Im_1,Re_2,Im_2,....,Re_{2560},Im_{2560}$
Unit: [1]




The *POWER VS SLOT* softkey selects the indication of the power of the selected code channel depending on the slot number. The power of the selected channel (marked red in the CDP diagram) is displayed versus all slots of a frame of the 3GPP FDD signal. The softkey is only valid if one frame of the 3GPP signal is analyzed.

Beginning at the start of the 3GPP FDD frame, 15 or 30 successive slots are displayed, depending on the value of the *SLOT RES HALF / FULL* softkey. The power is shown in absolute scaling.

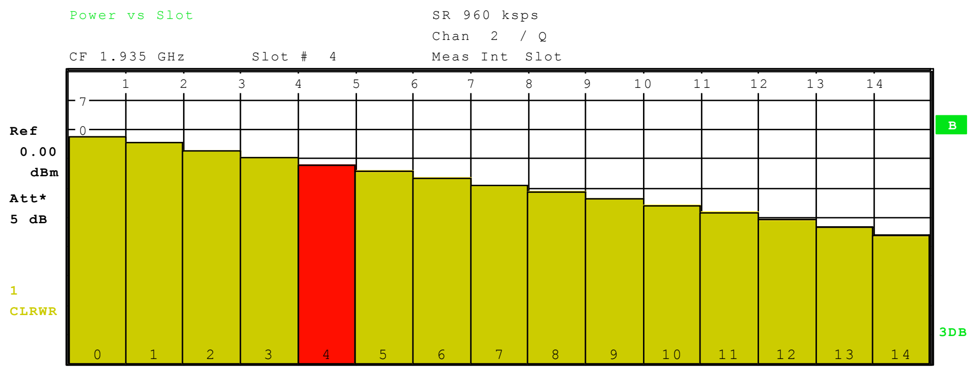



Fig. 17 Power versus Slot measurement for an active channel

It is not only possible to select a code channel in the CDP diagram, but also to mark a slot in the power-versus-slot diagram. Marking is done by entering the slot number (see *SELECT SLOT* softkey) and the selected slot is marked in red. For more detailed displays, the marked slot of the channel is selected (see SLOT # entry in the function panels above the diagrams in the Figures).

Modifying a slot number has the following effects:

- The CDP diagram in the upper half of the display is updated referred to the entered slot number.
- All results that depend on the selected slot are recalculated for selected channel. The relevant graphics are updated.

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:PVSL"`


The *RESULT SUMMARY* softkey selects the numerical display of all results. The display is subdivided as follows:

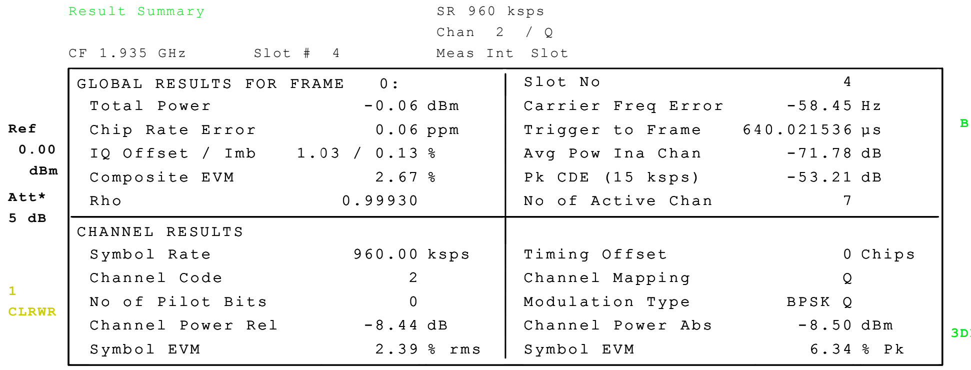



Fig. 18 Display of Result Summary

The upper part contains the results relating to the total signal:

Slot No: Number of slot for which the measurement is done (see *SELECT SLOT* softkey). The entry is only valid if one frame of the 3GPP signal is analyzed. Due to the possibility of analyzing either a complete slot or half of a slot (see *SLOT RES HALF / FULL* softkey), this entry will be written "Slot No" in case of *SLOT RES FULL* with ranging 0 to 14 or "Halfslot No" in case of *SLOT RES HALF* with ranging 0 to 29.

Total Power: Outputs the total signal power (average power of total evaluated 3GPP FDD frame).

Carrier Freq Error:
Outputs the frequency error referred to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error.
Differences of more than 1 kHz between transmitter and receiver frequency impair the synchronization of the CDP measurement. For this reason, the transmitter and receiver should be synchronized (see chapter Getting Started).

Chip Rate Error:
Outputs the chip rate error in ppm
As a result of a high chip rate error symbol errors arise and the CDP measurement is possibly not synchronized to the 3GPP FDD signal. The result is valid even if the synchronization of analyzer and signal failed.

Trigger to Frame:
This result outputs the timing offset from the beginning of the recorded signal section to the start of the analyzed 3GPP FDD frame. In the case of triggered data collection, this timing offset is identical with the timing offset of frame trigger (+ trigger offset) – frame start. In the case of failure of the synchronization of analyzer and 3GPP FDD signal, the value of Trigger to Frame is not significant.

IQ Offs / Imb: DC offset and IQ imbalance of the signal in % (see "Explanation of IQ impairment model").

Av Pow Ina Chan: The power in the code domain of all inactive channels is averaged to give the user an overview on the difference between active and inactive channels.

Composite EVM: The composite EVM is the difference between the test signal and the ideal reference signal (see *COMPOSITE EVM* softkey). The composite EVM value for the selected slot is given in the *RESULT SUMMARY*.

Pk CDE: The *Pk CDE* measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see *PEAK CODE DOMAIN ERR* softkey). The Pk CDE value for the selected slot is indicated in the *RESULT SUMMARY*. The spreading factor onto which projection is made is shown beneath the measurement result.

Rho: Quality paramter rho for every slot.

No of Active Chan:
Indicates the number of active channels detected in the signal. Both the detected data channels and the control channels are considered active channels.

The results of measurements on the selected channel (red in the CDP diagram) are displayed in the lower part of the *RESULT SUMMARY*.

Symbol Rate: Symbol rate at which the channel is transmitted.

Timing Offset: Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD frame.

Channel Code: Number of the spreading code of the selected channel.

Chan Mapping: Component onto which the channel is mapped (I or Q)

No of Pilot Bits: Indicates the number of pilot bits detected in the control channel.

Modulation Type: Indicates the modulation type of the selected channel. Valid entries are BPSK I for channels on branch I, BPSK Q for channels on branch Q and NONE for inactive channels.

Chan Pow rel. / abs.:
Channel relative (referred to the total power of the signal) and absolute.

Symbol EVM Pk / rms:
Peak or average of the results of the error vector magnitude measurement (see SYMBOL EVM softkey). The measurement provides information on the EVM of the channel (marked red) in the CDP diagram in the slot (marked red) of the power-versus-slot diagram at symbol level.

IEC/IEEE bus command:

```
:CALC2:FEED "XTIM:CDP:ERR:SUMM"
:CALC1:MARK1:FUNC:WCDP:RES?
                          PTOT | FERR | TFR | TOFF | MACC |
                          PCD | EVMR | EVMP | CERR |
                          SRAT | CHAN | CDP | CDPR |
                          IQOF | IQIM | PSYM | RHO | TOFF|
                          MTYP | ACH | MPIC
```

**Explanation of IQ impairment model**

In RF devices including analog mixers such as up-converter, the analog complex base band signal (r(t)=rI(t)+j*rQ(t)) is shifted to a real high frequency signal (sHF(t)) (Fig. 19). Each non-ideal complex mixer adds IQ impairments to the base band signal. Two of them, the IQ offset and the IQ imbalance are estimated by the R&S FS-K73. Both values are given in the Result Summary display. The estimation and display of IQ offset and IQ imbalance do NOT depend on the status of the NORMALIZE ON/OFF key. The key only controls an algorithm which compensates the IQ offset to normalize the constellation diagram to the origin.

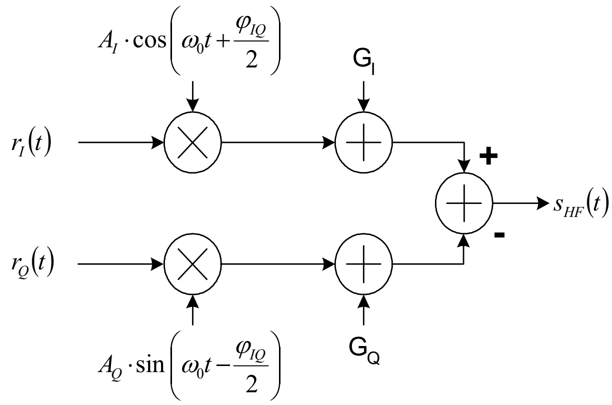



Fig. 19 Basic model of possible IQ impairment parameters in complex up converter devices.

IQ Offset The IQ offset is given in the Result Summary display. It represents a complex offset which leads to a shifted composite constellation diagram. The value is given relative to the mean power of the signal. It is calculated as follows:

$$offset_{IQ} = |g| \cdot 100\% = \sqrt{\left|g_I + j \cdot g_Q\right|^2} \cdot 100\% = \sqrt{\frac{G_I^2 + G_Q^2}{\frac{1}{T}\int_0^T |r(t)|^2 dt}} \cdot 100\%$$

where: |g| - magnitude of the relative IQ offset
$g_I$ - relative IQ offset of the real part
$g_Q$ - relative IQ offset of the imaginary part
$G_I$ - absolute IQ offset of the real part
$G_Q$ - absolute IQ offset of the imaginary part
r(t) - complex base band signal (reference signal matching with optimum EVM assuming that AWGN is given)
T - evaluation time (T=666µs → 1 slot)
$offset_{IQ}$ - IQ offset parameter

IQ Imbalance The IQ imbalance is given in the Result Summary display. It represents a complex gain error between the mixer gain in the I path and the mixer gain in the Q path. We assume that a base band signal r(t) is multiplied by a complex analog oscillator with radian frequency $\omega_0 = 2\pi * f_0$ Fig. 19). The complex signal r(t) can be split into a real part $\{r_I(t)\}$ and an imaginary part $\{r_Q(t)\}$. Using this assumption, an ideal complex local oscillator ($LO_{ideal}$) can also be described by two real sinusoidal signals with a phase offset of 90°. These signals are described as $\cos(\omega_0 t)$ and $\sin(\omega_0 t)$.

$$LO_{ideal} = A \cdot \exp(j\omega_0 t) = A \cdot \cos(\omega_0 t) + j \cdot A \cdot \sin(\omega_0 t)$$

The local oscillator is not ideal in an analog mixer. Normally there are two different amplitude values ($A_I$ and $A_Q$) in each (Fig. 19) path. Moreover, an unwanted phase shift ($\varphi_{IQ}$) between the real part and the imaginary part of the local oscillator ($LO_{impairment}$) may occur. Considering these impairments a non ideal LO can be described as follows:

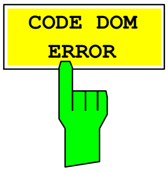
$$LO_{impairment} = A_I \cdot \cos\left(\omega_0 t + \frac{\varphi_{IQ}}{2}\right) + j \cdot A_Q \cdot \sin\left(\omega_0 t - \frac{\varphi_{IQ}}{2}\right)$$

The IQ imbalance expresses the relative gain error of the mixer. It is calculated as follows:

$$imbalance_{IQ} = \sqrt{\frac{\left|A_I \cdot \exp\left(j\frac{\varphi_{IQ}}{2}\right) - A_Q \cdot \exp\left(-j\frac{\varphi_{IQ}}{2}\right)\right|^2}{\left|A_I \cdot \exp\left(j\frac{\varphi_{IQ}}{2}\right) + A_Q \cdot \exp\left(-j\frac{\varphi_{IQ}}{2}\right)\right|^2}} \cdot 100\%$$

where: $A_I$ - amplitude mixer gain of the real part
$A_Q$ - amplitude mixer gain of the imaginary part
$\varphi_{IQ}$ - additional phase shift between real part and imaginary part
$imbalance_{IQ}$ - IQ imbalance parameter

**Note:** *In 3GPP UPLINK signals, each code channel is BPSK-modulated. The BPSK symbols are sent to the I path or Q path. This is controlled by higher layer functionalities. In signals of lower data rates with only one data channel, IQ impairments may affect the detected code channel configuration. IQ impairments result in a power leakage from the I path to the Q branch and vice versa. This power leakage increases the channel power in the non-active channels and slightly decreases the power in the active channels. If the IQ impairments are enlarged, the leakage power is also enlarged and may cause a false detection of non-active channels in the code channel. If these leakage power code channels are detected as active channels, the displayed values of the IQ impairments and composite error vector magnitude (EVM) are decreased.*
*The displayed IQ impairments and the EVM value are calculated based on a comparison between an estimated ideal base band signal and the received signal. The fact that it depends on the detected channel configuration can be explained as follows: the estimated ideal signal based on a channel configuration including these additionally detected leakage power channels matches far better with the received signal than the estimated ideal signal. This estimated ideal signal is based on a channel configuration of actually sent active channels.*
*A false detection of leakage power channels is indicated in the code domain power display (CDP) where all active channels are highlighted in yellow. All active channels are yellow. Yellow channels of low power and high data rate are most likely code channels. To suppress these channels, a PREDEFINED channel table can be used. A predefined channel table can be set via the CHAN CONF menu. This menu is selected by a softkey at the bottom of the screen.*




The *CODE DOM ERROR* softkey selects the code domain error power (CDEP) display mode. The displayed error power is always referred to the total power.
The code domain error power (CDEP) is calculated by subtracting a chip-stream of a generated reference signal ($chip_{ref}$) from the received chips ($chip_{rec}$). This difference signal is de-spread to all 256 code channels of code class 8 ($Dspr_n$). The average power of the error symbols of the selected slot is related to the total power of the selected slot. The measurement interval for determining the CDEP of the channels is one slot or one half slot, depending on *SLOT RES HALF / FULL*: at *SLOT RES FULL* one complete slot is used for determining the CDEP, at *SLOT RES HALF* half of a slot is used.

$$CDEP = \frac{\frac{1}{N}\sum_{n=1}^{N}\left[\mathrm{Re}\left\{Dspr_n\left(chip_{rec} - chip_{ref}\right)\right\}^2 + \mathrm{Im}\left\{Dspr_n\left(chip_{rec} - chip_{ref}\right)\right\}^2\right]}{\frac{1}{N}\sum_{n=1}^{N}\left[\mathrm{Re}\left\{Dspr_n\left(chip_{ref}\right)\right\}^2 + \mathrm{Im}\left\{Dspr_n\left(chip_{ref}\right)\right\}^2\right]}$$

The powers of the active channels and of the unassigned codes are shown in different colours:

- yellow: active channels
- blue: unassigned codes

The CDEP is calculated for each channel of code class 8 (CC8). In case of an active code channel of a lower code class, all included CC8 channels are marked yellow. The power is displayed for each CC8 channel and not subsumed for all CC8 channels of the active channel.

By entering a channel number (see *SELECT CHANNEL* softkey), it is possible to mark a channel for more detailed display modes. The first CC8 code channel of a marked channel of a lower code class is shown in red.

The figure below shows the I and Q branch with no code domain error.

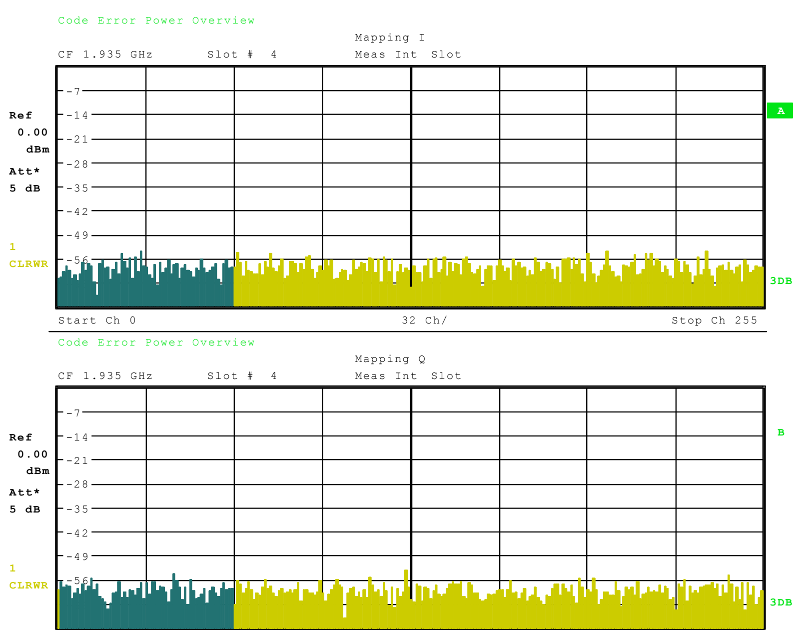



Fig. 20 Code domain error display: Signal with no code domain error in the I and Q branch

If a channel is not detected, a code domain error will occur. The power level of the error is similar to the power of the CC8 channels in the code range of the undetected code. This case is shown in the figure below.

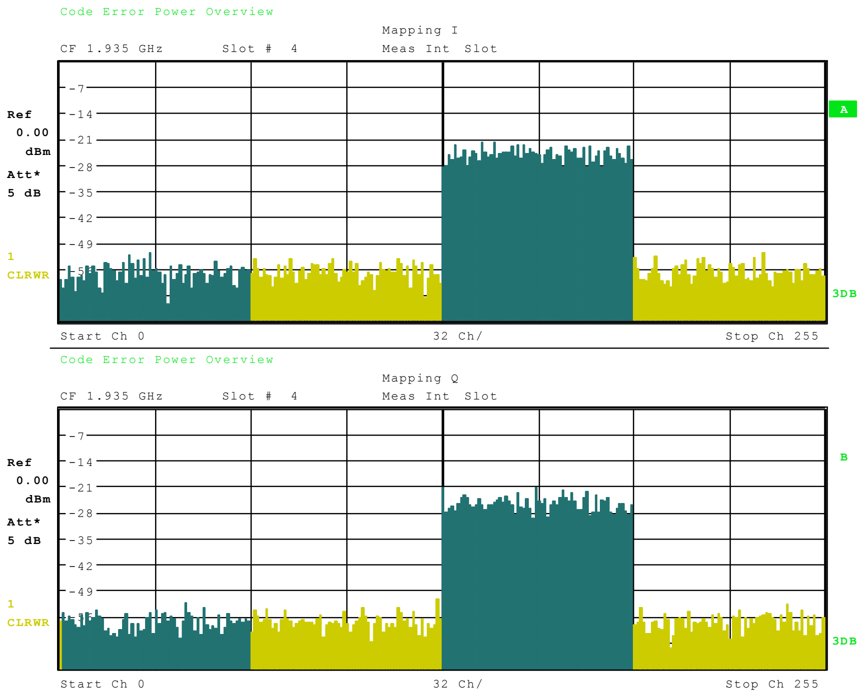



Fig. 21 Code domain error power with an unrecognized code channel in the I and Q branch.

IEC/IEEE bus command: :CALCulate<1>:FEED "XPOWer:CDEP"

Query of result: :TRAC1:DATa? TRAC1

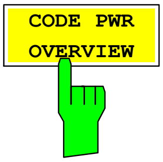
Output: CDEP list of each CC8 channel

Format: <code class>$_{1}$, <code number>$_{1}$, <CDEP>$_{1}$, <channel flag>$_{1}$,
<code class>$_{2}$, <code number>$_{2}$, <CDEP>$_{2}$, <channel flag>$_{2}$,
,....,
<code class>$_{256}$, <code number>$_{256}$, <CDEP>$_{256}$, <channel flag>$_{256}$

Unit: < [1] >, < [1] >, < [dB] >,< [1] >
Range: < 8 > , < 0...256 >, < -∞ ... ∞ >, < 0 ; 1 >
Quantity: 256

Code class: Highest code class of a WCDMA signal is always set to 8 (CC8)
Code number: Code number of the evaluated CC8 channel
CDEP: Code domain error power value of the CC8 channel
Channel flag: Indicates whether the CC8 channel belongs to an assigned code channel or not:

Range: 0b00 0d0 - CC8 is inactive
0b01 0d1 - CC8 channel belongs to an active code channel




The *CODE PWR OVERVIEW* softkey enables screen B to show a code power display. By enabling the overview mode, both mappings (I mapping and Q mapping) are displayed. In this case the I mapping is displayed in screen A, which corresponds to trace 1, and the Q mapping is displayed in screen B, which corresponds to trace 2. The softkey can be used in code domain power (CDP) measurements for absolute or relative scaling as well as in code domain error power (CDEP) measurements.

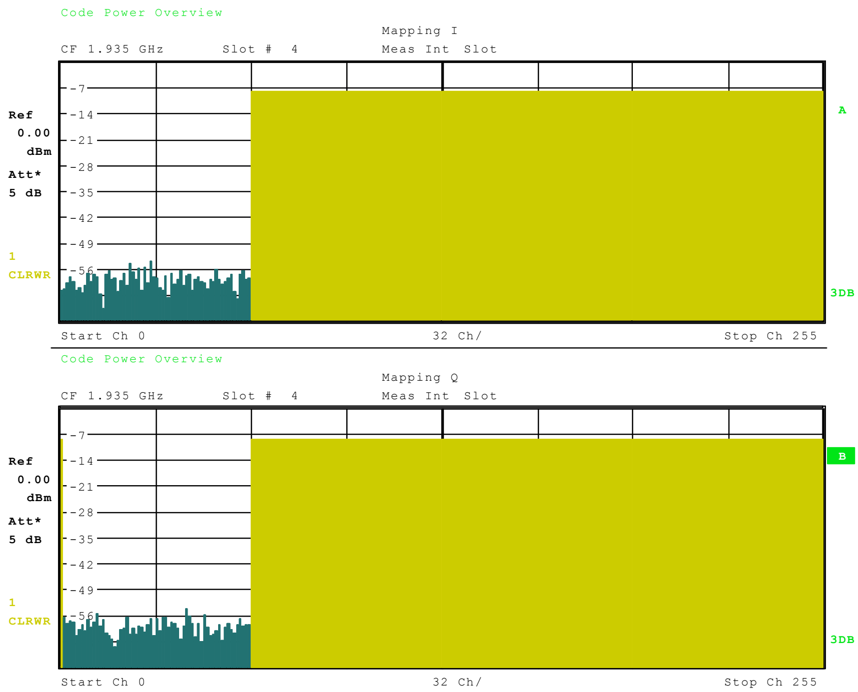



Fig. 22 Overview display of code domain power

IEC/IEEE bus command:

`:[SENSe:]CDPower:OVERview ON | OFF`

ON: Code Power Overview On mode.

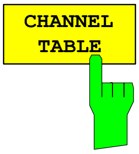
| | | | |
|---|---|---|---|
| Screen A: | I mapping | (TRACE1) | ($CDP_{abs.}$ or $CDP_{rel.}$ or CDEP) |
| Screen B: | Q mapping | (TRACE2) | ($CDP_{abs.}$ or $CDP_{rel.}$ or CDEP) |

OFF: Code Power Overview Off mode.

| | | | |
|---|---|---|---|
| Screen A: | I mapping | (TRACE1) | ($CDP_{abs.}$ or $CDP_{rel.}$ or CDEP) |
| Screen B: | Result summary | (TRACE2) | |

`:CALCulate<1>:FEED 'XPOW:CDP:OVERview'`

| | | | |
|---|---|---|---|
| Screen A: | I mapping | (TRACE1) | ($CDP_{rel.}$) |
| Screen B: | Q mapping | (TRACE2) | ($CDP_{rel.}$) |




The *CHANNEL TABLE* softkey selects the display of the channel assignment table. The channel assignment table can contain a maximum of 512 entries, corresponding to the 256 codes that can be assigned within the class of spreading factor 256, both I and Q components.

The upper part of the table indicates the DPCCH channel that has to be present in every signal to be analyzed. Furthermore there are additional control channels used in HSDPA and HSUPA signals. These channels (HSDPCCH and EDPCCH) are also displayed in the upper part of the table.

The lower part of the table indicates the data channels (DPDCH and E-DPDCH) that are contained in the signal. As specified in 3GPP, the channel table can contain up to 6 DPDCHs or up to 4 E-DPDCHs. The channels are in descending order according to symbol rates and within a symbol rate in ascending order according to the channel numbers. Therefore, the unassigned codes are always to be found at the end of the table.

