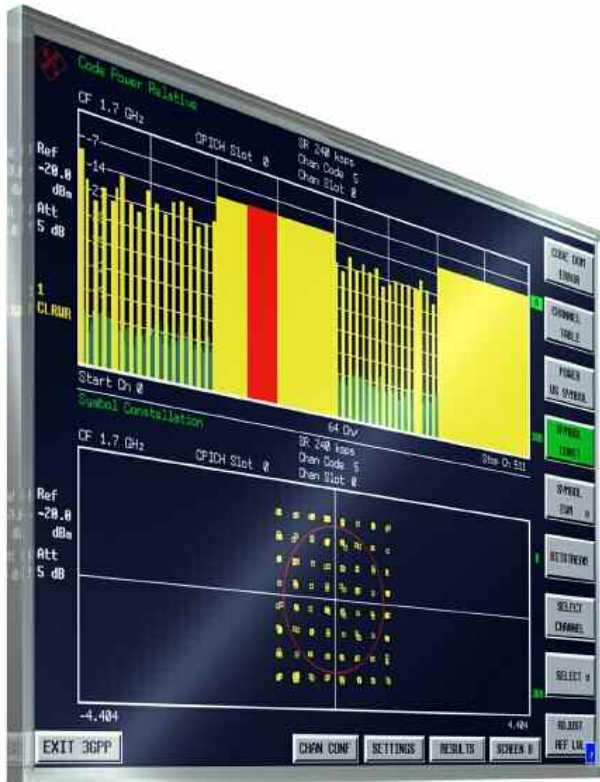


# R&S®FS-K72/K74/K74+ 3GPP FDD Base Station Test 3GPP FDD-HSDPA Base Station Test Software Manual



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The Software Manual describes the following R&S®FS-K72/K74/K74+ options:

- R&S®FS-K72
- R&S®FS-K74
- R&S®FS-K74+

Rohde&Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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The following abbreviations are used throughout this manual:

R&S®FS-K72/K74/K74+ is abbreviated as R&S FS-K72/K74/K74+.

# Basic Safety Instructions

## Always read through and comply with the following safety instructions!

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

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

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

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





## Symbols and safety labels

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

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

### Tags and their meaning

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

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

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

### Operating states and operating positions

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

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

### Electrical safety

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

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

## Basic Safety Instructions

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

### Operation

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

### Repair and service

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

### Batteries and rechargeable batteries/cells

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

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

### Transport

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

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

### **Waste disposal**

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

## Informaciones elementales de seguridad

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

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

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









## Informaciones elementales de seguridad

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

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

### Símbolos y definiciones de seguridad

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

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

## Palabras de señal y su significado

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



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



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



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



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

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

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

## Estados operativos y posiciones de funcionamiento

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

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

## Seguridad eléctrica

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

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

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

## Funcionamiento

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

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

### **Reparación y mantenimiento**

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

### **Baterías y acumuladores o celdas**

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

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

## Informaciones elementales de seguridad

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

### Transporte

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

### Eliminación

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

# Qualitätszertifikat

## Certificate of quality

## Certificat de qualité

Certified Quality System  
**ISO 9001**

Certified Environmental System  
**ISO 14001**

### Sehr geehrter Kunde,

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

### Der Umwelt verpflichtet

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

### Dear Customer,

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

### Environmental commitment

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

### Cher client,

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

### Engagement écologique

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

# 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.

### Europe, Africa, Middle East

Phone +49 89 4129 12345  
[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)

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## Documentation Overview

The user documentation for the R&S FS-K72/74/74+ is divided as follows:

R&S®FMU

R&S®FSG

R&S®FSMR

R&S®FSP

R&S®FSQ

R&S®FSU

R&S®FSUP

# Contents of Operating Manual for Application Firmware FS-K72/K74/K74+

This manual contains all information about the operation of an R&S FSx equipped with Application Firmware FS-K72/K74/K74+. It covers operation via menus and the remote control commands for the 3GPP FDD base station test.

This manual consists of the data sheet and 10 chapters:

- |                   |                                                                                                                                                                                                                                   |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Chapter 1</b>  | Describes the procedure for enabling the application firmware module.                                                                                                                                                             |
| <b>Chapter 2</b>  | Provides typical examples of measurements by means of tests.                                                                                                                                                                      |
| <b>Chapter 3</b>  | Describes the measurement setup for base station tests.                                                                                                                                                                           |
| <b>Chapter 4</b>  | Describes the 3GPP FDD test models as stipulated in the BTS test (3G TS 25.141 V3.7.0).                                                                                                                                           |
| <b>Chapter 5</b>  | Provides a schematic overview of the FS-K72/K74/K74+ control menus.                                                                                                                                                               |
| <b>Chapter 6</b>  | Contains a detailed description of the possible base station test measurements as a reference for manual operation. This chapter also presents a list of remote control commands associated with each function.                   |
| <b>Chapter 7</b>  | Describes all remote control commands defined for the code domain measurement. An alphabetic list of all remote control commands and a table of softkeys with the assignment of commands are provided at the end of this chapter. |
| <b>Chapter 8</b>  | Contains the performance test.                                                                                                                                                                                                    |
| <b>Chapter 9</b>  | Contains an explanation of terms related to measured quantities of the code domain measurement.                                                                                                                                   |
| <b>Chapter 10</b> | Contains the index for this operating manual.                                                                                                                                                                                     |