Physical channels used in 3GPP UPLINK signals according to Release 99 specification:

DPCCH: The **D**edicated **P**hysical **C**ontrol **Ch**annel is used to synchronize the signal. It carries pilot symbols and is expected in the Q branch at code class 8 with code number 0. The channel is displayed in the upper part of the table.

DPDCH: The **D**edicated **P**hysical **D**ata **Ch**annel is used to carry UPLINK data from the UE to the BS. The code allocation depends on the total required symbol rate. The following table represents the possible configurations of DPCH spreading factors and code allocation.

Channel Table SR 960 ksps
Chan 2 / Q
CF 1.935 GHz Slot # 4 Meas Int Slot

Ref 0.00 dBm
Att* 5 dB

| Chan Type | Symb Rate [ksps] | Chan# | Status | Mapping | PilotL [Bits] | Pwr Abs [dBm] | Pwr Rel [dB] |
|---|---|---|---|---|---|---|---|
| DPCCH | 15.0 | 0 | active | Q | 8 | -8.53 | -8.47 |
| HSDPCCH | -.- | --- | inactv | I | --- | -.-- | -.-- |
| EDPCCH | -.- | --- | inactv | I | --- | -.-- | -.-- |
| DPDCH | 960.0 | 1 | active | I | --- | -8.49 | -8.43 |
| DPDCH | 960.0 | 1 | active | Q | --- | -8.53 | -8.47 |
| DPDCH | 960.0 | 2 | active | I | --- | -8.50 | -8.44 |
| DPDCH | 960.0 | 2 | active | Q | --- | -8.50 | -8.44 |
| DPDCH | 960.0 | 3 | active | I | --- | -8.52 | -8.46 |
| DPDCH | 960.0 | 3 | active | Q | --- | -8.51 | -8.46 |
| DPDCH | 15.0 | 0 | inactv | I | --- | -61.99 | -61.93 |

A
3DB

Fig. 23 Channel Table of an UPLINK signal according to Release 99 specification

HSDPCCH: The **H**igh **S**peed **D**edicated **P**hysical **C**ontrol **Ch**annel (for HS-DCH) is used to carry control information (CQI / ACK/NACK) for downlink high speed data channels (HS-DCH). It is used in HSDPA signal setup. The data rate is fixed to 15ksps. The code allocation depends on the number of active DPCH and is described in the table below. This control channel is displayed in the upper part of the channel table. The HS-DPCCH can be switched on or of at for a duration of 1/5 frame → 3 slots → 2ms. Power control is applicable too.

EDPCCH: The **E**nhanced **D**edicated **P**hysical **C**ontrol **Ch**annel is used to carry control information for uplink high speed data channels (EDPDCH). It is used in HSUPA signal setup. The data rate is fixed to 15ksps. This control channel is displayed in the upper part of the channel table.

EDPDCH: The **E**nhanced **D**edicated **P**hysical **D**ata **Ch**annel is used to carry UPLINK data for high speed channels (EDPDCH). It is used in HSUPA signal setup. The data rate and code allocation depends on the number of

DPDCH and HS-DPCCH (refer to table below). This data channel is displayed in the lower part of the channel table.

Channel Table SR 15 ksps
Chan 1 / I
CF 1.935 GHz Slot # 6 Meas Int Slot

Ref 0.00 dBm
Att* 5 dB

| Chan Type | Symb Rate [ksps] | Chan# | Status | Mapping | PilotL [Bits] | Pwr Abs [dBm] | Pwr Rel [dB] |
|---|---|---|---|---|---|---|---|
| DPCCH | 15.0 | 0 | active | Q | 8 | -10.86 | -1.65 |
| HSDPCCH | 15.0 | 33 | active | Q | --- | -26.92 | -17.70 |
| EDPCCH | 15.0 | 1 | active | I | --- | -19.88 | -10.67 |
| EDPDCH | 1920.0 | 1 | active | I | --- | -19.78 | -10.56 |
| EDPDCH | 1920.0 | 1 | active | Q | --- | -25.59 | -16.38 |
| EDPDCH | 960.0 | 1 | active | I | --- | -19.85 | -10.63 |
| EDPDCH | 960.0 | 1 | active | Q | --- | -27.79 | -18.58 |
| DPDCH | 15.0 | 0 | inactv | I | --- | -60.78 | -51.57 |
| DPDCH | 15.0 | 1 | inactv | Q | --- | -57.01 | -47.79 |
| DPDCH | 15.0 | 2 | inactv | I | --- | -57.90 | -48.68 |

A
3DB

Fig. 24 Channel Table of an UPLINK signal according to Release 7 specification

The following parameters of these channels are determined by the CDP measurement:

Type: Type of channel (active channels only)

Symbol Rate: Symbol rate at which the channel is transmitted (15 ksps to 960 ksps).

Chan #: Number of channel spreading code (0 to [spreading factor-1])

Status: Status display. Codes that are not assigned are marked as inactive channels.

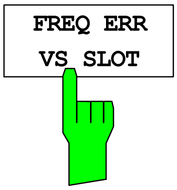
Mapping: Component onto which the channel is mapped (I or Q). The entry is not editable, since the standard specifies the channel assignment for each channel.

PilotL: Number of pilot bits of the channel (only valid for the control channel DPCCH).

Pwr Abs / Pwr Rel:
Indication of the absolute and relative channel power (referred to the CPICH or the total power of the signal).

In *CODE CHAN AUTOSEARCH* mode, a data channel is designated as active if its power has a minimum value compared to the total power of the signal and if a minimum signal/noise ratio is maintained within the channel.
In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

IEC/IEEE bus command: `CALC1:FEED "XTIM:CDP:ERR:CTAB"`




The *FREQ ERR VS SLOT* softkey selects the new display mode of frequency error versus slot. The softkey is available in frame mode of R&S FS-K73. In slot mode of R&S FS-K73, the softkey will not appear.
To reduce the overall span of frequency error versus slot, for each value to be displayed the difference between the frequency error of the corresponding slot and the mean frequency error of the frame is calculated. This will help to eliminate a static frequency offset of the whole signal to better display a real-time-based frequency curve.
The measurement result consists of one frequency error measurement value per slot or half slot, depending on the value of softkey *SLOT RES HALF / FULL*. For *SLOT RES FULL*, this results in a total of 15 values to be displayed for frequency error. For *SLOT RES HALF* the number of values displayed will turn to 30. The time reference for the start of slot 0 is the start of the 3GPP FDD frame.
For R&S FS-K73, the measurement is inflected by the elimination of 25 µs of tail chips at each end of the one slot (see *ELIMINATE TAIL CHIPS* softkey).
The values of *FREQ ERR VS SLOT* are displayed in Hz.

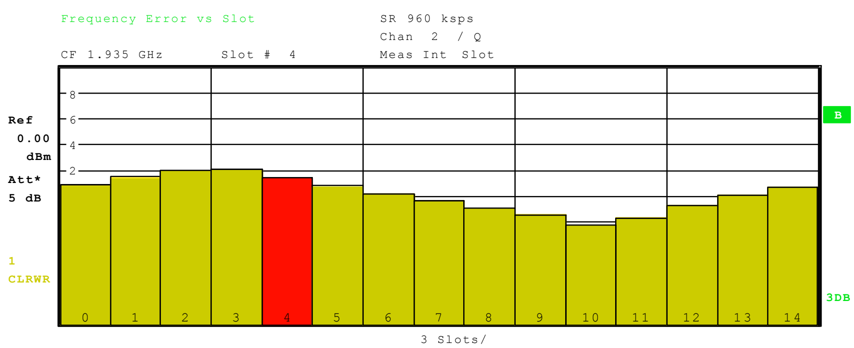



Fig. 25 Relative frequency error versus slot

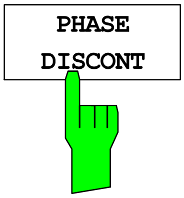
The relative frequency error $df_{rel}(i)$ is displayed versus slot. The values are given in Hz. They are referenced to the mean frequency error of the frame. In the figure above a relative frequency $df_{rel}(i)$ error with a sine shape is given. The displayed frequency error is given as

$$df_{rel}(i) = df_{abs}(i) - \frac{1}{N}\sum_{n=0}^{N-1} df_{abs}(n) \quad | \quad i \in [0...14] \quad N = 15$$

| | | | |
|---|---|---|---|
| where: | $df_{rel}(i)$ | [Hz] | - relative frequency error for each slot |
| | $df_{abs}(i)$ | [Hz] | - absolute frequency error for each slot |
| | N | [] | - number of slots per frame |

The absolute frequency error $df_{abs}(i)$ is displayed in the result summary

IEC/IEEE bus command: `:CALC2:FEED "XTIM:CDP:FVSL"`
Trace readout via: `:TRAC? TRACE2.`




The *PHASE DISCONT* softkey selects the new display mode of phase discontinuity versus slot. The softkey is available in frame mode of R&S FS-K73. In slot mode of R&S FS-K73, the softkey will not appear.

The phase discontinuity is calculated in accordance with 3GPP specifications. The phase calculated for each measurement interval will be interpolated to both ends of the interval using its the frequency shift. The difference between the phase interpolated for the beginning of one measurement interval and the end of the preceding measurement interval is displayed as the phase discontinuity of that interval. The measurement interval can be one full slot or one half slot, depending on the value of softkey *SLOT RES HALF / FULL*. SLOT RES FULL will result in a total of 15 values of phase discontinuity, *SLOT RES HALF* will give 30 values. For R&S FS-K73, the setting of the *ELIMINATE TAIL CHIPS* softkey (see *ELIMINATE TAIL CHIPS* softkey) is taken into account.

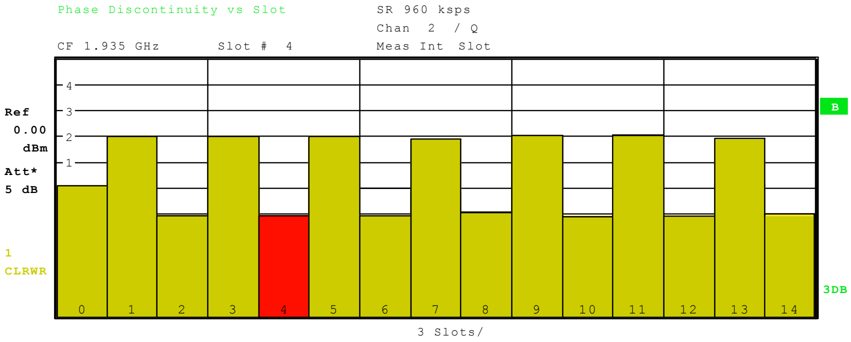



Fig. 26 Phase discontinuity versus slot

The phase discontinuity $d\phi_{disc}(i)$is displayed versus slot. The values of *PHASE DISCONT* are displayed in ° (deg). They are calculated by the difference of the absolute phase at the end of the previous slot [$\phi_{slot_end}(i-1)$] and the absolute phase at the beginning of the current slot [$\phi_{dslot_start}(i)$] Fig. 26). In case of slot zero (i=0), the phase at the end of slot 14 of the previous frame is taken as reference. [$\phi_{slot_end}(-1) = \phi_{slot_end_prev_frame}(14)$].
In Fig. 27 a signal with a alternating phase discontinuity of +/- 10 degree is measured.

$$d\phi_{disc}(i) = \phi_{slot\_end}(i-1) - \phi_{slot\_start}(i) \quad | \quad i \in [0...14]$$

where: $d\phi_{disc}(i)$ [deg] - phase discontinuity result at the slot boarder
$\phi_{slot\_start}(i)$ [deg] - absolute phase at the start of the current slot
$\phi_{slot\_end}(i-1)$ [deg] - absolute phase at the end of the previous slot

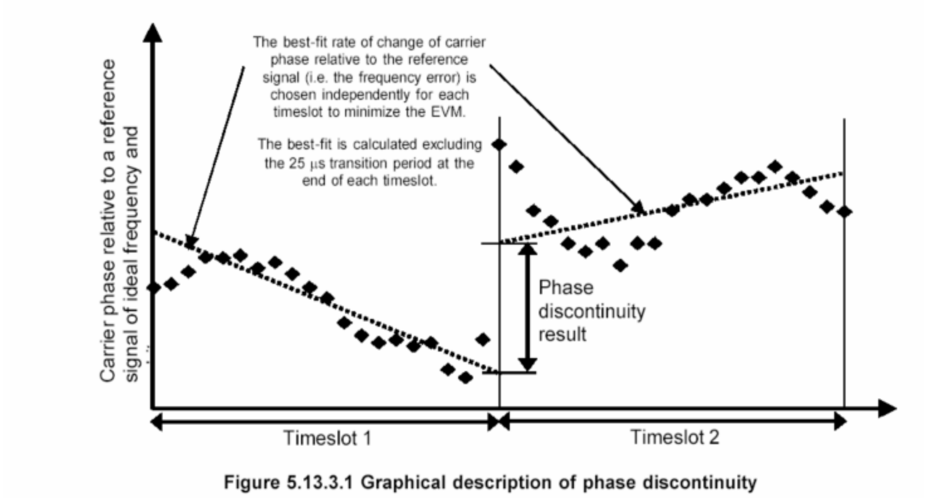
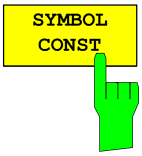



Fig. 27 Measurement of phase discontinuity

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:PVS"`
Trace readout via: `TRAC? TRACE2.`




The *SYMBOL CONST* softkey selects the display of symbol constellation diagram. The symbols are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).
The measurement interval for displaying the symbol constellation is one half slot or one full slot, depending on the value of softkey *SLOT RES HALF / FULL*.
In order to provide a better illustration of the constellation, the channel is entered in the diagram as if its constellation points would lie in the I/Q plane, i.e. channels that are mapped onto the I component have points on the real axis and channels mapped onto the Q component have points on the imaginary axis.
It is possible to display the symbol constellation for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not meaningful, as the unassigned code channel does not contain data.
For orientation the unit circle is shown within the diagram.

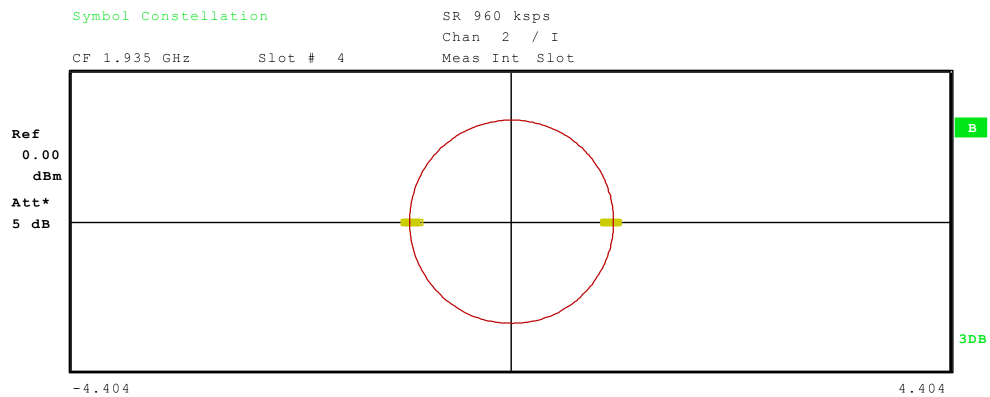



Fig. 28 Symbol Constellation Diagram of a channel mapped onto I component

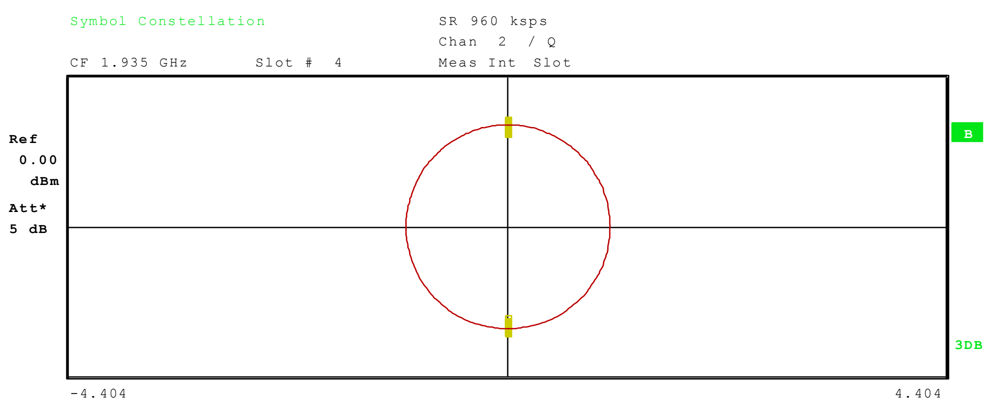
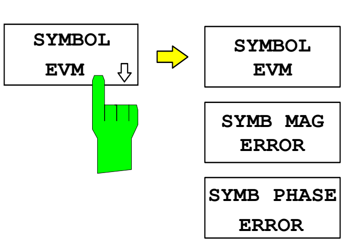
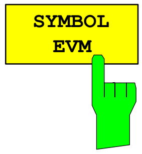



Fig. 29 Symbol Constellation Diagram of a channel mapped onto Q component

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:SYMB:CONS"`




The *SYMBOL EVM* softkey opens a submenu for symbol error vector magnitude display.




The *SYMBOL EVM* softkey activates the symbol error vector magnitude display. The EVM is displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).
The measurement interval for displaying the symbol EVM is one half slot or one full slot, depending on the value of softkey *SLOT RES HALF / FULL*.
It is possible to display the symbol error vector magnitude for unassigned codes (red marking in the CDP diagram on a code represented in blue), but the results are not valid.

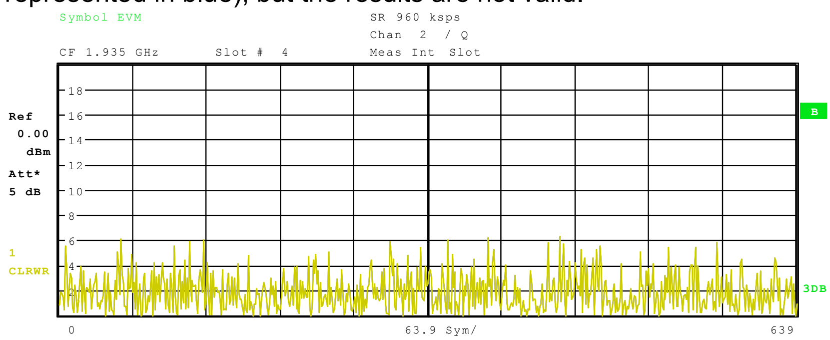
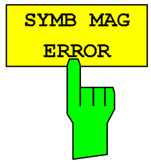



Fig. 30 Error Vector Magnitude for the selected slot of the selected channel

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:SYMB:EVM"`




The *SYMB MAG ERROR* softkey selects the new display mode of symbol magnitude error. The softkey is available in both frame and slot modes of R&S FS-K73.
The measurement interval for displaying the symbol magnitude error is one half slot or one full slot, depending on the value of softkey *SLOT RES HALF / FULL*.
The symbol magnitude error is calculated analogously to symbol EVM. The result of calculation is one symbol magnitude error value for each symbol of the slot of a special channel. Positive values of symbol magnitude error indicate a symbol magnitude that is larger than the expected ideal value; negative symbol magnitude errors indicate a symbol magnitude that is less than the ideal one.
Symbol magnitude error like symbol EVM can be calculated for both active and inactive slots of a channel. For inactive slots of a channel, however, the results are meaningless.
The values of *SYMB MAG ERROR* are displayed in %.

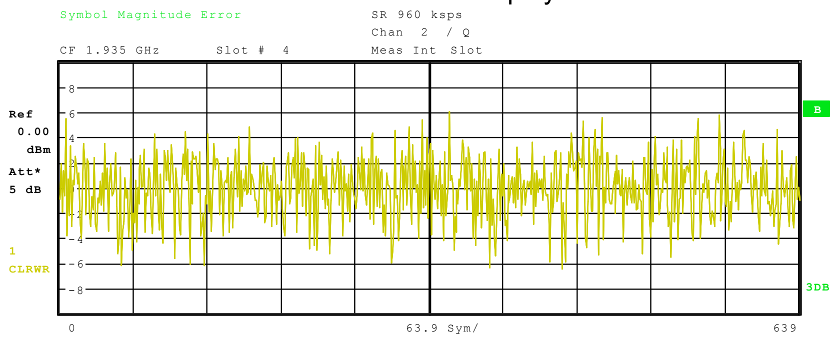
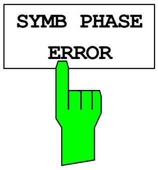



Fig. 31 Error Vector Magnitude for the selected slot of the selected channel

IEC/IEEE bus command:
`CALC2:FEED "XTIM:CDP:SYMB:EVM:MAGN"`

Query of results: `TRAC? TRACE2.`




The *SYMB PHASE ERROR* softkey selects the new display mode of symbol phase error. The softkey is available both frame and slot modes of R&S FS-K73.
The measurement interval for displaying the symbol phase error is one half slot or one full slot, depending on the value of softkey *SLOT RES HALF / FULL*.
The symbol phase error is calculated analogously to symbol EVM. The result of calculation is one symbol phase error value for each symbol of the slot of a special channel. Positive values of symbol phase error indicate a symbol phase that is larger than the expected ideal value; negative symbol phase errors indicate a symbol phase that is less than the ideal one.
Symbol phase error like symbol EVM can be calculated for both active and inactive slots of a channel. For inactive slots of a channel, however, the results are meaningless.
For R&S FS-K73, the displayed symbol phase error will always be calculated to zero. This effect is caused by the following: For R&S FS-K73, each channel is projected to one of the branches I or Q exclusively. For symbol error calculation, only the symbols spread onto this branch are taken into account. Therefore no phase difference between the measured and ideal symbols can occur. The phase error is always calculated to zero.
The values of *SYMB PHASE ERROR* are displayed in ° (deg).

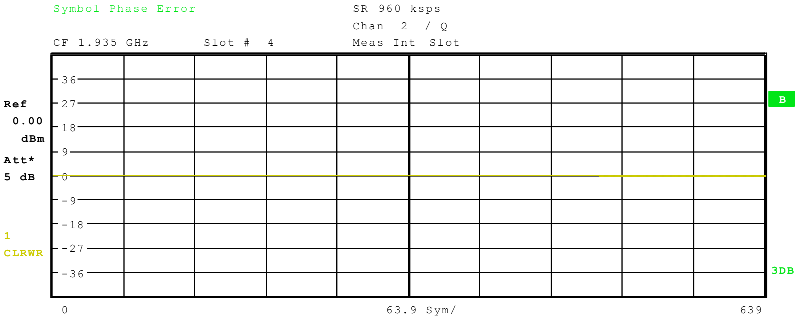
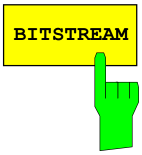
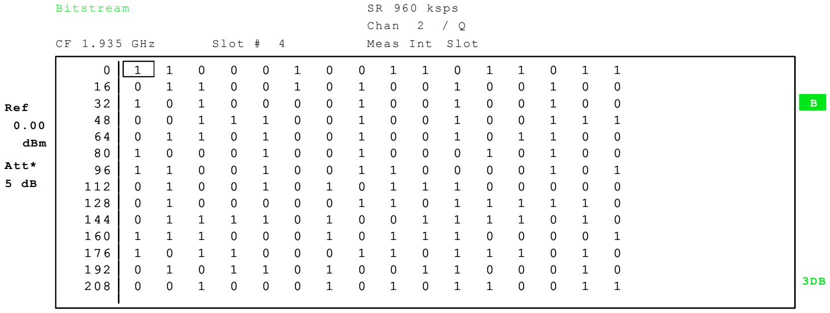



Fig. 32 Display of symbol phase error

IEC/IEEE bus command:
`CALC2:FEED "XTIM:CDP:SYMB:EVM:PHAS"`
Query of results: `TRAC? TRACE2.`



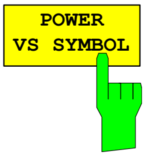

The *BITSTREAM* softkey activates the bitstream display.
The decided bits are displayed for the selected channel (red marking in the CDP diagram) and the selected slot (red marking in the power-versus-slot diagram).
While it is possible to display the bitstream for unused codes (red marking in the CDP diagram at a code displayed in blue), the missing data means that the results are not very informative. In this case, "-" is used to indicate that all the bits are invalid.




| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 16 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 32 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 48 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| 64 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 80 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 96 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 112 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 128 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 144 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 160 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| 176 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 192 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 208 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |

Fig. 33 Demodulated bits for the selected slot of the selected channel

IEC/IEEE bus command: `CALC2:FEED "XTIM:CDP:BSTR"`




The *POWER VS SYMBOL* softkey displays the symbol power in a selected channel within a selected slot. The number of symbols depends on the code class of the selected channel and the value of the softkey *SLOT RES HALF / FULL*..
In case of *SLOT RES FULL* the number of symbols can be calculated as

$$NOF_{Symbols} = 10 \cdot 2^{(8-CodeClass)}$$

In case of *SLOT RES HALF* it will be:

$$NOF_{Symbols} = 5 \cdot 2^{(8-CodeClass)}$$

The power curve below represents the ratio of the symbol power to the total power of the selected slot.

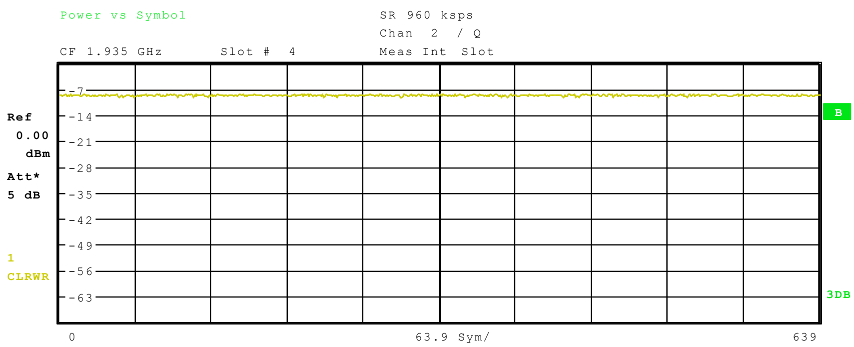
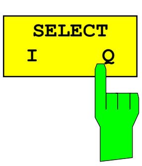



Fig. 34 Power versus symbol for one slot of a channel with 640 symbols

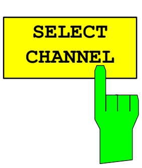
IEC/IEEE bus command: `:CALC1:FEED "XTIM:CDP:PVSY"`

| | |
|---|---|
| Query of result: | `:TRAC1:DATA2 TRACE2` |
| Output: | List of symbol power values deviating from the reference power |
| Format: | $Val_1$, $Val_2$,...., $Val_{NOF}$ |
| Unit: | [dB] |
| Quantity: | $NOF_{Symbols} = 10 \cdot 2^{(8-CodeClass)}$ for *SLOT RES FULL* |
| | $NOF_{Symbols} = 5 \cdot 2^{(8-CodeClass)}$ for *SLOT RES HALF* |




The *SELECT I/Q* softkey switches the display modes *CDP PWR RELATIVE /ABSOLUTE*, *CODE PWR ZOOM*, *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM* between indication of I and Q component. Only channels that are mapped onto the corresponding component are taken into account by the respective display modes.

IEC/IEEE bus command: `SENS:CDP:MAPP Q`




The *SELECT CHANNEL* softkey activates the selection of a channel for the display modes *CDP PWR RELATIVE/ABSOLUTE*, *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM*.

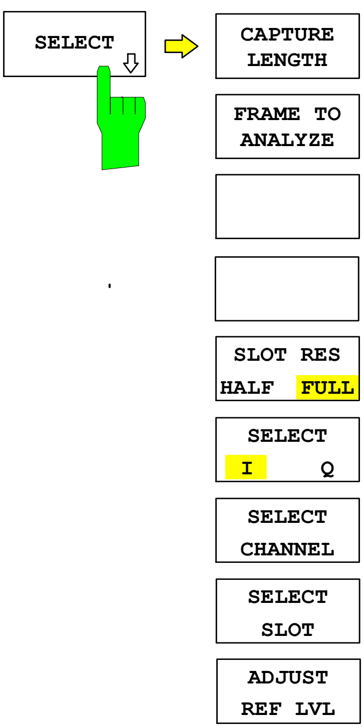
There are two ways of entering the channel numbers:

- Entry of channel number and spreading factor, separated by a decimal point
  If the channel number and the spreading factor are entered simultaneously, the entered channel is selected and marked in red if an active channel is concerned. For the display, the channel number entered is converted on the basis of spreading factor 256. For unused channels, the code resulting from the conversion is marked.
  Example: Entry 2.4
  Channel 2 is marked at spreading factor 4 (960 ksps) if the channel is active, otherwise code 128 at spreading factor 256.

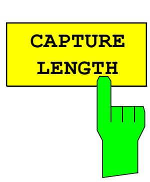
- Entry of a channel number without a decimal point
  In this case, R&S FS-K73 interprets the entered code as based on spreading factor 256. If the code entered corresponds to a used channel, the whole associated channel is marked. If the code corresponds to an unused channel, only the code entered is marked.
  Example: Entry 128
  Code 128 is marked at spreading factor 256 if there is no active channel on this code. If for instance channel 2 is active at spreading factor 4, the entire channel 2 is marked.

If the entered code corresponds to an active channel, the whole associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked.
If the code number is modified using the roll key, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel. The step width of the changed roll key position refers to spreading factor 256.

IEC/IEEE bus command: `SENS:CDP:CODE 0 to 255`



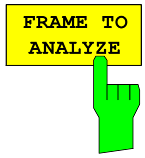

The *SELECT* softkey opens a submenu special parameters of analysis.




The softkey *CAPTURE LENGTH* enables an entry window for determining the number of frames that are to be captured at each sweep.

IEC/IEEE bus command:
`:SENS:CDP:IQL <numeric value>`

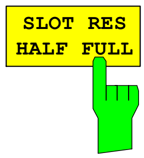
| | | | |
|---|---|---|---|
| Range: | R&S FSU / FSP-B70 *(free run)*: | <numeric value> | *[1 ... 2]* |
| | R&S FSU / FSP-B70 *(ext. Trig)*: | <numeric value> | *[1 ... 3]* |
| | R&S FSQ: | <numeric value> | *[1 ... 100]* |
| | R&S FSMR *(free run)*: | <numeric value> | *[1 ... 2]* |
| Unit: | <numeric value> | *[0 ... CAPTURE_LENGTH - 1]* | |




The softkey *FRAME TO ANALYZE* enables an entry window for selecting the frame number to be analyzed.

IEC/IEEE bus command: `:SENS:CDP:FRAM:VAL <numeric value>`

Range: <numeric value> *[0 ... CAPTURE_LENGTH - 1]*



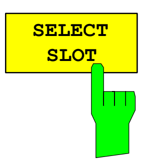

The softkey *SLOT RES HALF / FULL* schaltet die R&S FS-K73 zwischen Analyse eines halben Slots und eines vollen Slots um.

In case of *SLOT RES FULL* the length of each analysis interval will be 2560 chips, corresponding to one time slot of the 3GPP signal. The time reference for the start of slot 0 is the start of a 3GPP radio frame.

In case of *SLOT RES HALF* the length of each analysis interval is reduced to 1280 chips, corresponding to the half of one time slot of the 3GPP signal. The softkey *SELECT SLOT* switches its caption to *SELECT HALF SLOT* and via the keys half slot numbers can be entered. The time reference for the start of half slot 0 remains the same as above: the start of one radio frame of 3GPP signal.

Both measurement intervals are influenced by the softkey *ELIMINATE TAIL CHIPS*: If *ELIMINATE TAIL CHIPS* is selected, 96 chips at both ends of the measurement interval are not taken into account for analysis.

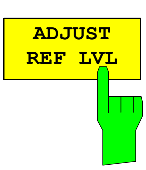
IEC/IEEE bus command: `SENS:CDP:HSL ON | OFF`




The softkey *SELECT SLOT* activates the selection of the slot number for the display modes *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM*. The softkey is only valid if one frame of the 3GPP signal is analyzed.
The caption of the softkey is influenced by softkey *SLOT RES HALF / FULL*: At *SLOT RES HALF* the caption will change to *SELECT HALF SLOT* and the range of entries will be 0 to 29 instead *SELECT SLOT* and 0 to 14 in case of *SLOT RES FULL*.

When the slot number is entered, the red marking in the power-versus-slot diagram changes its position in steps of a slot.

IEC/IEEE bus command: `SENS:CDP:SLOT 0 to 14`

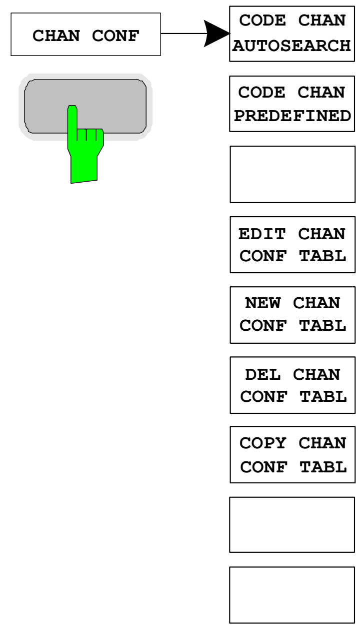



The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small S/N ratio.

IEC/IEEE bus command: `SENS:POW:ACH:PRES:RLEV`

## Measurement Configuration –*CHAN CONF* hotkey

Hotkey *CHAN CONF*

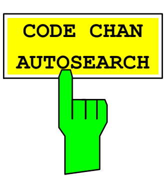



The *CHAN CONF* hotkey opens a submenu with different configurations for measurements. In this submenu, predefined channel tables can be selected as a basis for code domain measurements.

When the hotkey is selected, a table including the channel tables stored on the measuring instrument's hard disk is opened. The table provides just an overview and a table for the measurement can only be selected after actuating the *CODE CHAN PREDEFINED* softkey.

IEC/IEEE bus command:

```
CONF:WCDP:MS:CTAB:CAT?
```



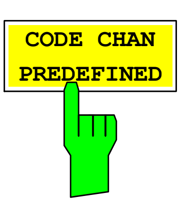

The *CODE CHAN AUTOSEARCH* softkey allows code domain power measurements in the automatic search mode. In this mode, the whole code domain (all permissible symbol rates and channel numbers) is searched for active channels. The channel search is based on a comparison of the powers of active channels and unused codes. Furthermore, the restrictions in channel configuration given by the 3GPP specifications are taken into account.

The synchronization channel DPCCH is assumed to be present in the signal by the CDP analysis and added to the channel table for each measurement.

The *CODE CHAN AUTOSEARCH* mode is the preset search mode when starting the CDP analysis. It is mainly intended for giving the user an overview of the channels contained in the signal. If the signal contains channels that are not detected as being active in the automatic search mode, the CDP analysis can be performed with the channel configurations predefined by the user by switching to the *CODE CHAN PREDEFINED* mode.

IEC/IEEE bus command:

```
CONF:WCDP:MS:CTAB:STAT OFF
```



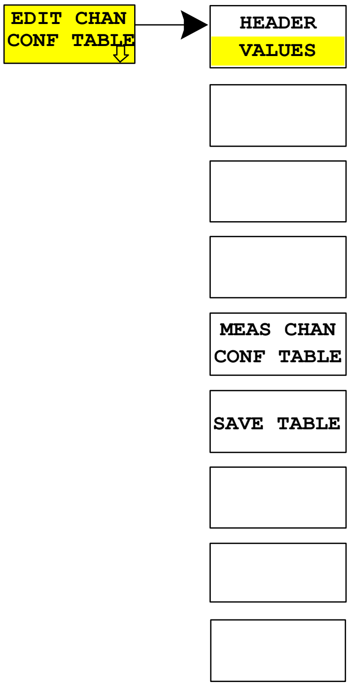

The *CODE CHAN PREDEFINED* softkey activates the predefined channel table mode. No search for active channels in the code domain is performed in this mode, but the channels contained in a channel table defined prior to the measurement are assumed to be active. The code domain power measurement and all further evaluations are carried out for these channels.

On selecting the softkey, a table containing all channel tables stored in the measuring instrument is opened. The CDP analysis is switched to

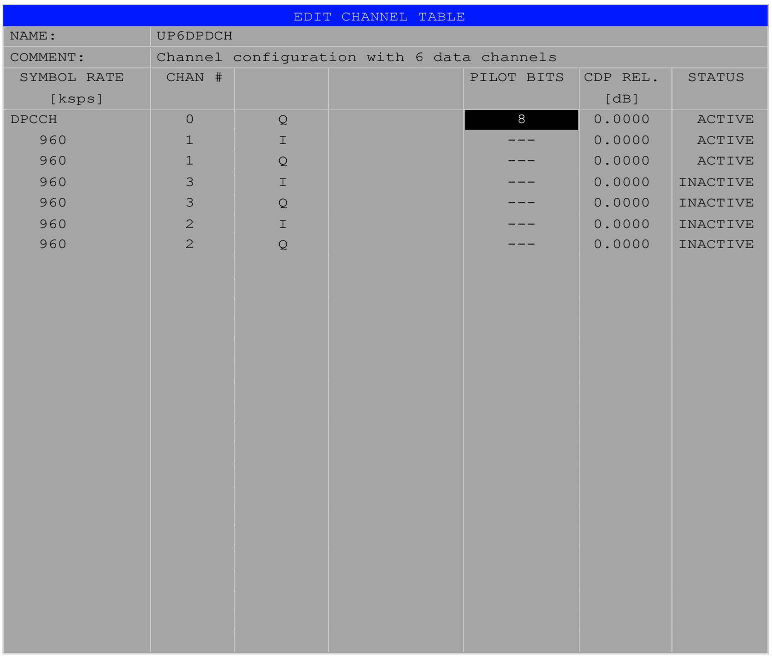
the mode “predefined channel table”. When the next measurement is started, the power is measured according to this mode. The last table of the automatic search mode is first taken as a basis for the measurement. This table is available under the *RECENT* entry.
Switching to one of the predefined channel tables is done by selecting the corresponding table entry and pressing one of the unit keys. From the next measurement onwards, the selected channel table is taken as a basis for the sweep. A tick marks the selected channel table.

IEC/IEEE bus command:

```
CONF:WCDP:MS:CTAB:STAT ON
CONF:WCDP:MS:CTAB:SEL "CTAB 1”
```




The *EDIT CHAN CONF TABLE* softkey opens a channel table in which the user can edit the channel configuration. In addition, a submenu is opened giving access to the softkeys required for editing the table.


EDIT CHANNEL TABLE

NAME: UP6DPDCH
COMMENT: Channel configuration with 6 data channels

| SYMBOL RATE [ksps] | CHAN # | | | PILOT BITS | CDP REL. [dB] | STATUS |
|---|---|---|---|---|---|---|
| DPCCH | 0 | Q | | 8 | 0.0000 | ACTIVE |
| 960 | 1 | I | | --- | 0.0000 | ACTIVE |
| 960 | 1 | Q | | --- | 0.0000 | ACTIVE |
| 960 | 3 | I | | --- | 0.0000 | INACTIVE |
| 960 | 3 | Q | | --- | 0.0000 | INACTIVE |
| 960 | 2 | I | | --- | 0.0000 | INACTIVE |
| 960 | 2 | Q | | --- | 0.0000 | INACTIVE |

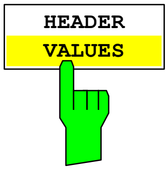
Fig. 35 Table for editing a channel configuration

Basically, any channel table stored on the instrument's hard disk can be edited as required. An edited table is not stored automatically but only after pressing the *SAVE TABLE* softkey. This prevents inadvertent overwriting of a table.

If the user edits the table currently used in CDP analysis, the edited table is taken as a basis for the next measurement immediately after it is stored. The effects of modifications made to the table show, therefore, at once. Here, too, the *SAVE TABLE* softkey must be pressed to store the edited table on the instrument's hard disk.

If the user edits a table stored on the hard disk but currently not active, the modifications become visible only after storage (*SAVE TABLE* softkey) and subsequent activation.
IEC/IEEE bus command:

```
CONF:WCDP:MS:CTAB:EDAT
```




The *HEADER/VALUES* softkey switches between editing the channel table header or its values.

*HEADER* allows editing the table header, i.e. the name and the comment. By changing the table name, overwriting of a table already stored is prevented. The table name may contain max. 8 characters.

IEC/IEEE bus command:

```
CONF:WCDP:MS:CTAB:NAME "NEW_TAB"
```

*VALUES* allows editing the entries in a channel table. The following parameters are available for each channel of a table (confirm each entry with one of the unit keys):

SYMBOL RATE: Symbol rate at which a channel is transmitted. This entry can only be edited if one data channel is used within the channel configuration.

CHAN #: Number of channel in the associated transmission class. For the channel numbers are fixed for all channel configurations of 3GPP uplink, the entry is not editable. The channel numbers will be set automatically according to the specifications.

MAPPING: I or Q component the channel is projected onto. The entry is not editable since the component the channel should be projected onto is fixed in 3GPP specifications for each channel.

PILOT BITS: Number of pilot bits of a channel. The entry is editable for the DPCCH only.

CDP REL.: Information about relative channel power. This entry cannot be edited and exists only for the *RECENT* table; it is used for indicating low-power channels.

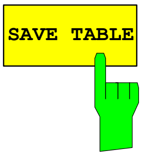
STATUS: Channel status (active/inactive). Setting the channel status to inactive excludes a channel entered in the table from CDP analysis without the complete channel line having to be cleared from the table. Only channels with an active status are taken into account in CDP analysis. By activating/deactivating a channel the analysis is switched between the one-data-channel-model and the multiple-data-channel-model. At the model with more than one data channel, the channel configurations will be set according to the 3GPP specifications.

IEC/IEEE bus commands:

```
CONF:WCDP:MS:CTAB:DATA 8,4,1
CONF:WCDP:MS:CTAB:COMM "Comment for new table"
```

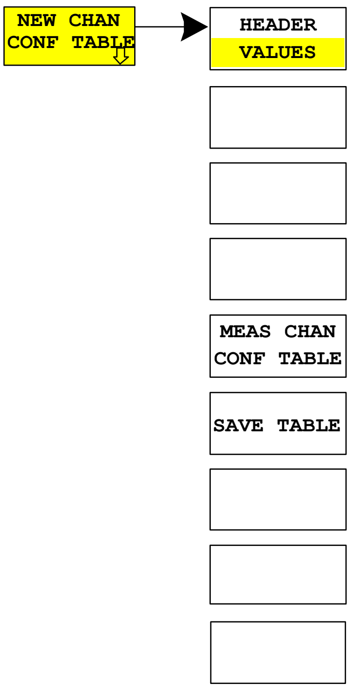

The *MEAS CHAN CONF TABLE* softkey starts a measurement in the *CODE CHAN AUTOSEARCH* mode. The measurement results are entered in the channel table currently open. This softkey is available only in the *CODE CHAN AUTOSEARCH* mode.

IEC/IEEE bus command: --

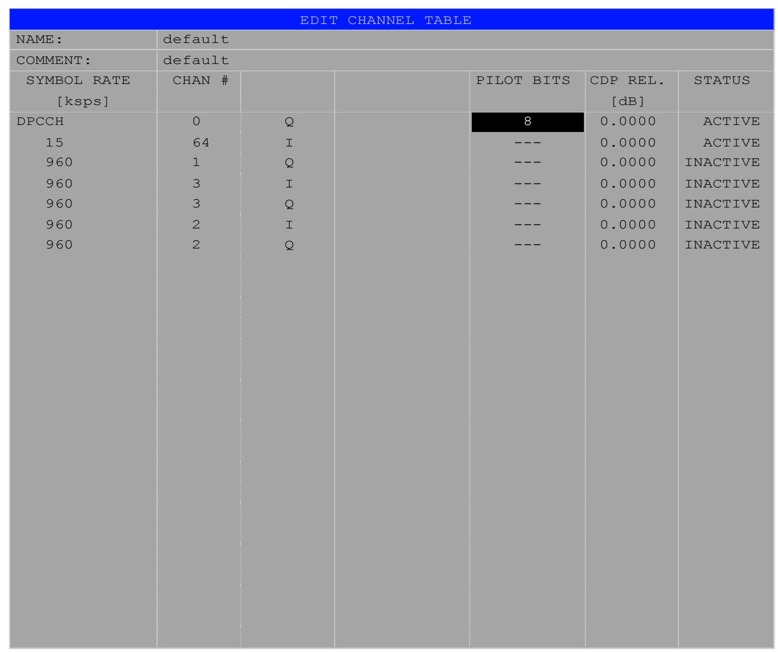



The *SAVE TABLE* softkey saves the table under the specified name.
*Caution:* Editing a channel model and storing it under its original name will overwrite the model.

IEC/IEEE bus command:
-- (automatic storage with remote control)




The *NEW CHAN CONF TABLE* softkey opens a submenu identical to that opened by the *EDIT CHAN CONF TABLE* softkey. In contrast to *EDIT CHAN CONF TABLE, NEW CHAN CONF TABLE* opens a table in which only the control channel is entered; the table name is not yet defined.



EDIT CHANNEL TABLE

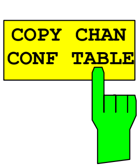
NAME: default
COMMENT: default

| SYMBOL RATE [ksps] | CHAN # | | | PILOT BITS | CDP REL. [dB] | STATUS |
|---|---|---|---|---|---|---|
| DPCCH | 0 | Q | | 8 | 0.0000 | ACTIVE |
| 15 | 64 | I | | --- | 0.0000 | ACTIVE |
| 960 | 1 | Q | | --- | 0.0000 | INACTIVE |
| 960 | 3 | I | | --- | 0.0000 | INACTIVE |
| 960 | 3 | Q | | --- | 0.0000 | INACTIVE |
| 960 | 2 | I | | --- | 0.0000 | INACTIVE |
| 960 | 2 | Q | | --- | 0.0000 | INACTIVE |

Fig. 36 Creating a new channel configuration


The *DEL CHAN CONF TABLE* softkey deletes a selected table from the list. The currently active table in the *CODE CHAN PREDEFINED* mode cannot be deleted.

IEC/IEEE bus command: `CONF:WCDP:MS:CTAB:DEL`

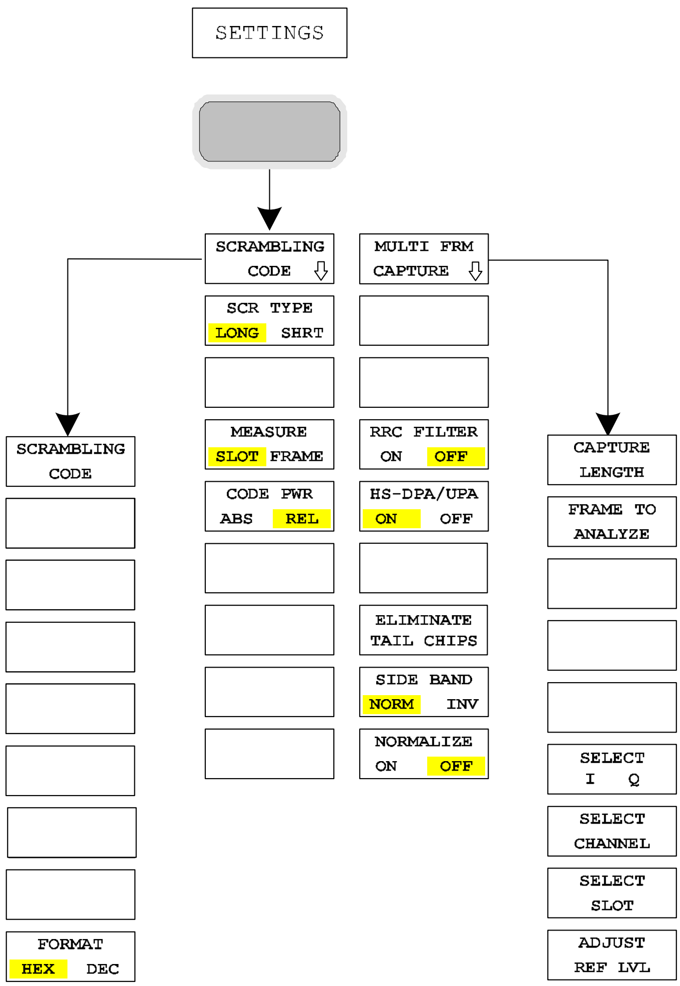



The *COPY CHAN CONF TABLE* softkey copies a selected table. The user is queried to enter the name under which the copy is to be saved.