This manual is a supplement to the R&S Analyzer operating manual. It exclusively includes functions of Application Firmware FS-K72/K74/K74+. For all other descriptions, please refer to the R&S Analyzer operating manual.

## 3GPP FDD Base Station Test - Application Firmware R&S FS-K72/K74/K74+

The Analyzer R&S FSx or Measuring Receiver R&S FSMR equipped with Application Firmware R&S FS-K72 performs code domain power measurements on downlink signals according to the 3GPP standard (FDD mode). The application firmware is in line with the 3GPP standard (Third Generation Partnership Project) with Release 5. Signals that meet the conditions for channel configuration of test models 1 to 4 according to the 3GPP standard can be measured with R&S FS-K72. In addition to the code domain measurements specified by the 3GPP standard, the application firmware offers measurements with predefined settings in the frequency domain, e.g. power and ACLR measurements. The R&S Analyzer equipped with Application Firmware R&S FS-K74 additionally allows measurements to be performed on test model 5 (HSDPA), i.e. including HSPDSCH channels with modulation formats QPSK and 16QAM. R&S FS-K72 must be installed before R&S FS-K74 is installed on the R&S Analyzer. The Application Firmware R&S FS-K74+ additionally allows measurements according to test model 6 (HSPA+) including HSPDSCH channels with modulation format 64QAM. R&S FS-K72 and R&S FS-K74 must be installed before installing R&S FS-K74+ on the R&S Analyzer



Please note that FS-K72/K74/K74+ requires options R&S FSP-B15 and R&S FSP-B70 in order to run on an R&S FSP

---

# 1 Enabling the Firmware Option

Firmware option FS-K72/K74/K74+ is enabled in the *GENERAL SETUP* menu by entering a keyword. The keyword is delivered together with the option. R&S FS-K72, R&S FS-K74 and R&S FS-K74+ have different keywords. R&S FS-72 must be installed before R&S FS-K74 is installed, and R&S FS-74 must be installed before R&S FS-K74+ is installed. If the options are factory-installed, they are already enabled.

GENERAL SETUP menu:

## **OPTIONS**

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 during submenu entry.

## **INSTALL OPTION**

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

One or more keywords can be entered in the entry field. When a valid keyword is entered, *OPTION KEY OK* is displayed in 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

This chapter explains basic 3GPP FDD base station tests by means of a setup with a Signal Generator R&S SMIQ. It describes how operating and measurement errors can be avoided using correct presetting. The measurements are performed with an analyzer equipped with R&S FS-K72. Additionally Installing R&S FS-K74 is not required.

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

The measurements are performed using the following units and accessories:

- The Spectrum Analyzer R&S Analyzer with Application Firmware R&S FS-K72: 3GPP FDD base station test
- The Vector Signal Generator R&S SMIQ with option R&S SMIQB45: digital standard 3GPP (options R&S SMIQB20 and R&S SMIQB11 required)
- 1 coaxial cable, 50  $\Omega$ , approx. 1 m, N connector
- 2 coaxial cable, 50  $\Omega$ , approx. 1 m, BNC connector

Conventions for displaying settings on the 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 the R&S SMIQ:
  - [<KEY>] Press a key on the front panel, e.g. **[FREQ]**
  - <MENÜ> Select a menu, parameter or a setting, e.g. **DIGITAL STD**. The menu level is marked by an indentation.
  - <nn unit> Enter a value and terminate by entering the unit, e.g. **12 kHz**.

## 2.1 Basic Settings in Code Domain Measurement Mode

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

**Table 1 Default settings for code domain measurement**

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

## 2.2 Measurement 1: Measurement of the Signal Channel Power

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

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

The power is measured in the zero span mode (time domain measurement) using a digital channel filter of 5 MHz in bandwidth. According to the 3GPP standard, the measurement bandwidth is 5 MHz.

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

Settings on the R&S SMIQ: **[PRESET]**  
**[LEVEL:** 0 dBm]  
**[FREQ:** 2.1175 GHz]  
 DIGITAL STD  
   WCDMA/3GPP  
     TEST MODELS ...  
       TEST1\_32  
         STATE: ON

Settings on the **[PRESET]**  
**[CENTER:** 2.1175 GHz]

## Measurement 2: Measurement of the Spectrum Emission Mask

R&S Analyzer: **[AMPT:** *0 dBm]*  
**[3G FDD BS]**  
**[MEAS:** *POWER]*

Measurement on The following is displayed:

- the R&S Analyzer:
- Time domain trace of the WCDMA signal.
  - Signal channel power within a bandwidth of 5 MHz (in the marker info field)

## 2.3 Measurement 2: Measurement of the Spectrum Emission Mask

The 3GPP specification defines a measurement that monitors compliance with a spectral mask in a range of at least  $\pm 12.5$  MHz around the WCDMA carrier. To assess the power emissions in the specified range, the signal power is measured in the range near the carrier by means of a 30 kHz filter, and in the ranges far away from the carrier by means of a 1 MHz filter. The resulting trace is compared to a limit line defined in the 3GPP specification.

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

Settings on the R&S SMIQ: **[PRESET]**  
**[LEVEL:** *0 dBm]*  
**[FREQ:** *2.1175 GHz]*  
DIGITAL STD  
WCDMA/3GPP  
TEST MODELS ...  
TEST1\_32  
STATE: ON

Settings on the R&S Analyzer: **[PRESET]**  
**[CENTER:** *2.1175 GHz]*  
**[AMPT:** *0 dBm]*  
**[3G FDD BS]**  
**[MEAS:** *SPECTRUM EM MASK]*

Measurement on The following items are displayed:

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

## 2.4 Measurement 3: Measurement of the Relative Code Domain Power

A code domain power measurement on one of the test models (model 1 with 32 channels) is shown in the following. To demonstrate the effects, the basic parameters of the CDP measurements permitting an analysis of the signal are changed one after the other from values adapted to the measurement signal to non-adapted values.

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

Settings on the R&S SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2.1175 GHz]
DIGITAL STD
  WCDMA 3GPP
    TEST MODELS ...
      TEST1_32
    STATE: ON
```

Settings on the R&S Analyzer:

```
[PRESET]
[CENTER:         2.1175 GHz]
[AMPT:           10 dBm]
[3G FDD BS]

[SETTINGS:       SCRAMBLING CODE 0]
```

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

Screen A: Code domain power of signal (test model 1 with 32 channels)

Screen B: Numeric results of CDP measurement

### 2.4.1 Synchronization of the Reference Frequencies

Synchronization of the reference oscillators both of the DUT and the 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 the R&S SMIQ (coaxial cable with BNC connectors).

Settings on the R&S SMIQ: *Same as for measurement 2*

Settings on the R&S Analyzer: *Same as for measurement 2, plus*  
**[SETUP: REFERENCE EXT]**

Measurement on the 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.**

## 2.4.2 Setting: Behaviour with Deviating Center Frequency Setting

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

Settings on the R&S SMIQ: ▶ Tune the center frequency of the signal generator in 0.5 kHz steps and watch the analyzer screen:

Measurement on the 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 the accuracy of the code domain power measurement.
- Above a frequency error of 1 kHz, the probability of impaired synchronization increases. With continuous measurements, all channels are at times displayed in blue with almost the same level.
- Above a frequency error of approx. 2 kHz, a CDP measurement cannot be performed. The R&S Analyzer displays all possible codes in blue with a similar level.

Settings on the R&S SMIQ: ▶ Set the signal generator center frequency to 2.1175 GHz again:

**[FREQ: 2.1175 GHz]**

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

## 2.4.3 Setting: Behaviour with Incorrect Scrambling Code

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

Settings on the R&S SMIQ

```

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

```

Measurement on the R&S Analyzer The CDP display shows all possible codes with approximately the same level.

Settings on the R&S Analyzer: Set scrambling code to new value:  
**[SETTINGS: SCRAMBLING CODE 1]**

Measurement on the R&S Analyzer: The CDP display again shows the test model.

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



## 2.6 Measurement 5: Measurement of the Composite EVM

The 3GPP specification defines the composite EVM measurement as the average square deviation of the total signal:

An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other. The square deviation yields the composite EVM.

### Test setup

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

### Settings on the R&S SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2.1175 GHz]
DIGITAL STD
  WCDMA 3GPP
    TEST MODELS ...
      TEST4
        SELECT BS/MS
          BS 1 ON
            CPICH STATE ON
              STATE: ON
```

### Settings on the R&S Analyzer:

```
[PRESET]
[CENTER:         2.1175 GHz]
[REF:           10 dBm]
[3G FDD BS]

[TRIG           EXTERN]
[RESULTS       COMPOSITE EVM]
```

### Measurement on the R&S Analyzer:

The following is displayed:

Screen A: Code domain power of signal (Test model 4)

Screen B: Composite EVM (EVM for total signal)

## 2.7 Measurement 6: Measurement of Peak Code Domain Error

The peak code domain error measurement is defined in the 3GPP specification for WCDMA signals.