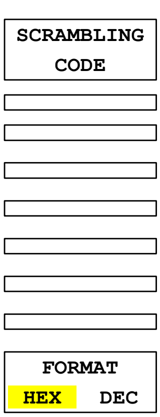
IEC/IEEE bus command: `CONF:WCDP:MS:CTAB:COPY "CTAB2"`

## Configuration of CDP Measurement – *SETTINGS* hotkey

Hotkey *SETTINGS*



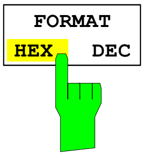

The *SETTINGS* hotkey opens a submenu with softkeys for setting parameters for the CDP measurement.




The *SCRAMBLING CODE* softkey opens a window for entering the scrambling code. The scrambling code is input in hex format.

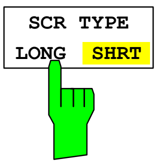
The entered scrambling code has to coincide with that of the signal. Otherwise a CDP measurement of the signal is not possible.

IEC/IEEE bus command: `SENS:CDP:LCOD:VAL #H2`



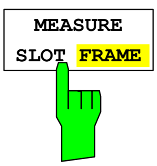

The format for the entry of the *SCRAMBLING CODE* can be specified. With the *FORMAT HEX/DEC* softkey, either hexadecimal or decimal can be selected. Default is hexadecimal.

IEC/IEEE bus command: Scrambling code hex (legacy commandl)
`SENS:CDPower:LCOD:VAL <hex>`
Scrambling code dec
`SENS:CDP:LCOD:DVAL <numeric_value>`



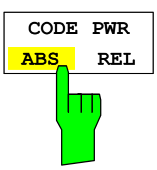

The *SCR TYPE LONG/SHRT* softkey determines whether the scrambling code entered (see softkey SCRAMBLING CODE) is to be handled as long or short scrambling code.

IEC/IEEE bus command: `SENSe:CDP:LCOD:TYPE SHOR`




The *MEASURE SLOT / FRAME* softkey switches between a result length of one slot and one complete frame. The softkey is only valid, if the spectrum analyzer R&S FSU or R&S FSQ is used. For spectrum analyzer R&S FSP, a fixed result length of one slot is used.

IEC/IEEE bus command:
`SENS:CDP:BASE SLOT | FRAME`

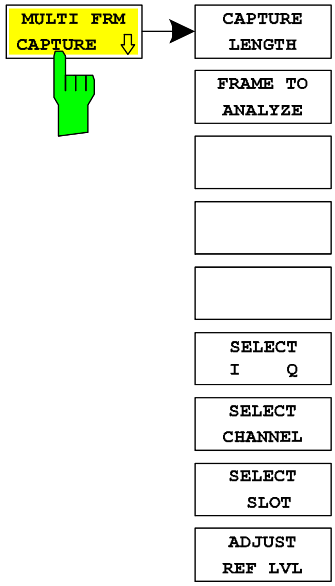



The *CODE PWR ABS / REL* softkey toggles the display mode of the code domain power display (see CODE DOM POWER). If the power versus slot measurement is active, the slot power is indicated in absolute or relative values.

REL: Selects relative scaling of the CDP measurement. The power is referenced to the total power of the selected slot. The values are displayed in dB (default settings).

ABS: Selects an absolute scaling of the CDP measurement. The values are displayed in dBm.

IEC/IEEE bus command:
Rel. Scaling: `CALC1:FEED "XPOW:CDP:RAT"`
Abs. Scaling: `CALC1:FEED "XPOW:CDP"`
`CALC1:FEED "XPOW:CDP:ABS"`
`CALC1:FEED "XTIM:CDP:PVSL:ABS"`
`CALC1:FEED "XTIM:CDP:PVSL:RAT"`




The Softkey MULTI FRM CAPTURE opens a submenu for specifying the parameters for multi-frame measurement. This measurement supports the data aquisition and evaluation of more than one 3GPP WCDMA frame. Depending on the analyser type that is used, several frames can be captured and evaluated.
The following figure shows the memory structure of the captured data. The size of the stored data depends on the parameter CAPTURE LENGTH, which defines the number of frames that are captured after a sweep is forced. If the parameter CAPTURE LENGTH has been changed, a new sweep must be started (SINGLE SWEEP) or must have been finished (CONTINUOUS SWEEP) in order to obtain valid measurement results for the specified range. The maximum number of storable frames depends on the trigger mode (FREE RUN or EXT TRIG). By changing the parameter FRAME TO ANALYZE, the frame number to be analyzed can be selected. The displayed results are refreshed if FRAME TO ANALYZE has been changed or a new sweep is started.
The *TRIGGER TO FRAME* time (TTF) is measured from the external trigger event to the start of the selected frame (*FRAME TO ANALYZE*). Therefore, the TTF of frame 0 is usually smaller than one slot (<667 us). If frame 1 is selected, the displayed TTF is between 10 ms and 10.667 ms. The TTF time is diplayed in the result summary. For the TTF time of frame n, the following equation is used:

$$TTF_n = TTF_0 + n \cdot 10\ ms$$

The maximum number of captured frames depends on the memory size and the trigger mode.

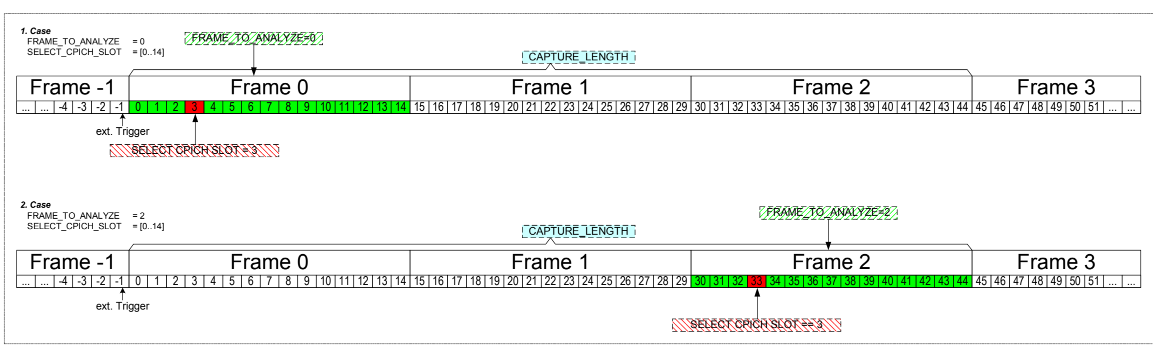
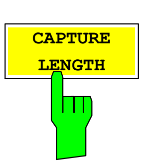



Fig. 37 Data scheme of the captured and analyzed frames

Maximum number of captured frames

| Analysator | Downlink (K72/K74) EXT TRIGGER | Downlink (K72/K74) FREE RUN | Uplink (K73) EXT TRIGGER | Downlink (K73) FREE RUN |
|---|---|---|---|---|
| R&S FSP | --- | --- | 1 slot | 1 slot |
| R&S FSP (B70) | 3 frames | 2 frames | 3 frames | 2 frames |
| R&S FSU | 3 frames | 2 frames | 3frames | 2 frames |
| R&S FSQ | 100 frames | 100 frames | 100 frames | 100 frames |

**Note:** *The SELECT I/Q, SELECT CHANNEL and ADJUST REF LVL softkeys are described on page 68.*

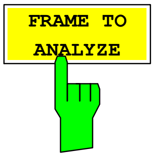



The softkey *CAPTURE LENGTH* enables an entry window for determining the number of frames that are to be captured at each sweep.

IEC/IEEE bus command: `SENS:CDPr:IQL <numeric value>`

Range: R&S FSU / R&S FSP-B70 *(free run)*: <numeric value> *[1 ... 2]*
R&S FSU / R&S FSP-B70 *(ext. Trig)*: <numeric value> *[1 ... 3]*
R&S FSQ: <numeric value> *[1 ... 100]*

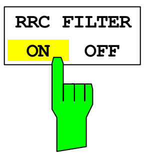
Unit: [Frames]]




The softkey *FRAME TO ANALYZE* enables an entry window for selecting the frame number to be analyzed.

IEC/IEEE bus command: `SENS:CDP:FRAM:VAL` <numeric value>

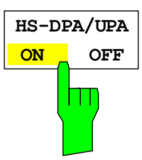
Range: <numeric value> *[0 ... CAPTURE_LENGTH - 1]*
Unit: [Frames]]




The *RRC FILTER ON|OFF* softkey selects if a root raised cosine (RRC) receiver filter is used or not. This feature is useful if the RRC filter is implemented in the device under test (DUT).

ON: If an unfiltered WCDMA signal is received (normal case), the RRC filter should be used to get a correct signal demodulation. (Default settings)
OFF: If a filtered WCDMA signal is received, the RRC filter should not be used to get a correct signal demodulation. This is the case if the DUT filters the signal.

IEC/IEEE bus command: `SENS:CDP:FILT ON|OFF`




The *HS-DPA/UPA ON/OFF* softkey selects if the HS-DPCCH, E-DPCCH and E-DPDCH channels are displayed or not.

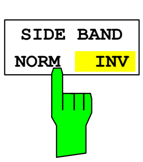
ON: The HSUPA/HSDPA channel can be detected.(Default settings)
OFF: The HSUPA/HSDPA channel cannot be detected.

IEC/IEEE bus command: `SENS:CDP:HSDP ON|OFF`
`CONF:WCDP:MS:CTAB:DATA:HSDP ON|OFF`


The *ELIMINATE TAIL CHIPS* selects length of the measurement interval for calculation of error vector magnitude (EVM). In accordance with 3GPP specification Release 5, the EVM measurement interval is one slot (4096 chips) minus 25 µs at each end of the burst (3904 chips) if power changes are expected. If no power changes are expected, the evaluation length is one slot (4096 chips).

ON: Changes of power are expected. Therefore an EVM measurement interval of one slot minus 25 µs (3904 chips) is considered.
OFF: Changes of power are not expected. Therefore an EVM measurement interval of one slot (4096 chips) is considered. (Default settings)

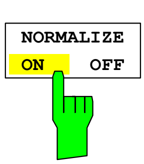
IEC/IEEE bus command: `SENS:CDP:ETCH ON|OFF`




The *SIDE BAND NORM / INV* softkey is used to perform the measurement both in the normal (NORM) and inverted position (INV).

NORM The normal position allows the measurement of RF signals from the user equipment.
INV The inverted position is useful for measurements on IF modules or components in case of spectral inversion.

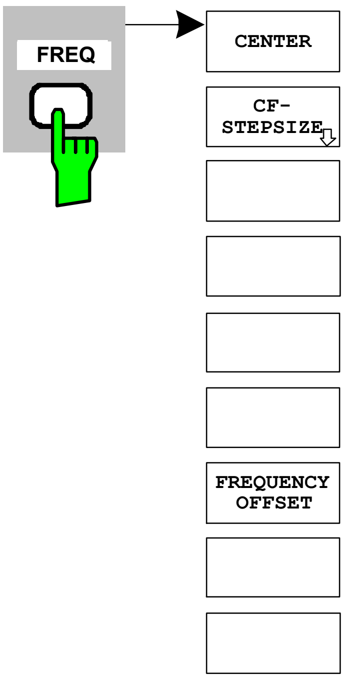
IEC/IEEE bus command: `SENS:CDP:SBAN NORM|INV`




The *NORMALIZE ON / OFF* softkey eliminates the DC offset of the signal.

IEC/IEEE bus command `SENS:CDP:NORM OFF`

## Frequency Settings – Key *FREQ*




The *FREQ* key opens a submenu for changing the measurement frequency.

The *CENTER* softkey opens the window for manually entering the center frequency.
The allowed range of values for the center frequency is:

$$\text{minspan} / 2 \le f_{center} \le f_{max} - \text{minspan} / 2$$

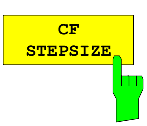
| | |
|---|---|
| $f_{center}$ | center frequency |
| minspan | smallest selectable span > 0 Hz (10 Hz) |
| $f_{max}$ | max. frequency |

IEC/IEEE bus command: `FREQ:CENT 100MHz`

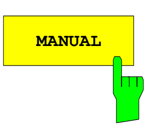
The CF *STEPSIZE* softkey opens a submenu for setting the step size of the center frequency. The step size can be coupled to the span (frequency domain) or the resolution bandwidth (time domain) or it can be manually set to a fixed value. The softkeys are mutually exclusive selection keys.

The *FREQUENCY OFFSET* softkey activates the window for entering an arithmetical frequency offset which is added to the frequency axis labeling. The allowed range of values for the offset is -100 GHz to 100 GHz. The default setting is 0 Hz.

IEC/IEEE bus command: `FREQ:OFFS 10 MHz`




The center frequency can be adjusted either be typing in the carrier frequency or by using the up and down keys or the rotary knob. The step size can be set, e.g. to a carrier spacing in multicarrier measurements. With the *CF STEPSIZE* softkey, a submenu with the *MANUAL* softkey is available. The default value of 10 Hz can be adjusted.

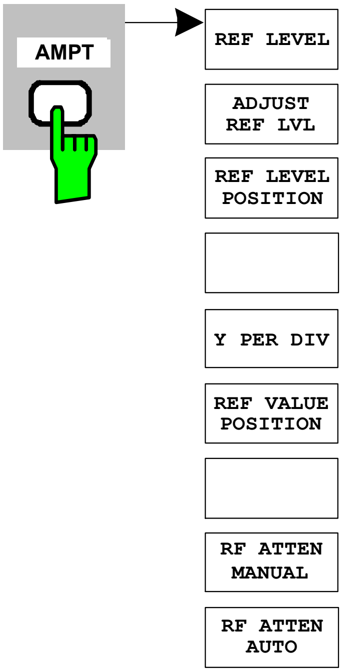



IEC/IEEE bus command: `SENS:FREQ:CENT:STEP 15 Hz`

## Span Settings – Key *SPAN*

The *SPAN* key is disabled for measurements in the CDP mode. For all other measurements (see *MEAS* key), the permissible span settings are described with the relevant measurement. The associated menu corresponds to that of the measurement in the basic unit and is described in the manual of the basic unit.

## Level Settings – Key *AMPT*




The *AMPT* key opens a submenu for level setting.

The *REF LEVEL* softkey allows the reference level to be input in the currently active unit (dBm, dBμV, etc).

IEC/IEEE bus command: `DISP:WIND:TRAC:Y:RLEV -60dBm`

*ADJUST REF LVL* executes a routine for optimum adjustment of the reference level to the signal.

IEC/IEEE bus command: `SENS1|2:CDP:LEV:ADJ`

The *REF LEVEL OFFSET* softkey allows the arithmetic level offset to be entered. This offset is added to the measured level irrespective of the selected unit. The scaling of the Y-axis is changed accordingly.
The setting range is ±200 dB in 0.1 dB steps.

IEC/IEEE bus command:
`DISP:WIND:TRAC:Y:RLEV:OFFS -10dB`

*Y PER DIV* determines the grid spacing on the Y axis for all diagrams, where possible.

IEC/IEEE bus command:
`DISP:WIND1|2:TRAC1:Y:SCAL:PDIV`

*REF VALUE POSITION* allows entry of the position of the reference value on the Y axis (0 – 100%).

IEC/IEEE bus command:
`DISP:WIND1|2:TRAC1:Y:SCAL::RPOS`

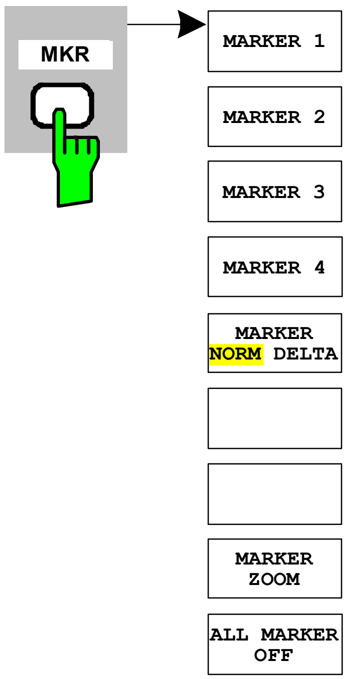
The *RF ATTEN MANUAL* softkey allows the attenuation to be entered irrespective of the reference level.
If the defined reference level cannot be set for the given RF attenuation, the reference level will be adjusted accordingly and the warning "Limit reached" will be output.

IEC/IEEE bus command: `INP:ATT 40 DB`

The *RF ATTEN AUTO* softkey sets the RF attenuation automatically as a function of the selected reference level.
This ensures that the optimum RF attenuation desired by the user is always used.
*RF ATTEN AUTO* is the default setting.

IEC/IEEE bus command: `INP:ATT:AUTO ON`

## Marker Settings – Key *MKR*




The *MARKER* key opens a submenu for the marker settings.

Markers are not available for the *RESULT SUMMARY* and *CHANNEL TABLE* displays. In all other displays, up to four markers can be activated, which can be defined as marker or delta marker by means of the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* .softkey selects the corresponding marker and activates it.
*MARKER 1* is always the normal marker. After they have been switched on, *MARKERS 2 to 4* are delta markers that refer to *MARKER 1*. These markers can be converted into markers with absolute value display by means of the *MARKER NORM DELTA* softkey. When *MARKER 1* is the active marker, pressing the M*ARKER NORM DELTA* softkey switches on an additional delta marker.
Pressing the *MARKER 1 to 4* softkey again switches off the selected marker.

IEC/IEEE bus command:

```
CALC:MARK ON;
CALC:MARK:X <value>;
CALC:MARK:Y?
CALC:DELT ON;
CALC:DELT:MODE ABS|REL
CALC:DELT:X <value>;
CALC:DELT:X:REL?
CALC:DELT:Y?
```

The *MARKER ZOOM* softkey expands the area around MARKER 1. With the zoom function, more details of the display can be seen.
If *MARKER 1* is not active when the softkey is pressed, it is automatically activated and set to the highest peak in the window.
If an instrument setting is changed after selection of *MARKER ZOOM*, the function is aborted.

IEC/IEEE bus command: `CALC:MARK1:FUNC:ZOOM`

The *ALL MARKER OFF* softkey switches off all markers (reference and delta markers). It also switches off all functions and displays associated with the markers/delta markers.

IEC/IEEE bus command: `CALC:MARK:AOFF`

The parameters concerning an activated marker are output at the top of the diagram:

```
Marker 1 [T1 ]
                       -6.02 dBm
   Slot  4 SR 960.0 ksps Ch 2
```

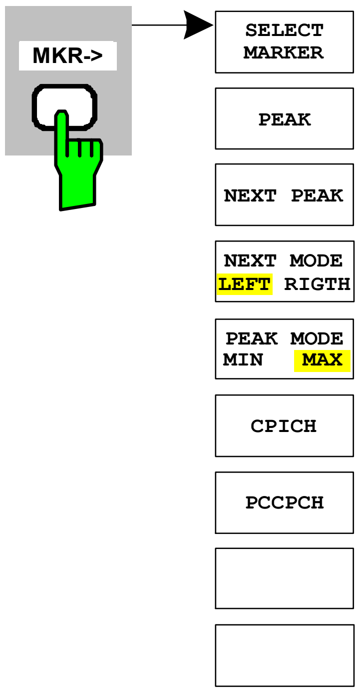
Fig. 38 Parameters of the marker info field

Besides the channel power, the parameters are:

| | |
|---|---|
| Slot 4: | Slot number of the channel |
| SR 960 ksps: | Symbol rate of the channel unassigned codes 15 ksps) |
| Ch 2: | Number of the spreading code of the channel |

For all other measurements, the marker functions of the basic unit apply.

## Changing Instrument Settings – Key *MKR→*




The *MKR→* key opens a submenu for marker functions:

The *SELECT MARKER* softkey activates the numerical selection of the marker in the data entry field. Delta marker 1 is selected by input of ' 0 '.

IEC/IEEE bus command: `CALC:MARK1 ON;`
`CALC:MARK1:X <value>;`
`CALC:MARK1:Y?`

The *PEAK* softkey sets the active marker or delta marker to the peak of the trace.
If no marker is active when *MKR->* menu is called, *MARKER 1* is automatically switched on and the peak search is performed.

IEC/IEEE bus command: `CALC:MARK:MAX`
`CALC:DELT:MAX`
`CALC:MARK:MIN`
`CALC:DELT:MIN`

The *NEXT PEAK* softkey sets the active marker/delta marker to the next lower peak value on the trace. The search direction is defined in the *NEXT MODE* submenu (see below).

IEC/IEEE bus command: `CALC:MARK:MAX:NEXT`
`CALC:DELT:MAX:NEXT`
`CALC:MARK:MIN:NEXT`
`CALC:DELT:MIN:NEXT`

The *NEXT MODE LEFT/RIGHT* softkey defines the searching direction for the search of the next maximum/minimum. For *NEXT MODE LEFT/RIGHT* the next extreme is searched to the left/right of the active marker.

IEC/IEEE bus command: `CALC:MARK:MAX:LEFT`
`CALC:DELT:MAX:LEFT`
`CALC:MARK:MIN:LEFT`
`CALC:DELT:MIN:LEFT`
`CALC:MARK:MAX:RIGH`
`CALC:DELT:MAX:RIGH`
`CALC:MARK:MIN:RIGH`
`CALC:DELT:MIN:RIGH`

The *PEAK MODE MIN/MAX* softkey defines whether the peak should be searched in minima or maxima. This parameter influences the behaviour of the softkeys *PEAK* and *NEXT PEAK*.

IEC/IEEE bus command: --

## Marker Functions – Key MKR *FCTN*

The *MKR FCTN* key is disabled for all measurements in the code domain power. For all other R&S FS-K73 measurements, the menu softkeys are described in the manual of the basic unit.

## Bandwidth Setting – Key *BW*

The *BW* key is disabled for all measurements in the code domain power. For all other R&S FS-K73 measurements, the menu-specific softkeys are described in the manual of the basic unit.

## Measurement Control – Key *SWEEP*

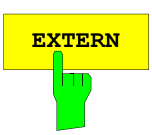
The menu of the *SWEEP* key contains options for switchover between single measurement and continuous measurement and for the control of individual measurements. For measurements within the spectrum, the measurement time for a sweep can also be set. All menu-specific softkeys are described in the manual of the basic unit.

## Measurement Selection – Key *MEAS*

The menu of the *MEAS* key contains all the R&S FS-K73 measurements, which can be selected at a keystroke. The menu and its submenus are described in chapter 6.

## Trigger Settings – Key *TRIG*

The selectable trigger functions depend on the measurement selected. Code domain power measurements allow the free run mode as well as the frame trigger mode specified by the 3GPP standard. For all other measurements, the trigger modes are identical to those of the corresponding measurement in the basic unit. The associated softkeys are described in the manual of the basic unit.




With the *TRIGGER EXTERN* softkey the external trigger source can be selected. The external trigger level can be adjusted in the range from 0.5V to 3.5V. The default value is 1.4 V.

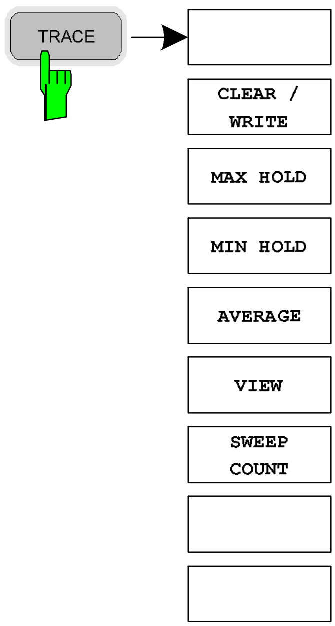
IEC/IEEE bus commands:
`TRIG:SEQ:LEV:EXT <numeric_value>`

Read trigger level
`TRIG1:SEQ:LEV:EXT?`

Activate external Trigger Mode
`TRIG1:SEQ:SOUR EXT`

Inactivate external Trigger Mode
`TRIG1:SEQ:SOUR IMM`

## Trace Settings – Key *TRACE*




The Key *TRACE* opens the following submenu:

The *CLEAR/WRITE* softkey activates the overwrite mode for the collected measured values, i.e. the trace is overwritten by each sweep.
In the *CLEAR/WRITE* display mode, all available detectors can be selected. In the default mode, the autopeak detector (setting *AUTO*) is selected.
Each time the *CLEAR/WRITE* softkey is actuated, the analyzer clears the selected trace memory and restarts the measurement.

IEC/IEEE bus command `DISP:WIND:TRAC:MODE WRIT`

The *MAX HOLD* softkey activates the max peak detector.
The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.
The signal spectrum is filled upon each sweep until all signal components are detected in a kind of envelope.
Pressing the *MAX HOLD* softkey again clears the trace memory and restarts the max hold mode.

IEC/IEEE bus command `DISP:WIND:TRAC:MODE MAXH`

The *MIN HOLD* softkey activates the min peak detector.
The analyzer saves the sweep result in the trace memory only if the new value is greater than the previous one.
The signal spectrum is filled up upon each sweep until all signal components are detected in a kind of envelope.
Pressing the *MIN HOLD* softkey again clears the trace memory and restarts the max hold mode.

IEC/IEEE bus command `DISP:WIND:TRAC:MODE MINH`

The *AVERAGE* softkey activates the trace averaging function. The average is formed over several sweeps. Averaging can be performed with any of the detectors available. If the detector is automatically selected by the analyzer, the sample detector is used.
Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared.

IEC/IEEE bus command `DISP:WIND:TRAC:MODE AVER`

The *VIEW* softkey freezes the current contents of the trace memory and displays them.
If a trace is frozen by *VIEW*, the instrument settings can be changed without the displayed trace being modified (exception: level display range and reference level, see below). The fact that the trace and the current instrument setting no longer agree is indicated by an enhancement label "*" at the right edge of the grid.
If in the *VIEW* display mode the level display range (*RANGE*) or the reference level (*REF LEVEL*) is changed, the R&S Analyzer automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be carried out after the measurement in order to show details of the trace.

IEC/IEEE bus command `DISP:WIND:TRAC:MODE VIEW`

The *SWEEP COUNT* softkey activates the entry of the number of sweeps used for averaging. The allowed range of values is 0 to 30000 and the following should be observed:

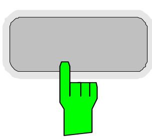
| | |
|---|---|
| Sweep Count = 0 | means running averaging |
| Sweep Count = 1 | means no averaging being carried out |
| Sweep Count > 1 | means averaging over the selected number of sweeps; in the continuous sweep mode averaging is performed until the set number of sweeps is attained and is then continued as running averaging. |

The default setting is running averaging (Sweep Count = 0). The number of sweeps used for averaging is the same for all active traces in the selected diagram.

IEC/IEEE bus command `SWE:COUN 64`

SCREEN A

SCREEN B



By using the softkeys *SCREEN A* or *SCREEN B,* the upper (A) or lower (B) part of the display screen can be selected. The trace statistic functions described above are applied only to the measurement results, which are displayed in the selected screen. The display of special interest is the RESULT SUMMARY. It is shown in the lower part (SCREEN B). If the trace statistic functions are applied to the result summary, the affected results are marked if it is an average result, a max hold or a min hold result.

| | |
|---|---|
| CLEAR/WRITE | Displays the result value of the last sweep (<none>) |
| MAX HOLD: | Displays the maximum result values of a number of sweeps (<MAX>) |
| MIN HOLD: | Displays the minimum result value of a number of sweeps (<MIN>) |
| AVERAGE: | displays the average result value of a number of sweeps (<AVG>) |

The number of evaluated sweeps depends on the sweep count value. The figure below shows an example of the result summary display with applied sweep averaging. All averaged values are marked with "AVG". In particular, the resolution and accuracy of the trigger-to-frame value can be increased by using the trace average mode.

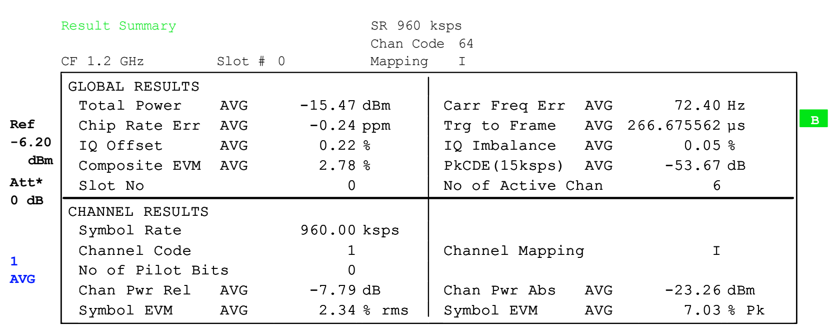



Fig. 39 Result summary with applied average mode

## Display Lines – Key *LINES*

The *LINES* key is disabled for all measurements in the code domain power. For all other measurements, the menu settings are equivalent to those of the corresponding measurement in the basic unit; the associated softkeys are described in the manual of the basic unit.

## Settings of Measurement Screen – Key *DISP*

The menu of the *DISP* key contains softkeys for the configuration of the measurement screen. The menus and the softkey functions are described in the manual of the basic unit.

## Storing and Loading of Unit Data – Key *FILE*

The *FILE* menu is identical to that of the basic unit. All softkeys are described in the manual of the basic unit.

All keys of the analyzer front panel that are not specifically mentioned are identical to those of the basic unit. The key functions and the softkeys are described in the manual of the basic unit.

# 7 Remote-Control Commands

The following chapter describes the remote-control commands for the application firmware. An alphabetical list at the end of this chapter provides an overview of the commands. The commands, which are also valid for the basic unit in the signal analyzer mode as well as the system settings, are described in the operating manual of the analyzer.

## CALCulate:FEED - Subsystem

The CALCulate:FEED subsystem selects the evaluation method for the measured data. This corresponds to the result display selection in manual operation.

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| :CALCulate<1\|2><br>:FEED | <string> | | |

**:CALCulate<1|2>:FEED** <string>

This command selects the measured data that are to be displayed. .

**Parameter:** <string>::=
‘XPOWer:CDPower’ |
‘XPOWer:CDPower:ABSsolute’ |
‘XPOWer:CDPower:RATio’ |
‘XPOWer:CDPower:OVERview’ |
‘XPOW:erCDPower’ |
'XTIMe:CDPower:CHIP:EVM’ |
'XTIMe:CDPower:CHIP:MAGNitude’ |
'XTIMe:CDPower:CHIP:PHASe’ |
'XTIMe:CDPower:COMP:CONStellation'
'XTIMe:CDPower:FVSLot’ |
‘XTIMe:CDPower:MACCuracy’ |
‘XTIMe:CDPower:PVSlot’ |
'XTIMe:CDPower:PVSLot:ABSolute' |
‘XTIMe:CDPower:PVSYmbol’ |
‘XTIMe:CDPower:BSTReam’ |
‘XTIMe:CDPower:ERRor:SUMMary’ |
‘XTIMe:CDPower:ERRor:CTABle’ |
‘XTIMe:CDPower:ERRor:PCDomain‘ |
‘XTIMe:CDPower:SYMBol:CONStellation‘ |
‘XTIM:CDPower:SYMBol:EVM‘
'XTIMe:CDPower:SYMBol:EVM:MAGNitude’ |
'XTIMe:CDPower:SYMBol:EVM:PHASe’

**Example:** `":CALC2:FEED ‘XTIM:CDP:MACC’"`

**Features:** *RST value: ‘XTIM:OFF’
SCPI: conforming

***Note:*** *For code domain power (CDP) measurements, the display is always operated in the SPLIT SCREEN mode and the assignment of display mode to measurement window is fixed. Therefore, the numeric suffix that is required or permitted is given in brackets for each display mode.*

The string parameters have the following meaning:

| | |
|---|---|
| ‘XPOW:CDP’ | Result display of code domain power as bar graph absolute scaling (CALCulate<1>) |
| 'XPOW:CDP:ABS‘ | Result display of code domain power as bar graph absolute scaling (CALCulate<1>) |
| ‘XPOW:CDP:RAT’ | Result display of code domain power ratio as bar graph relative scaling (CALCulate<1>) |
| ‘XPOW:CDP:OVER’ | Result display of code domain power (both I and Q component) as bar graph (CALCulate<1>) |
| ‘XPOW:CDP’ | Result display of code domain error power as bar graph (CALCulate<1>) |
| 'XTIMe:CDP:CHIP:EVM’ \| | Result display of error vector magnitude (EVM) versus Chip |
| 'XTIMe:CDP:CHIP:MAGNitude’ \| | Result display of magnitude error versus chip |
| 'XTIMe:CDP:CHIP:PHASe’ \| | Result display of phase error versus chip |
| 'XTIM:CDP:COMP:CONS' | Result display of composite constellation (CALCulate2) |
| ‘XTIM:CDP:ERR:SUMM’ | Result display in tabular form (CALCulate2) |
| ‘XTIM:CDP:ERR:CTAB’ | Result display of channel assignment table (CALCulate<1>) |
| ‘XTIM:CDP:ERR:PCD’ | Result display of peak code domain error (CALCulate2) |
| ’XTIM:CDP:FVSL’ | Result display of frequency versus Slot (CALCulate2) |
| ‘XTIM:CDP:MACC’ | Result display of composite EVM (error vector magnitude referenced to the overall signal) (CALCulate2) |
| ‘XTIM:CDP:PVSLot’ | Result display of power versus slot (CALCulate2) |
| ‘XTIM:CDP:PVSLot:ABSolute’ | Result display of power versus slot [absolute scaling] (CALCulate2) |
| ‘XTIM:CDP:PVSL:RAT’ | Result display of power versus slot |
| 'XTIM:CDP:PVSY' | Result display of power versus symbol (CALCulate2) |
| ‘XTIM:CDP:BSTR’ | Result display of bit stream (CALCulate2) |
| ‘XTIM:CDP:SYMB:CONS’ | Result display of symbol constellation (CALCulate2) |
| ‘XTIM:CDP:SYMB:EVM’ | Result display of symbol error vector magnitude (CALCulate2) |
| ‘XTIM:CDP:SYMB:EVM:PHAS | Result display of the phase of EVM versus symbols (CALCulate2) |
| ‘XTIM:CDP:SYMB:EVM:MAGN | Result display of the magnitude of EVM versus symbols (CALCulate2) |

## CALCulate:LIMit – Subsystem

## CALCulate:LIMit:ACPower Subsystem

The CALCulate:LIMit:ACPower subsystem defines limit checking for adjacent channel power measurements.

<table>
<tr><th>COMMAND</th><th>PARAMETER</th><th>UNIT</th><th>COMMENT</th></tr>
<tr><td>CALCulate<1|2></td><td></td><td></td><td></td></tr>
<tr><td>:LIMit1</td><td></td><td></td><td></td></tr>
<tr><td>:ACPower</td><td></td><td></td><td></td></tr>
<tr><td>[:STATe]</td><td>< ON | OFF></td><td></td><td></td></tr>
<tr><td>ACHannel</td><td></td><td>DB, DB</td><td></td></tr>
<tr><td>[:RELative]</td><td><value></td><td></td><td></td></tr>
<tr><td>:STATe</td><td>< ON | OFF></td><td>DBM, DBM</td><td></td></tr>
<tr><td>:ABSolute</td><td><value></td><td></td><td></td></tr>
<tr><td>:STATe</td><td>< ON | OFF></td><td></td><td></td></tr>
<tr><td>:RESult?</td><td><value>,<value></td><td></td><td></td></tr>
<tr><td>:ALTernate<1…11></td><td></td><td></td><td></td></tr>
<tr><td>[:RELative]</td><td><value></td><td>DB, DB</td><td></td></tr>
<tr><td>:STATe</td><td>< ON | OFF></td><td></td><td></td></tr>
<tr><td>:ABSolute</td><td><value></td><td></td><td></td></tr>
<tr><td>:STATe</td><td>< ON | OFF></td><td></td><td></td></tr>
<tr><td>:RESult?</td><td><value>,<value></td><td></td><td></td></tr>
</table>

**CALCulate<1|2>:LIMit1:ACPower[:STATe]** ON | OFF

This command switches on and off the limit check for adjacent channel power measurements in the selected measurement window. The commands `CALCulate:LIMit:ACPower:ACHannel:STATe` or `CALCulate:LIMit:ACPower:ALTernate:STATe` must be used in addition to specify whether the limit check is to be performed for the upper/lower adjacent channel or for the alternate adjacent channels.

**Example:** "`CALC:LIM:ACP ON`"

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

**CALCulate<1|2>:LIMit1:ACPower:ACHannel[:RELative]** 0 to 100dB, 0 to 100dB

This command defines the relative limit of the upper/lower adjacent channel for adjacent channel power measurements in the selected measurement window. The reference value for the relative limit value is the measured channel power.

It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit value defined with `CALCulate:LIMit:ACPower:ACHannel:ABSolute`. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

**Parameter:** The first numeric value is the limit for the upper (lower) adjacent channel. The second value is ignored but must be indicated for reasons of compatibility with the FSE family.

**Example:** "`CALC:LIM:ACP:ACH 30DB, 30DB`"
'Sets the relative limit value in for the power in the lower and upper adjacent channel to 30 dB below the channel power.

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

**CALCulate<1|2>:LIMit1:ACPower:ACHannel[:RELative]:STATe** ON | OFF

This command activates the limit check for the relative limit value of the adjacent channel when adjacent channel power measurement is performed. Before the command, the limit check must be activated using `CALCulate:LIMit:ACPower:STATe ON`.

The result can be queried with `CALCulate:LIMit:ACPower:ACHannel:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

**Example:** "`CALC:LIM:ACP:ACH:REL:STAT ON`"
'Switches on the check of the relative limit values for adjacent channels.

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

**CALCulate<1|2>:LIMit1:ACPower:ACHannel:ABSolute** -200DBM to 200DBM, -200 to 200DBM

This command defines the absolute limit value for the lower/upper adjacent channel during adjacent-channel power measurement (Adjacent Channel Power) in the selected measurement window.

It should be noted that the absolute limit value has no effect on the limit check as soon as it is below the relative limit value defined with `CALCulate:LIMit:ACPower:ACHannel:RELative`. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

**Parameter:** The first value is the limit for the lower and the upper adjacent channel. The second limit value is ignored but must be indicated for reasons of compatibility with the FSE family.

**Example:** "`CALC:LIM:ACP:ACH:ABS -35DBM, -35DBM`"
'Sets the absolute limit value in for the power in the lower and upper adjacent channel to -35 dBm.

**Characteristics:** *RST value: -200DBM
SCPI: device-specific

**CALCulate<1|2>:LIMit1:ACPower:ACHannel:ABSolute:STATe** ON | OFF

This command activates the limit check for the adjacent channel when adjacent-channel power measurement (Adjacent Channel Power) is performed. Before the command, the limit check for the channel/adjacent-channel measurement must be globally switched on using `CALC:LIM:ACP ON`.

The result can be queried with `CALCulate:LIMit:ACPower:ACHannel:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

**Example:** "`CALC:LIM:ACP:ACH:ABS:STAT ON`"
'Switches on the check of absolute limit values for the adjacent channels.

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

**CALCulate<1|2>:LIMit1:ACPower:ACHannel:RESult?**

This command queries the result of the limit check for the upper/lower adjacent channel in the selected measurement window when adjacent channel power measurement is performed.
If the power measurement of the adjacent channel is switched off, the command produces a query error.

**Parameter:** The result is returned in the form <result>, <result> where
<result> = PASSED | FAILED, and where the first returned value denotes the lower, the second denotes the upper adjacent channel.

**Example:** "CALC:LIM:ACP:ACH:RES?"
'Queries the limit check result in the adjacent channels Sets the relative limit value for the power in the lower and upper adjacent channel to 30 dB below the channel power.

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

**CALCulate<1|2>:LIMit1:ACPower:ALTernate<1...11>[:RELative]** 0 to 100dB, 0 to 100dB

This command defines the limit for the selected alternate adjacent channel in the selected measurement window for adjacent channel power measurements.The reference value for the relative limit value is the measured channel power.

The numeric suffix after `ALTernate<1...11>` denotes the first or the second alternate channels. It should be noted that the relative limit value has no effect on the limit check as soon as it is below the absolute limit defined with `CALCulate:LIMit:ACPower:ALTernate:ABSolute`. This mechanism allows automatic checking of the absolute basic values of adjacent channel power as defined in mobile radio standards.

**Parameter:** The first value is the limit for the lower and the upper alternate adjacent channel. The second limit value is ignored but must be indicated for reasons of compatibility with the FSE family.

**Example:** "CALC:LIM:ACP:ALT2 30DB, 30DB"
'Sets the relative limit value for the power in the lower 'and upper second alternate adjacent channel to 30 dB below the channel power.

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

**CALCulate<1|2>:LIMit1:ACPower:ALTernate<1...11>[:RELative]:STATe** ON | OFF

This command activates the limit check for the selected alternate adjacent channel in the selected measurement window for adjacent channel power measurements. Before the command, the limit check must be activated using `CALCulate:LIMit:ACPower:STATe ON`.
The numeric suffix after `ALTernate` denotes alternate channel.
The result can be queried with `CALCulate:LIMit:ACPower:ALTernate<1...11>:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are obtained.

**Example:** "CALC:LIM:ACP:ACH:REL:STAT ON"
'Switches on the check of the relative limit values for the first alternate adjacent channels

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

**CALCulate<1|2>:LIMit1:ACPower:ALTernate<1...11>ABSolute** -200DBM to 200DBM, -200DBM to .200DBM

This command defines the absolute limit value for the selected alternate adjacent channel power measurement (Adjacent Channel Power) in the selected measurement window.
The numeric suffix after `ALTernate` denotes the first or the second alternate channel.
It should be noted that the absolute limit value for the limit check has no effect as soon as it is below the relative limit value defined with `CALCulate:LIMit:ACPower:ALTernate:RELative`. This mechanism allows automatic checking of the absolute basic values defined in mobile radio standards for the power in adjacent channels.

**Parameter:** The first value is the limit for the lower and the upper alternate adjacent channel. The second limit value is ignored but must be indicated for reasons of compatibility with the FSE family.

**Example:** "`CALC:LIM:ACP:ALT2:ABS -35DBM, -35DBM`"
'Sets the absolute limit value for the power in the lower and upper second alternate adjacent channel to -35 dBm.

**Characteristics:** *RST value: -200DBM
SCPI: device-specific

**CALCulate<1|2>:LIMit1:ACPower:ALTernate<1...11>:ABSolute:STATe** ON | OFF

This command activates the limit check for the selected alternate adjacent channel in the selected measurement window for adjacent channel power measurement (Adjacent Channel Power).
Before the command, the limit check must be globally switched on for the channel/adjacent channel power with the command `CALCulate:LIMit:ACPower:STATe ON`.
The numeric suffix after `ALTernate` denotes the alternate channel.
The result can be queried with `CALCulate:LIMit:ACPower:ALTernate:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are available.

**Example:** "`CALC:LIM:ACP:ACH:ABS:STAT ON`"
'Switches on the check of absolute limit values for the first alternate adjacent channels.

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

**CALCulate<1|2>:LIMit1:ACPower:ALTernate<1...11>:RESult?**

This command queries the result of the limit check for the selected alternate adjacent channel in the selected measurement window for adjacent channel power measurements.
The numeric suffix after `ALTernate` denotes the alternate channel.
If the power measurement of the adjacent channel is switched off, the command produces a query error.

**Parameter:** The result is returned in the form <result>, <result> where <result> = PASSED | FAILED and where the first (second) returned value denotes the lower (upper) alternate adjacent channel.

**Example:** "`CALC:LIM:ACP:ALT2:RES?`"
'Queries the limit check result in the second alternate adjacent channels.

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

## CALCulate:LIMit:ESPECtrum Subsystem

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| CALCulate:LIMit:ESPectrum | | | |
| :MODE | AUTO \| USER | | |
| :CHECk | | | |
| :X | <numeric value> | | Query only |
| :Y | <numeric value> | | Query only |
| :TRANsition | | | |

**:CALCulate:LIMit:ESPectrum:MODE** AUTO | USER

This command activates or deactivates automatic selection of the limit line in the spectrum emission mask measurement.

**Parameters:** AUTO The limit line is set as a function of the measured channel power.
USER Query only; user-defined limit lines are active (refer to description of limit lines in manual for basic unit).

**Example:** `":CALC:LIM:ESP:MODE AUTO"`

**Features:** *RST value: AUTO
SCPI: device-specific

**:CALCulate:LIMit:ESPectrum:CHECk:X?**

With this commands the frequency value of the worst fail of a SEM measurement can be queried.

**Unit:** [Hz]

**Example:** `":CALC:LIM:ESP:CHEC:X?"`

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

**:CALCulate:LIMit:ESPectrum:CHECk:Y?**

With this command the power value of the worst fail of a SEM measurement can be queried.

**Unit:** [dBm]

**Example:** `":CALC:LIM:ESP:CHEC:Y?"`

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

**:CALCulate<1|2>:LIMit<1...8>:ESPectrum:TRANsition** <numeric value>

Th command specifies the offset frequency at which the resolution bandwidth is changed between 30 kHz and 1 MHz.. The default value is 3.5 MHz.

**Example:** `":CALC2:LIM:ESP:TRAN 3 MHz"`

**Features:** *RST value:: 3.5 MHz
SCPI: device-specific

## CALCulate:MARKer – Subsystem

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| CALCulate<1\|2><br>:MARKer<1...4><br>:FUNCtion<br>:WCDPower<br>:MS<br>:RESult? | PTOTal \| FERRor \| TFRame \| MACCuracy \| PCDerror \| EVMRms \| EVMPeak \| CERRor \| CSLot \| SRATe \| CHANnel \| CDPabsolute \| CDPRelative \| IQOFfset \| IQIMbalance \| CMAPping \| PSYMbol \| RHO \| TOFFset \| MTYPe \| ACHannels\| MPIC | | Query only |
| :POWer<br>:RESult? | ACPower \| CPOWer \| MCACpower \| OBANdwidth \| OBWidth \| CN \| CN0 | | |
| :PHZ | ON\|OFF | | |

**:CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:MS:RESult?**
PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFfset | IQIMbalance | CMAPping | PSYMbol | RHO | TOFFset

This command queries the measured and calculated results of the 3GPP FDD code domain power measurement.

| | |
|---|---|
| PTOTal | total power |
| FERRor | frequency error in Hz |
| TFRame | trigger to frame |
| MACCuracy | composite EVM |
| PCDerror | peak code domain error |
| EVMRms | error vector magnitude RMS |
| EVMPeak | error vector magnitude peak |
| CERRor | chip rate error |
| CSLot | channel slot number |
| SRATe | symbol rate |
| CHANnel | channel number |
| CDPabsolute | channel power absolute |
| CDPRelative | channel power relative |
| IQOFfset | IQ offset |
| IQIMbalance | IQ imbalance |
| CMAPping | Channel component |
| PSYMbol | Number of pilot bits |
| RHO | Quality parameter rho for every slot |
| TOFFset | Offset between the start of the first slot in the channel and the start of the analyzed 3GPP FDD frame. |
| MTYPe | modulation type of the selected channel |
| ACHannels | number of active channels |
| MPIC | average power of the inactive codes for the selected slot |

**Example:** `":CALC:MARK:FUNC:WCDP:RES? PTOT"`

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

**:CALCulate<1|2>:MARKer1:FUNCtion:POWer:RESult:PHZ** ON|OFF

This command switches the query response of the power measurement results in the indicated measurement window between output of absolute values (OFF) and output referred to the measurement bandwidth (ON). The measurement results are output with `CALCulate:MARKer:FUNCtion:POWer:RESult?`

| | |
|---|---|
| ON | Results output referred to measurement bandwidth. |
| OFF | Results output in absolute values. |

**Example:** `"CALC:MARK:FUNC:POW:RES:PHZ ON"`

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

## CALCulate:PEAKsearch – Subsystem

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| :CALCulate<br>:PEAKsearch<br>:AUTO | <Boolean> | | |

**:CALCulate<1|2>:PEAKsearch:AUTO** ON | OFF

This command calculates a peak list of the spectrum emission mask measurement at each sweep. One peak value is determined for each range of the limit line.
With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on.

ON: Enables automatic peak search
OFF: Disables automatic peak search

**Example:** `":CALC1:PEAK:AUTO ON"`

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

## CALCulate:STATistics - Subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the instrument. The measurement window cannot be selected with these functions. The numeric suffix in CALCulate is therefore ignored.

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| :CALCulate | | | |
| :STATistics | | | |
| :MS | | | |
| :CCDF | | | |
| [:STATe] | <Boolean> | | |
| :NSAMples | <numeric_value> | -- | |
| :SCALe | | | |
| :Y | | | |
| :UPPer | <numeric_value> | -- | |
| :LOWe | <numeric_value> | -- | |
| :PRESet | | | |

**:CALCulate:STATistics:MS:CCDF[:STATe]** ON | OFF

This command switches on or off the measurement of the complementary cumulative distribution function (CCDF).

**Example:** "`CALC:STAT:MS:CCDF ON`"

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

**:CALCulate:STATistics:NSAMples** 100 to 32768

This command sets the number of measurement points to be acquired for the statistical measurement functions

**Example:** "`CALC:STAT:NSAM 5000`"

**Features:** *RST value: 10000
SCPI: device-specific

**:CALCulate:STATistics:SCALe:Y:UPPer** 1E-5 to 1.0

This command defines the upper limit for the Y-axis of the diagram in statistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

**Example:** "`CALC:STAT:SCAL:Y:UPP 0.01`"

**Features:** *RST value: 1.0
SCPI: device-specific

**:CALCulate:STATistics:SCALe:Y:LOWer** 1E-6 to 0.1

This command defines the lower limit for the Y-axis of the diagram in statistical measurements. Since probabilities are specified on the Y-axis, the entered numerical values are dimensionless.

**Example:** "`CALC:STAT:SCAL:Y:LOW 0.001`"

**Features:** *RST value: 1E-6
SCPI: device-specific

**:CALCulate:STATistics:PRESet[**

This command resets the scaling of the X and Y axes in a statistical measurement. The following values are set:

X axis ref level: -20 dBm
X axis range APD: 100 dB
X axis range CCDF: 20 dB

Y axis upper limit: 1.0
Y axis lower limit: 1E-6

| | | |
|---|---|---|
| **Example:** | "CALC:STAT:PRES" | Resets the scaling for statistical functions |
| **Characteristics:** | *RST value: | -- |
| | SCPI: | device-specific |

This command is an "event" which is why it is not assigned an *RST value and has no query.

## CONFigure:WCDPower Subsystem

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in `CONFigure`.

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| CONFigure | | | |
| :WCDPower | | | |
| :MS | | | Option R&S FS-K73 |
| :MEASurement | POWer \| ACLR \| ESPectrum \| OBANdwidth \| OBWidth \| WCDPower \| CCDF | | |
| :CTABle | | | |
| [:STATe] | <Boolean> | | |
| :SELect | <file_name> | | |
| :NAME | <file_name> | | |
| :DATA | <numeric_value>, <numeric_value> | | |
| :HSDPcch | <Boolean> | | |
| :COMMent | <string> | | |
| :COPY | <file_name> | | |
| :DELete | | | |
| :CATalog? | | | |
| :EDATa | <numeric_value>,<numeric_value>.. | | |
| :EDPCch | <Boolean> | | |

**CONFigure<1>:WCDPower:MS:MEASurement** POWer | ACLR | ESPectrum | OBANdwith | OBWidth | WCDPower | CCDF

This command selects the 3GPP FDD user equipment tests. The settings of the predefined measurements are described for the associated softkey in chapter 6.

**Parameter:**

| | |
|---|---|
| POWer | Channel power measurement (standard 3GPP FDD Forward) with predefined settings |
| ACLR | Adjacent channel power measurement (standard 3GPP 3GPP FDD Forward) with predefined settings |
| ESPectrum | Measurement of spectrum emission mask |
| OBANdwith \| OBWidth | Measurement of occupied power bandwidth |
| WCDPower | Code domain power measurement. This selection has the same effect as command `INSTrument:SELect WCDPower`. |
| CCDF | Measurement of Complementary Cumulative Distribution Function |

**Example:** "`CONF:WCDP:MS:MEAS POW`"

**Features:** *RST value: POWer
SCPI: device-specific

**:CONFigure<1>:WCDPower:MS:CTABle[:STATe]** ON | OFF

This command switches the channel table on or off. On switching on, the measured channel table is stored under the name RECENT and switched on. After the RECENT channel table is switched on, another channel table can be selected with the command `CONF:WCDP:MS:CTABle:SELect`.

***Note:*** *The RECENT channel table must always be switched on first with the command* `CONF:WCDP:MS:CTAB:STAT` *and then the required channel table can be selected with the command* `CONF:WCDP:CTAB:SEL`

**Example:** `":CONF:WCDP:MS:CTAB ON"`

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

**:CONFigure<1>:WCDPower:MS:CTABle:SELect** <string>

This command selects a predefined channel table file. Before using this command, the RECENT channel table must be switched on first with the command `CONF:WCDP:CTAB:STATe ON`.

**Example:** `":CONF:WCDP:MS:CTAB ON”`
`":CONF:WCDP:MS:CTAB:SEL 'CTAB_1'"`

**Features:** *RST value: "RECENT"
SCPI: device-specific

**:CONFigure:WCDPower:MS:CTABle:NAME** <file_name>

This command selects an existing channel table or creates the name of a new channel table.

**Example:** `":CONF:WCDP:CTAB:NAME 'NEW_TAB'"`

**Features:** *RST value: "RECENT"
SCPI: device-specific

**:CONFigure:WCDPower:MS:CTABle:DATA** <numeric_value>,<numeric_value>..

This command defines the values of the selected channel table. Each line of the table consists of 6 values:

<pilot length>,<code class>,<number of active channels>,<CDP rel. 1 [dB]>,
<CDP rel. 2 [dB]>,<CDP rel. 3 [dB]>,<CDP rel. 4 [dB]>,<CDP rel. 5 [dB]>,<CDP rel. 6 [dB]

Pilot length: pilot length of channel DPCCH
Code class: code class of channel 1. I-mapped
Number of active channels: 1 to 7
CDP rel. 1: measured value of channel 1, only when queried
CDP rel. 2: measured value of channel 2, only when queried
CDP rel. 3: measured value of channel 3, only when queried
CDP rel. 4: measured value of channel 4, only when queried
CDP rel. 5: measured value of channel 5, only when queried
CDP rel. 6: measured value of channel 6, only when queried

The Channel DPCCH may only be defined once. If channel DPCCH is missing in the command, it is automatically added at the end of the table.

Prior to this command, the name of the channel table has to be defined with command `CONF:WCDP:MS:CTAB:NAME`.

**Example:** `":CONF:WCDP:MS:CTAB:DATA 8,0,0,5,1,0.00, 4,1,1,0,1,0.00,4,1,0,0,1,0.00"`
The following channels are defined: DPCCH and two data channels with 960 ksps.

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

**:CONFigure:WCDPower:MS:CTABle:DATA:HSDPcch** ON|OFF

This command activates [ON] or deactivates [OFF] the HS-DPCCH entry in a predefined channel table.

**Example:** `:CONF:WCDP:MS:CTAB:DATA:HSDP ON`

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

**:CONFigure:WCDPower:MS:CTABle:COMMent** <string>

This command defines a comment for the selected channel table

Prior to this command, the name of the channel table has to be defined with command `CONF:WCDP:MS:CTAB:NAME` and the values of the table have to be defined with command `CONF:WCDP:MS:CTAB:DATA`.

**Example:** `":CONF:WCDP:MS:CTAB:COMM 'Comment for table 1'"`

**Features:** *RST value: ""
SCPI: device-specific

**:CONFigure:WCDPower:MS:CTABle:COPY** <file_name>

This command copies one channel table onto another one. The channel table to be copied is selected with command `CONF:WCDP:MS:CTAB:NAME`.

**Parameter:** <file_name> ::= name of the new channel table

**Example:** `":CONF:WCDP:MS:CTAB:COPY 'CTAB_2'"`

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

The name of the channel table may contain a maximum of 8 characters. This command is an "event" which is why it is not assigned an *RST value and has no query.

**:CONFigure:WCDPower:MS:CTABle:DELete**

This command deletes the selected channel table. The channel table to be deleted is selected with command `CONF:WCDP:MS:CTAB:NAME`.

**Example:** `":CONF:WCDP:MS:CTAB:DEL"`

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

This command is an "event" which is why it is not assigned an *RST value and has no query.

**:CONFigure:WCDPower:MS:CTABle:CATalog?**

This command reads out the names of all channel tables stored on the hard disk.

Syntax of output format:

<Sum of file lengths of all subsequent files>,<free memory on hard disk>,
<1st file name>,,<1st file length>,<2nd file name>,,<2nd file length>,....,<nth file name>,
<nth file length>

**Example:** `":CONF:WCDP:MS:CTAB:CAT?"`

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

**:CONFigure:WCDPower:MS:CTABle:EDATa** code class>,<number of active channels>,
<CDP rel. 1 [dB]>,<CDP rel. 2 [dB]>,<CDP rel. 3 [dB]>,
<CDP rel. 4 [dB]>

This command defines the values of the selected channel table.

Code class: code class of channel 1.
Number of active channels: 0 to 4
ECDP rel. 1: measured value of channel 1, only when queried
ECDP rel. 2: measured value of channel 2, only when queried
ECDP rel. 3: measured value of channel 3, only when queried
ECDP rel. 4: measured value of channel 4, only when queried

**Example:** `":CONF:WCDP:MS:CTAB:EDAT"`

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

**:CONFigure:WCDPower:MS:CTABle:EDATa:EDPCch** ON|OFF

This command activates [ON] or deactivates [OFF] the E-DPCCH entry in a predefined channel table..

**Example:** `:CONF:WCDP:MS:CTAB:EDAT:EDPC ON`

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

## DISPlay – Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. The measurement windows are selected by WINDow1 (screen A) or WINDow2 (screen B) .

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| :DISPlay<br>[:WINDow<1\|2>]<br>:SIZE<br>:TRACe<br>:MODE | <br><br>LARGe \| SMALl><br><br>VIEW | <br><br>-- | |

**:DISPlay[:WINDow<1|2>]:SIZE LARGe | SMALl**

This command switches the diagram to full screen size.

LARGe full screen size.

SMALl small screen size of the ACLR diagram.

**Example:** "`DISP:WIND1:SIZE LARG`"

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

**Query of results:** `:DISP:WINDow1:SIZE?`

**Result:** `<LARG|SMALl>`

**:DISPlay[:WINDow<1|2>]:TRACe<1...3>:MODE** VIEW

This command freezes the current contents of the trace memory and displays them.

If a trace is frozen by *VIEW*, the instrument settings can be changed without the displayed trace being modified (exception: level display range and reference level, see below). The fact that the trace and the current instrument setting no longer agree is indicated by an enhancement label "*" at the right edge of the grid.

If in the *VIEW* display mode the level display range (*RANGE*) or the reference level (*REF LEVEL*) is changed, the R&S Analyzer automatically adapts the measured data to the changed display range. This allows an amplitude zoom to be carried out after the measurement in order to show details of the trace.

**Example:** `:DISP:WIND:TRAC:MODE VIEW`

**Features:** *RST value: WRITe for TRACe1, STATe OFF for TRACe2/3
SCPI: device-specific

## INSTrument Subsystem

**:INSTrument[:SELect]** SANalyzer | RECeiver | MSGM | MWCDpower

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

Selection MWCDpower presets the instrument as described in Chapter 2, Section "Basic Settings in Code Domain Measurement Mode".

**Example:** ":INST MWCD"

**Features:** *RST value: SANalyzer
SCPI: conforming

## SENSe:CDPower Subsystem

This subsystem controls the parameters for the code domain mode. The numeric suffix in `SENSe<1|2>` is not significant in this subsystem.

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| [SENSe<1\|2>] | | | |
| :CDPower | | | Option R&S FS-K73 |
| :BASE | SLOT \| FRAME | | |
| :CODE | <numeric_value> | | |
| :ETCHips | <Boolean> | | |
| :FILTer | | | |
| [:STATe] | <Boolean> | | |
| :FRAMe | | | |
| [:VALue] | <numeric value> | | |
| :HSDPamode | ON \| OFF | | |
| :HSLot | ON \| OFF | | |
| :ICTReshold | <numeric_value> | dB | |
| :IQLength | <numeric value> | | |
| :LCODe | | | |
| :DVALue | <numeric_value> | | |
| [:VALue] | <hex> | | |
| :TYPE | LONG \| SHORT | | |
| :MAPPing | I \| Q | | |
| :NORMalize | <Boolean> | | |
| :OVERview | <Boolean> | | |
| :SBANd | NORMal \| INVerse | | |
| :SFACtor | 4 \| 8 \| 16 \| 32 \| 64 \| 128 \| 256 | | |
| :SLOT | <numeric_value> | | |
| :POWer | | | |
| :ACHannel | | | |
| :PRESet | | | |
| :RLEVel | -- | | |

**:[SENSe<1|2>:]CDPower:BASE** SLOT | FRAMe

This command chooses the base of the CDP analysis: At SLOT one slot of the signal is analyzed only; at FRAME the complete 3GPP frame will be analyzes.

**Example:** `":CDP:BASE SLOT"`

**Features:** *RST value: SLOT
SCPI: device-specific

**:[SENSe:]CDPower:CODE** 0 to 255

This command sets the code number. The code number refers to code class 8 (spreading factor 256).

**Example:** `":SENS:CDP:CODE 128"`

**Features:** *RST value: 0
SCPI: device-specific

**:[SENSe:]CDPower:ETCHips** ON|OFF

This command selects length of the measurement interval for calculation of error vector magnitude (EVM). In accordance with 3GPP specification Release 5, the EVM measurement interval is one slot (4096 chips) minus 25 µs at each end of the burst (3904 chips) if power changes are expected. If no power changes are expected, the evaluation length is one slot (4096 chips).

ON: Changes of power are expected. Therefore an EVM measurement interval of one slot minus 25 µs (3904 chips) is considered.

OFF: Changes of power are not expected. Therefore an EVM measurement interval of one slot (4096 chips) is considered

**Example:** `:SENS:CDP:ETCH ON`

**Features:** *RST value: OFF
SCPI:

**:[SENSe:]CDPower:FILTer[:STATe]** ON|OFF

This command selects if a root raised cosine (RRC) receiver filter is used or not. This feature is useful if the RRC filter is implemented in the device under test (DUT)

ON: If an unfiltered WCDMA signal is received (normal case), the RRC filter should be used to get a correct signal demodulation.

OFF: If a filtered WCDMA signal is received, the RRC filter should not be used to get a correct signal demodulation. This is the case if the DUT filters the signal..

**Example:** `:SENS:CDP:FILT:STAT OFF`

**Features:** *RST value: ON
SCPI: device-specific

**:[SENSe:]CDPower:FRAMe[:VALue]** <numeric value>

This command defines the frame to be analyzed within the captured data.

**Range:** <numeric value> *[0 ... CAPTURE_LENGTH - 1]*

**Example:** `":CDP:FRAM:VAL 1"`

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

**:[SENSe<1|2>:]CDPower:HSDPamode** ON|OFF

This command selects if the HS-DPCCH channel is searched or not.

ON: The HSUPA/HSDPA channel can be detected.

OFF: The HSUPA/HSDPA channel cannot be detected.

**Example:** `:CDP:HSDP OFF`

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

**:[SENSe:]CDPower:HSLot** ON | OFF

This command switches the R&S FS-K73 between the analysis of one half and one full slot.

**Example:** `":SENS:CDP:HSL ON"`

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

**:[SENSe:]CDPower:ICTReshold** -100 dB to + 10 dB

This command sets the threshold value from which a channel is treated as active. The level entered refers to the total signal power.

**Example:** ":CDP:ICTR –10DB"

**Characteristics:** *RST value: -60 dB
SCPI: device-specific

**:[SENSe:]CDPower:IQLength** <numeric value>

This command defines the number of frames which are captured for every sweep.

**Range:** R&S FSU *(free run)*: <numeric value> *[1 ... 2]*
R&S FSU *(ext. Trig)*: <numeric value> *[1 ... 3]*
R&S FSQ: <numeric value> *[1 ... 100]*

**Example:** ":CDP:IQL 1"

**:[SENSe:]CDPower:LCODe:TYPE** LONG | SHORt

This command switches between long and short scrambling code.

**Example:** ":CDP:LCOD:TYPE SHOR"

**Features:** *RST value: LONG
SCPI: device-specific

**:[SENSe:]CDPower:LCODe[:VALue]** #H0 to #H1fff

This command defines the scrambling code in hexadecimal format.

**Example:** ":CDP:LCOD #H2"

**Features:** *RST value: 0
SCPI: device-specific

**:[SENSe:]CDPower:MAPPing** I | Q

This command switches between I and Q component of the signal.

**Example:** "CDP:MAPP I"

**Features:** *RST value: Q
SCPI: device-specific

**:[SENSe:]CDPower:NORMalize** ON | OFF

This command switches elimination of IQ offset on or off.

**Example:** ":SENS:CDP:NORM OFF"

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

**:[SENSe<1|2>:]CDPower:OVERview** ON | OFF

This command switches to an overview display of a code domain measurement ($CDP_{rel.}$ / $CDP_{abs.}$ / CDEP). If it is enabled ("ON"), the I branch of the code power is displayed in screen A and the Q branch in screen B. Both results can be read via IEC by using TRACE:DATA? TRACE1 and TRACE:DATA? TRACE2 respectively. If it is disabled ("OFF"), screen A displays the I branch and screen B provides the result summary display.

**Example:** `":CDP:OVER OFF"`

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

**:[SENSe:]CDPower:SBANd** NORMal | INVers

This command is for interchanging the left and the right sideband.

**Example:** `":CDP:CDP:SBAN INV"`

**Features:** *RST value: NORM
SCPI: device-specific

**:[SENSe:]CDPower:SFACtor** 4 | 8 | 16 | 32 | 64 | 128 | 256

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR.

**Example:** `":SENS:CDP:SFAC 256"`

**Features:** *RST value: 256
SCPI: device-specific

**:[SENSe:]CDPower:SLOT** 0 to 14

This command sets the slot number.

**Example:** `":SENS:CDP:SLOT 3"`

**Features:** *RST value: 0
SCPI: device-specific

## SENSe:Power – Subsystem

This subsystem controls the parameters for the spectral power measurements. The numeric suffix in `SENSe<1|2>` is not significant in this subsystem.

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| [SENSe1\|2>] | | | |
| :POWer | | | Option R&S FS-K72/K74 |
| :ACHannel | | | |
| :ACPairs | <value> | -- | |
| :BANDwidth | | | |
| [:CHANNel] | <value> | [Hz] | |
| :ACHannel | <value> | [Hz] | |
| :ALTernate<1...11> | <value> | [Hz] | |
| :MODE | <ABSolute\|RELative> | -- | |
| :PRESet | < MCACpower > | -- | |
| :RLEVel | < -- > | -- | |
| :REFerence | | | |
| :TXCHannel | | | |
| :AUTO | < MINimum\|MAXimum\|LHIGhest > | -- | |
| :MANual | <value> | -- | |
| :SPACing | | | |
| :CHANNel | <value> | [Hz] | |
| [: ACHannel] | <value> | [Hz] | |
| :ALTernate<1...11> | <value> | [Hz] | |
| :TXCHannel | | | |
| :COUNt | <value> | -- | |
| :HSPeed | < ON\|OFF > | -- | |
| :NCORrection | < ON\|OFF > | -- | |

**:[SENSe<1|2>:]POWer:ACHannel:ACPairs** <value>

This command sets the number of adjacent channels (upper and lower channel in pairs). The number 0 stands for pure channel power measurement.

**Example:** `"POW:ACH:ACP 2"`

**Characteristics:**
Range: `0|1|2|3`
Unit: `[]`
*RST value: `2`
SCPI: device-specific

**Query of results:** `:SENS:POWer:ACH:ACP?`

**Result:** `<0|1|2|3>`

**:[SENSe<1|2>:]POWer:ACHannel:BANDwidth[:CHANnel]** <value>

This command sets the channel bandwidth of the radio communication system. The bandwidths of adjacent channels are not influenced by this modification.

**Example:** "POW:ACH:BWID:CHAN 3.84MHz"

**Characteristics:**

| | |
|---|---|
| Range: | 100Hz ... 1GHz |
| Unit: | [Hz] |
| *RST value: | 3.84 MHz |
| SCPI: | device-specific |

**Query of results:** :SENS:POW:ACH:BAND:CHAN?

**Result:** <100Hz ... 1GHz>

**:[SENSe<1|2>:]POWer:ACHannel:BANDwidth:ACHannel** <value>

This command defines the channel bandwidth of the adjacent channel of the radio transmission system. If the bandwidth of the adjacent channel is changed, the bandwidths of all alternate adjacent channels are automatically set to the same value.

**Example:** "POW:ACH:BWID:ACH 3.84MHz"

**Characteristics:**

| | |
|---|---|
| Range: | 100Hz ... 1GHz |
| Unit: | [Hz] |
| *RST value: | 3.84 MHz |
| SCPI: | device-specific |

**Query of results:** :SENSe:POW:ACH:BAND:ACH?

**Result:** <100Hz ... 1GHz>

**:[SENSe<1|2>:]POWer:ACHannel:BANDwidth:ALTernate<1...11>** <value>

This command defines the channel bandwidth of the first/second alternate adjacent channel of the radio transmission system. If the channel bandwidth of alternate adjacent channel 1 is changed, the bandwidth of alternate adjacent channel 2 is automatically set to the same value.

**Example:** "POW:ACH:BWID:ALT1 3.84MHz"
"POW:ACH:BWID:ALT2 3.84MHz"

**Characteristics:**

| | |
|---|---|
| Range: | 100Hz ... 1GHz |
| Unit: | [Hz] |
| *RST value: | 3.84 MHz |
| SCPI: | device-specific |

**Query of results:** :SENS:POW:ACH:BAND:ALT<1...11>?

**Result:** <100Hz ... 1GHz>

**:[SENSe<1|2>:] POWer:ACHannel:MODE** ABSolute|RELative

This command toggles between absolute and relative adjacent channel measurement. For the relative measurement the reference value is set to the currently measured channel power by command `SENSe:POWer:ACHannel:REFerence:AUTO ONCE`.

ABSolute absolute adjacent channel measurement.
RELative relative adjacent channel measurement.

**Example:** `"POW:ACH:MODE ABS"`

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

**Query of results:** `:SENS:POW:ACH:MODE?`

**Result:** `< ABS | REL >`

**:[SENSe<1|2>:]POWer:ACHannel:PRESet** MCACpower

This command adjusts the frequency span, the measurement bandwidths and the detector as required for the number of channels, the channel bandwidths and the channel spacings selected in the active power measurement. If necessary, adjacent-channel power measurement is switched on prior to the adjustment. To obtain valid results, a complete sweep with synchronization to the end of the sweep must be performed after the adjustment. Synchronization is possible only in the single-sweep mode.

**Example:** `"POW:ACH:PRES  MCAC"`

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

**:[SENSe<1|2>:]POWer:ACHannel:PRESet:RLEVel**

This command adapts the reference level to the measured channel power. This ensures, that the signal path of the instrument is not overloaded. Since the measurement bandwidth is significantly smaller than the signal bandwidth in channel power measurements, the signal path can be overloaded although the trace is still significantly below the reference level. If the measured channel power equals the reference level, the signal path is not overloaded.

**Example:** `"POW:ACH:PRES:RLEV"`

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

**:[SENSe<1|2>:]POWer:ACHannel:REFerence:TXCHannel:AUTO** MINimum|MAXimum|LHIGhest

This command activates the automatic selection of a transmission channel to be used as a reference channel in relative adjacent-channel power measurements. The transmission channel with the highest power, the transmission channel with the lowest power, or the transmission channel nearest to the adjacent channels can be defined as a reference channel. The command is available only for multicarrier channel and adjacent-channel power measurements.

**Example:** `"POW:ACH:REF:TXCH:AUTO MAX"`
`"POW:ACH:REF:TXCH:AUTO LHIG"`

**Characteristics::** Range:
`MINimum` Transmission channel with the lowest power
`MAXimum` Transmission channel with the highest power
`LHIGhest` Lowermost transmission channel for the lower adjacent channels, uppermost transmission channel for the upper adjacent channels
Unit: `[]`
*RST value: `---`
SCPI: device-specific

**:[SENSe<1|2>:]POWer:ACHannel:REFerence:TXCHannel:MANual** <value>

This command selects a transmission channel to be used as a reference channel in relative adjacent-channel power measurements. The command is available only for multicarrier channel and adjacent-channel power measurements

**Example:** `"POW:ACH:REF:TXCH:MAN 1"`

**Characteristics:**
Range: `<1 ... number of TX channels>`
Unit: `[]`
*RST value: `1`
SCPI: device-specific

**:[SENSe<1|2>:]POWer:ACHannel:SPACing:CHANnel** <value>

This command defines the channel spacing for the carrier signals. At the same time the spacing of carriers with higher channel number are set to the same value. If the spacing is equal between all carriers it is sufficient to set the spacing between carrier 1 and 2 with the command:

SENS:POW:ACP:SPAC:CHAN1

or

SENS:POW:ACP:SPAC:CHAN.

If the spacing are set in ascending order individual spacing of the carriers can be set.

**Example:** `"POW:ACH:SPAC:CHAN 4.8MHz"` 'sets the spacing between TX carrier 2 and 3 to 4.8 MHz.

**Characteristics:**
Range: 100Hz ... 1GHz
Unit: [Hz]
*RST value: 5MHz
SCPI: device-specific

**Query of results:** `:SENSe:POW:ACH:SPAC:CHAN?`

**Result:** <100Hz ... 1GHz>

***Note:*** *If the ACP or MCACP measurement is started all settings according to the standard including the channel bandwidths and channel spacings are set and can be adjusted afterwards.*

**:[SENSe<1|2>:]POWer:ACHannel:SPACing[:ACHannel]** <value>

This command defines the channel spacing of the adjacent channel to the TX channel. At the same time, the spacing of alternate adjacent channels 1 and 2 is set to the double or triple of the entered value.

**Example:** `"POW:ACH:SPAC:ACH 5MHz"`

**Characteristics:**
Range: `100Hz ... 1GHz`
Unit: `[Hz]`
*RST value: `5MHz`
SCPI: device-specific

**Query of results:** `:[SENS:POW:ACHann:SPAC:ACH?`

**Result:** `<100Hz ... 1GHz>`

**:[SENSe<1|2>:]POWer:ACHannel:SPACing:ALTernate<1...11>** <value>

This command defines the spacing between the first (ALTernate1) or the second alternate adjacent channel (ALTernate2) and the TX channel. If the spacing to the alternate adjacent channel ALTernate1 is modified, the spacing to alternate adjacent channel 2 is set to 1.5 times the entered value.

**Example:** `"POW:ACH:SPAC:ALT1 10MHz"`
`"POW:ACH:SPAC:ALT2 15MHz"`

**Characteristics:** Range: `100Hz ... 1GHz`
Unit: `[Hz]`
*RST value: `10MHz` (for ALTernate 1)
`15MHz` (for ALTernate 2)
SCPI: device-specific

**Query of results:** `:SENS:POW:ACH:SPAC:ALT<1...11>?`

**Result:** <100Hz ... 1GHz>

**:[SENSe<1|2>:] POWer:HSPeed** ON|OFF

This command switches on or off the high-speed adjacent channel leakage power measurement. The measurement itself is performed in the time domain on the center frequencies of the individual channels. The command automatically switches to the time domain and back. A weighting filters with root raised cosine characteristic and 0.22 roll off is used for band limitation.

ON high-speed measurement with RRC filter in time domain.

OFF measurement with gaussian filters in frequency domain.

**Example:** `"POW:HSP ON"`

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

**Query of results:** `:SENS:POW:HSP?`

**Result:** `<1|0>`

**:[SENSe<1|2>:]POWer:NCORrection** ON|OFF

This command switches on or off the correction of the instrument inherent noise for ACLR measurement. On activating this function, a reference measurement of the instrument inherent noise is performed. The measured noise power is then subtracted from the power in the examined channel. The instrument inherent noise is then re-determined after any change of the center frequency, resolution bandwidth, sweep time and level setting by repeating the reference measurement in the new instrument setting.

ON inherent noise correction is switched on.

OFF inherent noise correction is switched off.

**Example:** `"POW:NCOR ON"`

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

**Query of results:** `:SENS:POWer:NCOR?`

**Result:** `<1|0>`

## STATus-QUEStionable:SYNC Register

This register contains information on the error situation in the code domain power analysis of the R&S FS-K73 option. It can be queried with the following commands:

| COMMAND | PARAMETER | UNIT | COMMENT |
|---|---|---|---|
| STATus | | | |
| :QUEStionable | | | Option R&S FS-K73 |
| :SYNC | | | |
| :CONDition ? | <numeric_value> | [] | |
| [:EVENt] ? | <numeric_value> | [] | |

**:STATus:QUEStionable:SYNC:CONDition ?**

This command reads the information on the error situation in the code domain power analysis of the R&S FS-K73 option.

**Example:** ":STAT:QUES:SYNC:COND ?"

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

**Return value:** (see Table 7-1)

**:STATus:QUEStionable:SYNC[:EVENt] ?**

This command reads the information on the error situation in the code domain power analysis of the FS-K73 option. The value can only be read once.

**Example:** ":STAT:QUES:SYNC:EVENt?"

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

**Return value:** (see Table 10)

Table 6 Definition of the error bits of the SYNC register

| Bit No. | Definition |
|---|---|
| 0 | Not used in R&S FS-K73. |
| 1 | **R&S FS-K73 Frame Sync failed**<br>This bit is set when synchronization is not possible within the application.<br>Possible reasons:<br>Incorrectly set frequency<br>Incorrectly set level<br>Incorrectly set scrambling code<br>Incorrectly set values for Q-INVERT or SIDE BAND INVERT<br>Invalid signal at input |
| 2 to 4 | Not used in the R&S FS-K73 application. |
| 5 | **R&S FS-K73 Incorrect Pilot Symbol**<br>This bit is set when one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard.<br>Possible reasons:<br>Incorrectly sent pilot symbols in the received frame.<br>Low signal to noise ratio (SNR) of the WCDMA signal.<br>One or more code channels have a significantly lower power level compared with the total power. The incorrect pilots are detected in these channels because of low channel SNR.<br>One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display). |
| 6 to 14 | Not used in the R&S FS-K73 application. |
| 15 | This bit is always 0. |

## TRACe Subsystem

**:TRACe[:DATA]** TRACE1 | TRACE2 | ABITstream | CTABle | CWCDp | TPVSlot | LIST | CEVM

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

ABITstream can be set only if `CALC2:FEED "XTIM:CDP:BSTReam"` is selected (in the lower bitstream window). This command returns the bit streams of all 15 slots one after the other, the output format may be REAL, UINT or ASCII.
The output format is equal to that of the ":TRACe1:DATa? TRACE2" command in case of an activated bitstream display. The only difference is the number of symbols which are evaluated. The ABITSTREAM command evaluates all symbols of one frame. One value is transferred per bit (range 0,1,). Each symbol contains of two (QPSK) consecutive bits. The number of symbols is not constant and may vary depending on the spreading factor of the selected channel. The bit stream may contain invalid (symbols without power). In this case the character '9' is read.

| | |
|---|---|
| Unit: | [] |
| Range: | {0, 1, 7, 9} |
| Bits per symbol: | $N_{BitPerSymb} = 2$ |
| Number of symbols: | $N_{Symb} = 150*2^{(8\text{-Code Class})}$ |
| Number of bits: | $N_{Bit} = N_{Symb} * N_{BitPerSymb}$ |
| Format: | $Bit_{00}, Bit_{01}, Bit_{10}, Bit_{11}, Bit_{20}, Bit_{21}, ....,$ <br> $Bit_{NSymb\ 0}, Bit_{NSymb\ 1}$ |
| Explanation: | 0 – Low state of a transmitted bit <br> 1 – High state of a transmitted bit <br> 7 – Suppressed symbol of a HS-DPCCH slot <br> 9 – Bit of an inactive channel |

CTABle reads out the channel table: Seven values are transmitted for each channel, the sixth value (reserved for pilot length) being constantly 0:
< class>,<cannel number>,<absolute level>,<relative level>, <I/Q component>,0,<state>...

*CWCDp* can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length, channel state, channel type, modulation type and a reserved value are transmitted in addition to the values transmitted for trace 1. For each channel, 11 values are transmitted

<code class>, <channel number>, <IQ component>, <absolute level>, <relative level>, <timing offset>, <pilot length>, <active flag>, <channel type>, <modulation type>, <reserved>...

| No. | Parameter | Range | Unit | Explanation |
|---|---|---|---|---|
| 1) | <code class> | {2 to 8} | [1] | Code class of the channel. |
| 2) | <channel number> | {0 to 255} | [1] | Code number of the channel. |
| 3) | <IQ component> | {0, 1} | [1] | IQ component of the channel. |
| | | 0 - Q component | | Channel symbols ($S_n$) sent from **q**uadrate component; only imaginary part of $S_n$ is used. [Re {$S_n$} = 0 Im {$S_n$} ≠ 0] |
| | | 1 - I component | | Channel symbols ($S_n$) sent from **I**n phase component; only real part of $S_n$ is used. [Re {$S_n$} ≠ 0 Im {$S_n$} = 0] |
| 4) | <absolute level> | {-∞ to ∞} | [dBm] | Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.) |
| 5) | < relative level > | {-∞to ∞} | [dB] | Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.) |
| 6) | <timing offset> | {0 to 2560} | [chips] | Timing offset of the HS-DPCCH to the frame start. The value is measured in chips. The step width is 256 chips. For all other data channels, the timing offset is zero. |

| | | | | |
|---|---|---|---|---|
| 7) | <pilot length> | {0 to 8} | [symbols] | Pilot length of the DPCCH. |
| 8) | <active flag> | {0,1} | [1] | Flag to indicate whether a channel is active<br>0 - channel not active<br>1 - channel active |
| 9) | <channel type> | {0 ... 2} | [1] | Channel type indication |
| | | 0 - DPDCH | **D**edicated **P**hysical **D**ata **Ch**annel | |
| | | 1 - DPCCH | **D**edicated **P**hysical **C**ontrol **Ch**annel | |
| | | 2 – HS-DPCCH | **H**igh-**S**peed **D**edicated **P**hysical **C**ontrol **Ch**annel | |
| | | *3 – E-DPCCH* | ***E**nhanced **D**edicated **P**hysical **C**ontrol **Ch**annel* | |
| | | *4 - E-DPDCH* | ***E**nhanced **D**edicated **P**hysical **D**ata **Ch**annel* | |
| 10) | <modulation type> | {2} | [1] | Modulation type of the code channel |
| 11) | <reserved> | {0} | [1] | Reserved for future functionality. |

For TRACE1 or TRACE2 the following measured values are transferred depending on the display mode:

CODE PWR ABSOLUTE / RELATIVE , CHANNEL TABLE (TRACE1)

Each channel is defined by the class, the channel number, the absolute level, the relative level and the timing offset. The class denotes the spreading factor of the channel.

Class 8 corresponds to the highest spreading factor (256, symbol rate 15 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

Five values are transmitted for each channel.
<class>,<cannel number>,<absolute level>,<relative level>,<I/Q component>, .....

For CODE PWR ABSOLUTE / RELATIVE, the channels are output in ascending order sorted according to the code numbers, i.e. in the same sequence as they are displayed on the screen. For CHANNEL TABLE, the channels are sorted according to the code classes, i.e. the unassigned channels are transmitted last.

The units are:
Absolute level dBm,
Relative level dB referred to the total power of the signal.

The example shows the results of a query for three channels with the following configuration:
1st channel: spreading factor 256, channel number 0, component Q
2nd channel: spreading factor 4, channel number 1, component I
3rd channel: spreading factor 4, channel number 1, component Q

This yields the following result: 8,0,-20.0,0.0,0,2,-20.0,0.0,1,2,1,-20.0,0.0,0

The channels come in the same order as in the CDP diagram, i.e. depending on their position in the code domain of spreading factor 256.

CODE DOMAIN ERROR POWER (TRACE1 [Overview OFF] TRACE1 / TRACE2 [Overview ON])

Output: Five values are transmitted for each code class 8 channel. The channels are sorted according to the code numbers

Format: <code class>$_1$, <code number>$_1$, <CDEP>$_1$, <channel flag>$_1$, <code class>$_2$, <code number>$_2$, <CDEP>$_2$, <channel flag>$_2$, …
<code class>$_{256}$, <code number>$_{256}$, <CDEP>$_{256}$, <channel flag>$_{256}$

Unit: < [1] >, < [1] >, < [dB] >,< [1] >

Range: < 8 > , < 0...256 >, < -∞ ... ∞ >, < 0 ; 1 >

Quantity**:** 256

Explanation:

*code class:* [1] Highest code class of an uplink signal. It is always set to 8 (CC8).
*code number:* [1] Code number of the evaluated CC8 channel.
*CDEP:* [dB] Code domain error power value of the CC8 channel.
*channel flag:* [1] Indicates if the CC8 channel belongs to an assigned code channel:
Range: 0b00 0d0 - CC8 is inactive
0b01 0d1 - CC8 channel belongs to an active code channel

RESULT SUMMARY (TRACE2)

The results of the RESULT SUMMARY are output in the following order:

<composite EVM>,<peak CDE>,<carr freq Error>,<chip rate error>, <total power>,<trg to frame>,<EVM peak channel>,<EVM mean channel>, <class>, <channel number>,<power abs. channel>,<power rel. channel>,<I/Q component>, <pilotm length>,<IQ offset>,<IQ imbalance>

The units are:

EVM peak channel/mean channel, composite EVM, IQ offset/imbalance : %,
Peak CDE, total power and power abs. channel: dB.

| | |
|---|---|
| Power rel. Channel: | dB referred to the total power of the signal. |
| Carr freq error: | Hz |
| Chip Rate Error: | ppm. |
| Trg to Frame: | µs. |
| Pilot length: | bits |
| I/Q component: | absolute |

POWER VS SLOT (TPVSlot)

15 pairs of CPICH slot numbers and level values are always transferred. The query is only possible in frame mode and not in slot mode. But it is possible no matter which evaluation screen is selected in the code domain analyzer.
<slot number>, <level value in dBm>,<slot number>,<level value in dBm>,.....

POWER VS SLOT (TRACE2)

15 pairs of slot (slot number of CPICH) and level values (for 15 slots) are always transferred.
<slot number>, <level value in dB>,<slot number>,<level value in dB>,.....

SYMBOL EVM (TRACE2)

The number of level values depends on the spreading factor:

| | | | |
|---|---|---|---|
| Spreading factor 256 | 10 values | Spreading factor 128 | 20 values |
| Spreading factor 64 | 40 values | Spreading factor 32 | 80 values |
| Spreading factor 16 | 160 values | Spreading factor 8 | 320 values |
| Spreading factor 4 | 640 values | | |

PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2)

15 pairs of slot (slot number of CPICH) and values are always transferred.
PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>,.....
COMPOSITE EVM: <slot number>, <value in %>, .....

SYMBOL CONST(TRACE2)

The real and the imaginary part are transferred as a pair:
<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

For the channels have exclusively I or Q components in R&S FS-K73, the <re> or <im> values are 0, depending on the selected component.

The number of level values depends on the spreading factor:

| | | | |
|---|---|---|---|
| Spreading factor 256 | 10 values | Spreading factor 128 | 20 values |
| Spreading factor 64 | 40 values | Spreading factor 32 | 80 values |
| Spreading factor 16 | 160 values | Spreading factor 8 | 320 values |
| Spreading factor 4 | 640 values | | |

BITSTREAM (TRACE2)

The bitstream of one slot is transferred. One value is transferred per bit (range 0,1,). The number of symbols is not constant and may vary for each sweep. Specific symbols in the bitstream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by "9".

EVM VS CHIP (TRACe2)

The square root of square difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:.

Output: List of vector error values of all chips at the selected slot
Format: $VectError_0$, $VectError_1$, ...., $VectError_{2559}$
Unit: [%]
Quantity: 2560

MAGNITUDE ERROR VS CHIP (TRACe2)

The magnitude difference between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

Output: List of magnitude error values of all chips at the selected slot
Format: $MagError_0$, $MagError_1$, ...., $MagError_{2559}$
Unit: [%]
Quantity: 2560

PHASE ERROR VS CHIP (TRACe2)

The phase differences between received signal and reference signal for each chip are transferred. The values are normalized to the square root of the average power at the selected slot:

Output: List of magnitude error values of all chips at the selected slot
Format: $PhaseError_0$, $PhaseError_1$, ...., $PhaseError_{2559}$
Unit: [°]
Quantity: 2560

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

**Features:** *RST value: -
SCPI: conforming

LIST With this command the list evaluation results are queried in the following order:
<no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>

All results are float values.

no : range number
start : start frequency
stop : stop frequency
rbw : resolution bandwidth of range
freq : frequency of peak
power abs : absolut power in dBm of peak
power rel : relative power in dBc (related to the channel power) of peak
delta : distance to the limit line in dB (positive indicates value above the limit, fail)
limit check : limit fail (pass = 0, fail =1)
unused1 : reserved (0.0)
unused2 : reserved (0.0)

READ OUT RESULTS OF PEAK LIST EVALUATION

This command reads the peak list of the spectrum emission mask measurement list evaluation (refer to CALC:PEAK:AUTO ON | OFF). An array of values is returned for each range of the limit line. The arrays for each limit line range are following sequentially.

<value array of range 1>, <value array of range 2>, ….., <value array of range n>

The array of each range contains the following value list:

<No>, <Start>, <Stop>, <Rbw>, <Freq>, <Levelabs>, <Levelrel>, <Delta>, <Limitcheck>, <unused1>, <unused2>

*where:*

| | | |
|---|---|---|
| No | [] | : number of the limit line range |
| Start | [Hz] | : start frequency of the limit line range |
| Stop | [Hz] | : stop frequency of the limit line range |
| Rbw | [Hz] | : resolution band width of the limit line range |

Freq [Hz] : frequency of the power peak with in the range
Levelabs [dBm] : absolute power of the peak with in the range
Levelrel [dB] : relative power of the peak with in the range related to channel power.
Delta [dB] : power difference to margin power
Limitcheck [0 | 1] : decision whether the power is below [0] or above [1] the limit line
Unused1 [] : reserved (0.0)
Unused2 [] : reserved (0.0)

**Example:** `"TRAC:DATA? LIST"` Reads the value list of automatic peaks search

CEVM This command reads the root mean square (RMS) value of the error vector magnitude ($EVM_{rms}$). The measurement interval of the RMS value depends on analyzer settings and the channel configuration of the applied signal (refer to ":[SENSe:]CDPower:EINTerval" and ":[SENSe:]CDPower:ETCHips"). The information of the chip limits of the used measurement interval are given for each slot.
Fifteen (15) groups of 6 values are always transferred.

**Example:** `:TRAC:DATA? CEVM`

**Result:** 15 groups with 6 values per group are returned:

<$slot_0$>,<$EVM_0$>, <$BeginMeas_0$>,<$EndMeas_0$>,<$Reserved\_A_0$>,<$Reserved\_B_0$>
<$slot_1$>,<$EVM_1$>, <$BeginMeas_1$>,<$EndMeas_1$>,<$Reserved\_A_1$>,<$Reserved\_B_1$>
| | | | | |
<$slot_{14}$>,<$EVM_{14}$>, <$BeginMeas_{14}$>,<$EndMeas_{14}$>,<$Reserved\_A_{14}$>,<$Reserved\_B_{14}$>

| where: | <field> | [unitf] | {range} | - | explanation |
|---|---|---|---|---|---|
| | <$slot_n$> | [1] | {0 to 14} | - | slot nummer |
| | <$EVM_n$> | [%] | {0 to 100} | - | RMS value of error vector magnitude |
| | <$BeginMeas_n$> | [chip] | {0 to 1278} | - | Begin of the measurement interval for $EVM_{rms}$ value |
| | <$EndMeas_n$> | [chip] | {0 to 2559} | - | End of the measurement interval for $EVM_{rms}$ value |
| | < $Reserved\_A_n$> | [] | {0} | - | Reserved for possible additional information in future FW versions |
| | < $Reserved\_B_n$> | [] | {0} | - | Reserved for possible additional information in future FW versions |

## Table of Softkeys with Assignment of IEC/IEEE Commands

**3G FDD UE**

INSTrument:SELect BWCDpower|WCDPower

**POWER**

:CONFigure<1>:WCDPower:MEASurement POWer

Query of results: :CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? CPOWer

**ACLR**

:CONFigure<1>:WCDPower:MEASurement ACLR

Query of results: :CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? ACPower

**NO. OF ADJ CHAN**

:SENSe<1>:POWer:ACHannel:ACPairs 1

Query of results: :SENSe<1>:POWer:ACHannel:ACPairs?

**ADJUST SETTINGS**

:SENSe<1>:POWer:ACHannel:PRESet ACPower

**SWEEP TIME**

:SENSe<1>:SWEep:TIME <value>
Query of results: :SENSe<1>:SWEep:TIME ?
Result: <value> [sec]

**NOISE CORR ON OFF**

:SENSe<1>:POWer:NCORrection ON | OFF
Query of results: :SENSe<1>:POWer:NCORrection ?
Result: <0 | 1>

**FAST ACLR ON OFF**

:SENSe<1>:POWer:HSPeed ON | OFF
Query of results: :SENSe<1>:POWer:HSPeed ?
Result: <0 | 1>

**DIAGRAMM FULL SIZE**

----

**ADJUST REF LVL**

:SENSe<1>:POWer:ACHannel:PRESet:RLEVel

**ACLRLIMIT CHECK**

:CALCulate<1>:LIMit1:ACPower ON | OFF
Query of results: :CALCulate<1>:LIMit1:ACPower ?
Result: <0 | 1>

Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:RESult?
Result: <PASSED$_{Left\ SB}$ | FAILED$_{Left\ SB}$ , PASSED$_{Right\ SB}$ | FAILED$_{Right\ SB}$ >

Query of results: :CALCulate<1>:LIMit1:ACPower:ALTernate<1..2>:RESult?
Result: <PASSED$_{Left\ SB}$ | FAILED$_{Left\ SB}$ , PASSED$_{Right\ SB}$ | FAILED$_{Right\ SB}$ >

**EDIT ACLR LIMIT**

:CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative] <Val$_{left}$,Val$_{right}$>
Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative] ?
Result: <Val$_{left}$,Val$_{right}$> [dBc]

:CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative]:STATe ON
Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative]:STATe ?
Result: <0 | 1>

:CALCulate<1>:LIMit1:ACPower:ALTernate<1..2>:[RELative] <Val$_{left}$,Val$_{right}$>
Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative] ?
Result: <Val$_{left}$,Val$_{right}$> [dBc]

:CALCulate<1>:LIMit1:ACPower:ALTernate<1..2>:[RELative]:STATe ON
Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:[RELative]:STATe ?
Result: <0 | 1>

:CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute <Val$_{left}$,Val$_{right}$>
Query of results: :CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute ?
Result: <Val$_{left}$,Val$_{right}$> [dBm]

```
:CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute:STATe ON
Query of results:  :CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute:STATe ?
Result:            <0 | 1>
```

```
:CALCulate<1>:LIMit1:ACPower:ALTernate<1..2>:ABSolute <Val_left,Val_right>
Query of results:  :CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute ?
Result:            <Val_left,Val_right> [dBm]
```

```
:CALCulate<1>:LIMit1:ACPower:ALTernate<1..2>:ABSolute:STATe ON
Query of results:  :CALCulate<1>:LIMit1:ACPower:ACHannel:ABSolute:STATe ?
Result:            <0 | 1>
```

**CHANNEL BANDWIDTH**

```
:SENSe<1>:POWer:ACHannel:BWIDth <Value> Hz|kHz|MHz|GHz
Query of results:  :SENSe<1>:POWer:ACHannel:BWIDth ?
Result:            <Value> [Hz]
```

**ADJ CHAN BANDWIDTH**

```
:SENSe<1>:POWer:ACHannel:BWIDth:ACHannel <Value> Hz|kHz|MHz|GHz
Query of results:  :SENSe<1>:POWer:ACHannel:BWIDth:ACHannel ?
Result:            <Value> [Hz]
```

```
:SENSe<1>:POWer:ACHannel:BWIDth:ALTernate<1..2> <Value> Hz|kHz|MHz|GHz
Query of results:  :SENSe<1>:POWer:ACHannel:BWIDth:ALTernate<1..2> ?
Result:            <Value> [Hz]
```

**ADJ CHAN SPACING**

```
:SENSe<1>:POWer:ACHannel:SPACing[:ACHannel] <Value> Hz|kHz|MHz|GHz
Query of results:  :SENSe<1>:POWer:ACHannel:SPACing[:ACHannel] ?
Result:            <Value> [Hz]
```

```
:SENSe<1>:POWer:ACHannel:SPACing:ALTernate<1..2> <Value> Hz|kHz|MHz|GHz
Query of results:  :SENSe<1>:POWer:ACHannel:SPACing:ALTernate<1..2> ?
Result:            <Value> [Hz]
```

**ACLR ABS REL**

```
:SENSe<1>:POWer:ACHannel:MODE ABSolute | RELative
Query of results:  :SENSe<1>:POWer:ACHannel:MODE ?
Result:            <ABS | REL>
```

**CHAN PWR / Hz**

```
:CALCulate1:MARKer1:FUNCtion:POWer:RESult:PHZ ON|OFF
Query of results:  :CALCulate1:MARKer1:FUNCtion:POWer:RESult:PHZ ?
Result:            <0 | 1>
```

**POWER MODE**

```
:CALCulate:MARKer:FUNCtion:POWer:MODE WRITe|MAXHold
```

**SPECTRUM EM MASK**

```
:CONFigure:WCDPower:MEASurement ESPectrum
Query of results:  :CALCulate<1>:LIMit<1>:FAIL?
```

**LIMIT LINE AUTO**

```
:CALCulate<1>:LIMit<1>:ESPectrum:MODE AUTO
```

**LIMIT LINE USER**

```
:CALCulate:LIMit<1>:NAME <string>
:CALCulate:LIMit<1>:UNIT DBM
:CALCulate:LIMit<1>:CONTrol[:DATA] <num_value>, <num_value>, ...
:CALCulate:LIMit<1>:CONTrol:DOMain FREQuency
:CALCulate:LIMit<1>:CONTrol:TRACe 1
:CALCulate:LIMit<1>:CONTrol:OFFset <num_value>
:CALCulate:LIMit<1>:CONTrol:MODE   RELative
:CALCulate:LIMit<1>:UPPer[:DATA] <num_value>, <num_value>..
:CALCulate:LIMit<1>:UPPer:STATe   ON | OFF
:CALCulate:LIMit<1>:UPPer:OFFset <num_value>
:CALCulate:LIMit<1>:UPPer:MARGin <num_value>
:CALCulate:LIMit<1>:UPPer:MODE  ABSolute
:CALCulate:LIMit<1>:UPPer:SPACing LINear
```

**Notes:**

- If the y values are entered using the command:CALCulate:LIMit<1>:LOWer[:DATA] the limit check yields "failed" if the values are below the limit line.
- If a user-defined limit line is activated, it has priority over limit lines selected via AUTO.

| Softkey | Remote command |
|---|---|
| RESTORE STD LINES | :CALCulate<1>:LIMit<1>:ESPectrum:RESTore |
| LIST EVALUATION | :CALCulate1:PEAKsearch:AUTO ON \| OFF |
| ACJUST REF LVL | :[SENSe:]POWer:ACHannel:PRESet:RLEVel |
| 30kHz/1MHz TRANSISTON | :CALCulate<1\|2>:LIMit<1...8>:ESPectrum:TRANsition <numeric value> |
| OCCUPIED BANDWIDTH | :CONFigure<1>:WCDPower:MEASurement OBANdwidth<br>Query of results: :CALCulate<1>:MARKer<1>:FUNCtion:POWer:RESult? OBANdwidth |
| % POWER BANDWIDTH | :SENSe<1>:POWer:BANDwidth <value> PCT<br>Query of results: :SENSe<1>:POWer:BANDwidth ?<br>Result: <value> [%] |
| ADJUST REF LVL | :SENSe1:POWer:ACHannel:PRESet:RLEVel |
| ADJUST SETTINGS | :SENSe1:POWer:ACHannel:PRESet OBWidth |
| STATISTICS | :CONFigure:WCDPower:MEASurement CCDF or<br>:CALCulate:STATistics:MS:CCDF[:STATe] ON<br>Query of results: CALCulate:MARKer:X? |
| APD | :CALCulate1:STATistics:APD:STATe ON<br>Query of results: :CALCulate1:STATistics:APD:STATe?<br>Result: <0\|1> |
| CCDF | :CALCulate1:STATistics:CCDF:STATe ON<br>Query of results: :CALCulate1:STATistics:CCDF:STATe?<br>Result: <0\|1> |
| PERCENT MARKER | :CALCulate<1>:MARKer1:Y:PERCent <value> PCT<br>Query of results: :CALCulate<1>:MARKer1:Y:PERCent ?<br>Result: <0..100> [%] |
| NO OF SAMPLES | :CALCulate<1>:STATistics:NSAMples <value><br>Query of results: :CALCulate<1>:STATistics:NSAMples ?<br>Result: <value> |
| SCALING | :CALCulate<1>:STATistics:NSAMples <value><br>Query of results: :CALCulate<1>:STATistics:NSAMples ?<br>Result: <value> |
| X-AXIS REF LEVEL | :CALCulate<1>:STATistics:SCALe:X:RLEVel <value> dBm<br>Query of results: :CALCulate<1>:STATistics:SCALe:X:RLEVel ?<br>Result: <value> [dBm] |
| X-AXIS RANGE | :CALCulate<1>:STATistics:SCALe:X:RANGe <value> dBm<br>Query of results: :CALCulate<1>:STATistics:SCALe:X:RANGe ?<br>Result: <value> [dBm] |
| Y-AXIS MAX VALUE | :CALCulate<1>:STATistics:SCALe:Y:UPPer <value><br>Query of results: :CALCulate<1>:STATistics:SCALe:Y:UPPer?<br>Result: <value> Range: [1E-8...1] |
| Y-AXIS MIN VALUE | :CALCulate<1>:STATistics:SCALe:Y:LOWer <value><br>Query of results: :CALCulate<1>:STATistics:SCALe:Y:LOWer ?<br>Result: <value> Range: [1E-9...0.1] |

**ADJUST SETTINGS**

:CALCulate<1>:STATistics:SCALe:AUTO ONCE

**DEFAULT SETTINGS**

:CALCulate<1>:STATistics:PRESet

**ADJUST REF LVL**

:CALCulate<1>:STATistics:PRESet:RLEVel

**ADJUST SETTINGS**

:CALCulate<1>:STATistics:SCALe:AUTO ONCE

**CONT MEAS**

:INITiate<1>:CONTinuous ON
Query of results: :INITiate<1>:CONTinuous ?
Result: <1 | 0>

:INITiate<1>:IMMediate

**SINGLE MEAS**

:INITiate<1>:CONTinuous OFF
Query of results: :INITiate<1>:CONTinuous ?
Result: <0 | 1>

:INITiate<1>:IMMediate

**CODE DOM POWER**

:INSTrument<1>[:SELect] WCDPower
or
:CONFigure:WCDPower:MEASurement WCDPower

Query of results:
:TRACe:DATA? TRACE1 | TRACE2 | ABITstream | CTABle

or :CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower:RESult?
PTOTal | FERRor |TFRame | TOFFset | MACCuracy |
PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe
|
CHANnel | CDPabsolute | CDPRelative | IQOFfset |
IQIMbalance

or marker functions (see submenu MARKER)

**RESULT SUMMARY**

:CALCulate2:FEED "XTIM:CDP:ERR:SUMMary"

Query of results:
:CALCulate:MARKer:FUNCtion:WCDPower:MS:RESult?
PTOTal | FERRor | TFRame | MACCuracy | PCDerror | EVMRms | EVMPeak
| CERRor | CSLOt | SRATe | CHANnel | CDPabsolute | CDPRelative |
IQOFfset | IQIMbalance | TOFFset | RHO

**SELECT I Q**

:[SENSe:]CDPower:CMAPping I | Q

**SELECT CHANNEL**

:[SENSe:]CDPower:CODE 0...511

**ADJUST REF LVL**

:SENSe1:POWer:ACHannel:PRESet:RLEVel

**CODE DOM ERROR**

:CALCulate1:FEED 'XPOWer:CDEP'
Query of results:, :TRACe<1>:DATa? TRACe<1|2>

Format: <code class>$_1$, <code number>$_1$, <CDEP>$_1$, <channel flag>$_1$,
<code class>$_2$, <code number>$_2$, <CDEP>$_2$, <channel flag>$_2$,
,....,
<code class>$_{256}$, <code number>$_{256}$, <CDEP>$_{256}$, <channel flag>$_{256}$

Unit: < [1] >, < [1] >, < [dB] >,< [1] >
Range: < 8 > , < 0...256 >, < -∞ ... ∞ >, < 0 ; 1 >
Quantity: 256

| | |
|---|---|
| CODE PWR OVERVIEW | `:[SENSe:]CDPower:OVERview ON \| OFF`<br>`:CALCulate<1>:FEED 'XPOW:CDP:OVERview'` |
| CHANNEL TABLE | `:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"` |
| CHAN CONF | -- |
| CODE CHAN AUTOSEARCH | `:CONFigure:WCDPower:MS:CTABle[:STATe] OFF` |
| CODE CHAN PREDEFINED | `:CONFigure:WCDPower:MS:CTABle[:STATe] ON`<br>`:CONFigure:WCDPower:MS:CTABle:SELect <channel table name>` |
| EDIT CHAN CONF TABL | |
| HEADER VALUES | *HEADER*<br>`:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:COMMent "Comment for new table"`<br>*VALUES*<br>`:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:DATA <numeric_value>` |
| MEAS CHAN CONF TABLE | -- |
| SAVE TABLE | -- (automatically if using remote control) |
| NEW CHAN CONF TABL | please refere to `EDIT CHAN CONF TABLE` |
| DEL CHAN CONF TABLE | `:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:DELete` |
| CHAN CONF | -- |
| CODE CHAN AUTOSEARCH | `:CONFigure:WCDPower:MS:CTABle[:STATe] OFF` |
| CODE CHAN PREDEFINED | `:CONFigure:WCDPower:MS:CTABle[:STATe] ON`<br>`:CONFigure:WCDPower:MS:CTABle:SELect <channel table name>` |
| EDIT CHAN CONF TABL | |
| HEADER VALUES | *HEADER*<br>`:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:COMMent "Comment for new table"`<br>*VALUES*<br>`:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:DATA <numeric_value>` |
| MEAS CHAN CONF TABLE | -- |
| SAVE TABLE | -- (automatically if using remote control) |
| NEW CHAN CONF TABL | please refere to `EDIT CHAN CONF TABLE` |
| DEL CHAN CONF TABLE | `:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:DELete` |
| COPY CHAN CONF TABLE | `:CONFigure:WCDPower:MS:CTABle:NAME "channel table name"`<br>`:CONFigure:WCDPower:MS:CTABle:COPY "new channel table name"` |

| | |
|---|---|
| SETTINGS | -- |
| SCRAMBLING CODE | `:[SENSe:]CDPower:LCODe[:VALue] #H0 ... #H1fff<hex>` |
| FORMAT HEX DEC | `:[SENSe<1\|2>:]CDPower:LCODe[:VALue] <hex>` (scrambling code hex)<br>`:[SENSe<1\|2>:]CDPower:LCODe:DVALue <numeric_value>` (scrambling code dec) |
| SCR TYPE LONG SHRT | `:[SENSe:]CDPower:LCODe:TYPE LONG \| SHORT` |
| MEASURE SLOT FRAME | `:[SENSe:]CDPower:BASE SLOT \| FRAME` |
| CODE PWR ABS REL | *Absolute*<br>`:CALCulate<1>:FEED 'XPOW:CDP'`<br>`:CALCulate<1>:FEED 'XPOW:CDP:ABS'`<br>*Relative*<br>`:CALCulate<1>:FEED 'XPOW:CDP:RAT'` |
| MULTI FRM CAPTURE | --- |
| FRAME TO ANALYZE | `:[SENSe:]CDPower:FRAMe[:VALue] <numeric value>` |
| CAPTURE LENGTH | `:[SENSe:]CDPower:IQLength <numeric value>` |
| SELECT I Q | `:[SENSe:]CDPower:CMAPping I \| Q` |
| SELECT CHANNEL | `:[SENSe:]CDPower:CODE 0...511` |
| SELECT SLOT | `:[SENSe:]CDPower:SLOT 0 ... 14` |
| ADJUST REF LVL | `SENS:POW:ACH:PRES:RLEV` |
| RRC FILTER ON OFF | `:[SENSe:]CDPower:FILTer ON\|OFF` |
| HS-DPA/UPA ON OFF | `:[SENSe:]CDPower:HSDPamode ON\|OFF` |
| ELEMENTARE TAIL CHIPS | `:[SENSe:]CDPower:ETCHips ON\|OFF` |
| SIDE BAND NORM INV | `:[SENSe:]CDPower:SBANd NORMal \| INVerse` |
| NORMALIZE ON OFF | `:[SENSe:]CDPower:NORMalize ON \| OFF` |
| RESULTS | -- |
| CODE DOM POWER | *Absolute*<br>`:CALCulate<1>:FEED 'XPOW:CDP'`<br>`:CALCulate<1>:FEED 'XPOW:CDP:ABS'`<br>*Relative*<br>`:CALCulate<1>:FEED 'XPOW:CDP:RAT'` |

| | |
|---|---|
| COMPOSITE EVM | `:CALCulate2:FEED "XTIM:CDP:MACCuracy"` |
| COMPOSITE SIGNAL | --- |
| PEAK CODE DOMAIN ERR | `:CALCulate2:FEED "XTIM:CDP:ERR:PCDomain"` |
| EVM VS CHIP | `CALCulate2:FEED "XTIM:CDP:CHIP:EVM"`<br>Query of result: `:TRACe:DATA? TRACe2`<br>UNIT: [%]<br>Range: [0% … 100%] |
| MAG ERROR VS CHIP | `:CALCulate2:FEED "XTIM:CDP:CHIP:MAGNitude"`<br>Query of result: `:TRACe:DATA? TRACe2`<br>UNIT: [%]<br>Range: [-100% … 100%] |
| PHASE ERR VS CHIP | `CALCulate2:FEED "XTIM:CDP:CHIP:PHASe"`<br>Query of result: `:TRACe:DATA? TRACe2`<br>UNIT: [°]<br>Range: [-180° … 180°] |
| COMPOSITE CONST | `:CALCulate2:FEED "XTIM:CDP:COMP:CONS"`<br>Query of result: `:TRACe:DATA? TRACe2`<br>Output: List of I/Q values of all chips per slot<br>Format: $Re_1,Im_1,Re_2,Im_2,....,Re_{2560},Im_{2560}$<br>Unit: [1] |
| POWER VS SLOT | `:CALCulate2:FEED "XTIM:CDP:PVSLot"` |
| RESULT SUMMARY | `:CALCulate2:FEED "XTIM:CDP:ERR:SUMMary"`<br>Query of results:<br>`:CALCulate:MARKer:FUNCtion:WCDPower:MS:RESult? PTOTal \| FERRor \| TFRame \| MACCuracy \| PCDerror \| EVMRms \| EVMPeak \| CERRor \| CSLOt \| SRATe \| CHANnel \| CDPabsolute \| CDPRelative \| IQOFfset \| IQIMbalance \| TOFFset \| RHO` |
| CODE DOM ERROR | `:CALCulate1:FEED 'XPOWer:CDEP'`<br>Query of results: `:TRACe<1>:DATa? TRACe<1\|2>`<br>Format: $<code class>_1$, $<code number>_1$, $<CDEP>_1$, $<channel flag>_1$, $<code class>_2$, $<code number>_2$, $<CDEP>_2$, $<channel flag>_2$, ,....., $<code class>_{256}$, $<code number>_{256}$, $<CDEP>_{256}$, $<channel flag>_{256}$<br>Unit: < [1] >, < [1] >, < [dB] >,< [1] ><br>Range: < 8 > , < 0...256 >, < -∞ ... ∞ >, < 0 ; 1 ><br>Quantity:: 256 |
| CODE PWR OVERVIEW | `:[SENSe:]CDPower:OVERview ON \| OFF`<br>`:CALCulate<1>:FEED 'XPOW:CDP:OVERview'` |
| CHANNEL TABLE | `:CALCulate<1>:FEED "XTIM:CDP:ERR:CTABle"` |
| FREQ ERR VS SLOT | `:CALCulate<2>:FEED XTIM:CDP:FVSLot` |
| PHASE DISCOUNT | `:CALCulate<2>:FEED XTIM:CDP:PSVSLot`<br>Trace readout via `:TRAC? TRACe2` |
| SYMBOL CONST | `:CALCulate<2>:FEED "XTIM:CDP:SYMB:CONStellation"` |

| | |
|---|---|
| **SYMBOL EMV** | --- |
| **SYMBOL EVM** | `:CALCulate<2>:FEED "XTIM:CDP:SYMBol:EVM"` |
| **SYMB MAG ERROR** | `:CALCulate<2>:FEED XTIM:CDP:SYMBol:EVM:MAGNitude` |
| **SYMB PHASE ERROR** | `:CALCulate<2>:FEED XTIM:CDP:SYMBol:EVM:PHASe` |
| **BITSTREAM** | `:CALCulate<2>:FEED "XTIM:CDP:SYMB:BITStream"` |
| **POWER VS SYMBOL** | `:CALCulate<1>:FEED "XTIM:CDP:PVSYmbol"` |
| **SELECT I Q** | `:[SENSe:]CDPower:CMAPping I \| Q` |
| **SELECT CHANNEL** | `:[SENSe:]CDPower:CODE 0...511` |
| **SELECT** | --- |
| **CAPTUE LENGHTH** | `:[SENSe:]CDPower:IQLength <numeric value>`<br>Range: R&S FSU / FSP-B70 *(free run)*: <numeric value> *[1 ... 2]*<br>R&S FSU / FSP-B70 *(ext. Trig)*: <numeric value> *[1 ... 3]*<br>R&S FSQ: <numeric value> *[1 ... 100]*<br>R&S FSMR *(free run)*: <numeric value> *[1 ... 2]*<br>Unit: <numeric value> *[0 ... CAPTURE_LENGTH - 1* |
| **FRAME TO ANALYZE** | `:[SENSe:]CDPower.FRAMe[:VALue] <numeric value>` |
| **SLOT RES HALF FULL** | `:[SENSe:]CDPower::HSLot ON \| OFF` |
| **SELECT SLOT** | `:[SENSe:]CDPower:SLOT 0 ... 14` |
| **ADJUST REF LVL** | `:[SENSe:]POWer:ACHannel:PRESet:RLEVel` |

# 8 Performance Test

- Switch off the R&S analyzers before removing or inserting modules.
- Check the setting of the AC supply voltage selector (230 V) prior to switching on the unit.
- Measure the parameters after a warm-up time of at least 30 min. and the completion of system error correction of the analyzer and R&S SMIQ. Only then is it ensured that the specifications are complied with.
- Unless specified otherwise all settings are made after a PRESET.
- Conventions for settings on the analyzer during the measurement:

| | |
|---|---|
| [***<Key>***] | Press a key on the front panel, e.g. [SPAN] |
| *[<SOFTKEY>]* | Press a softkey, e.g. [MARKER -> PEAK] |
| [<nn unit>] | Enter a value and terminate by entering the unit, e.g. [12 kHz] |
| {<nn>} | Enter values indicated in one of the following tables. |

  Successive entries are separated by [:], e.g. [***SPAN***: 15 kHz].

- The values stated hereinafter are not guaranteed values. Only the data sheet specifications are binding.

## Required Measuring Equipment and Accessories

Table 7 Required Measuring Equipment and Accessories

| Item | Instrument type | Recommended characteristics | Recommended equipment | R&S Order No. |
|---|---|---|---|---|
| 1 | Signal generator | Vector signal generator for generating WCDMA signals | R&S SMIQ<br>with options:<br>R&S SMIQB42<br>R&S SMIQB20<br>R&S SMIQB11 | 1125.5555.xx<br><br>1104.7936.02<br>1125.5190.02<br>1085.4502.04 |

## Test Procedure

The performance test refers exclusively to results of the code-domain power.
It is not required to check the POWER-, ACLR- and SPECTRUM results since they are covered by the performance test of the basic unit.

Default settings on R&S SMIQ:

***[PRESET]***
***[LEVEL :*** *0 dBm* ***]***
***[FREQ:*** *2.1175 GHz* ***]***
*DIGITAL STD*
  *WCDMA 3GPP*
    *LINK DIRECTION UP/REVERSE*
    *TEST MODELS (NOT STANDARDIZED)...*
      *C+D960K*
    *SELECT BS/MS*
      *MS 1 ON*
        *OVERALL SYMBOL RATE... 6*960*
    *STATE: ON*

Trigger output: *RADIO FRAME*

The channel list should show the following:

| | | | | | | |
|---|---|---|---|---|---|---|
| CHANNEL NUMBER | 1 | 2 | 3 | 4 | 5 | 6 |
| TYPE | DPDCH | DPDCH | DPDCH | DPDCH | DPDCH | DPDCH |
| SYMBOL RATE | 960 | 960 | 960 | 960 | 960 | 960 |
| CHAN CODE | 1 | 1 | 3 | 3 | 2 | 2 |
| DATA | PN15 | PN15 | PN15 | PN15 | PN15 | PN15 |

Default settings on the analyzer:

***[PRESET]***
***[CENTER:*** *2.1175 GHz**]***
***[REF:*** *10 dBm**]***
*[3G FDD BS]*
***[TRIG*** *EXTERN**]***
*[SETTINGS SCRAMBLING CODE 0]*
*[RESULTS CHANNEL TABLE]*

Test setup and other settings

- Connect external trigger input of the analyzer to R&S SMIQ
- Connect external reference output of R&S FSU to R&S SMIQ

R&S SMIQ

*UTILITIES*
*REF OSC*
*SOURCE: EXT*

analyzer

***[SETUP****: REFERENCE INT]*

The display of the analyzer should show the following:

CF 1.935 GHz    Slot # 0    SR 960 ksps
Chan Code 2
Mapping Q

Ref 6.80 dBm
Att* 5 dB
1 CLRWR

A SGL TRG

**Channel Table**

| Type | Symb Rate | Chan# | Status | Mapping | PilotL | Pwr Abs | Pwr Rel |
|---|---|---|---|---|---|---|---|
| DPCCH | 15.0 ksps | 0 | active | Q | 8 | -10.20 | -8.45 |
| DPDCH | 960.0 ksps | 1 | active | I | --- | -10.21 | -8.45 |
| DPDCH | 960.0 ksps | 1 | active | Q | --- | -10.21 | -8.46 |
| DPDCH | 960.0 ksps | 2 | active | I | --- | -10.21 | -8.45 |
| DPDCH | 960.0 ksps | 2 | active | Q | --- | -10.21 | -8.45 |
| DPDCH | 960.0 ksps | 3 | active | I | --- | -10.20 | -8.45 |
| DPDCH | 960.0 ksps | 3 | active | Q | --- | -10.20 | -8.45 |
| ------ | 15.0 ksps | 0 | inactv | I | --- | -64.34 | -62.59 |
| ------ | 15.0 ksps | 1 | inactv | I | --- | -65.94 | -64.18 |
| ------ | 15.0 ksps | 1 | inactv | Q | --- | -65.36 | -63.60 |

Result Summary    SR 960 ksps
Chan Code 2
CF 1.935 GHz    Slot # 0    Mapping Q

EXT

Ref 6.80 dBm
Att* 5 dB
1 CLRWR

B

**Result Summary**

GLOBAL RESULTS

| | | | |
|---|---|---|---|
| Total Power | -1.75 dBm | Carrier Freq Error | -67.68 mHz |
| Chip Rate Error | -0.55 ppm | Trigger to Frame | -72.17 ns |
| IQ Offset | 0.02 % | IQ Imbalance | 0.06 % |
| Composite EVM | 1.39 % | Pk CDE (15.0 ksps) | -59.06 dB |
| Slot No | 0 | No of Active Chan | 7 |

CHANNEL RESULTS

| | | | |
|---|---|---|---|
| Symbol Rate | 960.00 ksps | Timing Offset | 0 Chips |
| Channel Code | 2 | Mapping | Q |
| No of Pilot Bits | 0 | | |
| Channel Power Rel | -8.45 dB | Channel Power Abs | -10.21 dBm |
| Symbol EVM | 1.23 % rms | Symbol EVM | 4.86 % Pk |

Date: 25.MAR.2002 11:22:31

# 9 Glossary

| | |
|---|---|
| Composite EVM | In accordance with the 3GPP specifications, the squared error between the real and imaginary parts of the test signal and an ideal reference signal is determined (EVM referred to the total signal) in a composite EVM measurement. |
| DPCCH | Dedicated physical control channel, control channel. The DPCCH contains pilot, TFCI, TPC and FBI bits. The control channel is assumed to be present in every signal in R&S FS-K73. |
| DPDCH | Dedicated physical data channel, data channel. The data channels only contain data bits. Data channels for user equipment signals are assigned a certain scheme defined in 3GPP specifications. |
| Inactive Channel Threshold | Minimum power that a single channel must have as compared to the total signal to be recognized as an active channel |
| Peak Code Domain Error | In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement. |

# 10 Index