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

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

Settings on the R&S SMIQ:

```

[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2.1175 GHz]
DIGITAL STD
  WCDMA 3GPP
    TEST MODELS ...
      TEST1_32
        STATE: ON
  
```

Settings on the R&S Analyzer:

```

[PRESET]
[CENTER:         2.1175 GHz]
[REF:            0 dBm]
[3G FDD BS]
[TRIG           EXTERN]
[RESULTS       PEAK CODE DOMAIN ERR]
                   SELECT PCDE SF 256]
  
```

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

Screen A: Code domain power of signal (test model 1 with 32 channels)

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



## 2.8 Measurement 7: Measurement of the Trigger To Frame Time

The trigger to frame (TTF) time measurement yields the time between an external trigger event and the start of the 3GPP WCDMA frame. The result is displayed in the result summary. The trigger event is expected in a time range of one slot (667us) before the frame start. The resolution and absolute accuracy depend on the analyzer type and the measurement mode.

### 2.8.1.1 Resolution of the TTF time measurement

The resolution of the TTF time depends on the analyzer type that is used and the applied trace statistic mode. By using an average mode, the resolution can be increased. The higher the number of sweeps, the higher the resolution at the expense of measurement time. In the average mode, the TTF time is averaged for a number of sweeps (TRACE→SWEEP COUNT). If the TTF time of the applied signal does not change during for this number of sweeps, the trigger resolution can be improved.

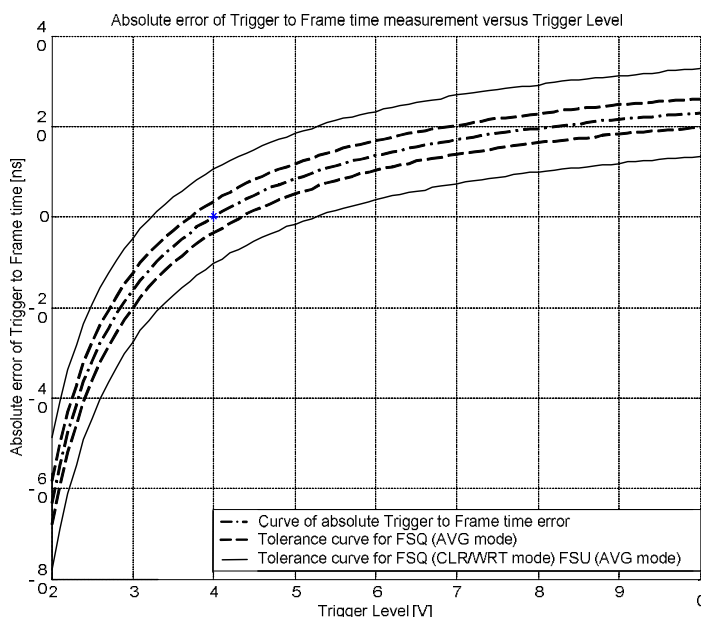
TTF time resolution in dependency of the analyzer type and the statistic mode:

Analyzer	Trace modus	TTF resolution	Number of sweeps
R&S - FSQ	CLEAR/WRITE	< 8 ns	1
R&S - FSQ	AVERAGE	< 0.5 ns	100
R&S - FSU	CLEAR/WRITE	< 65 ns	1
R&S - FSU	AVERAGE	< 4 ns	100
R&S - FSP	CLEAR/WRITE	< 65 ns	1
R&S - FSP	AVERAGE	< 4 ns	100

### 2.8.2 Absolute accuracy of the TTF time measurement

The absolute accuracy of the TTF time measurement depends on the level of the trigger pulse. The analyzer is calibrated to display the minimum deviation at a trigger pulse level of 4 V. The trigger threshold for an external trigger event is 1.4 V. Due to an internal low pass between the back panel and the trigger detector, the trigger pulse is delayed in correlation to its own level.

The absolute error of the TTF time measurement as a function of the trigger level is as follows:



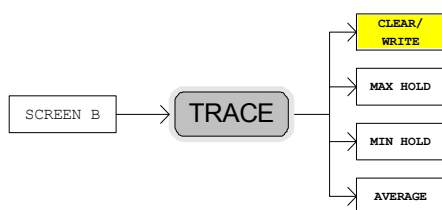
The dash-dotted curve shows the error of the TTF measurement. The dashed and solid curves indicate the expected measurement uncertainty depending on the analyzer type used and the applied trace statistic. To calculate the accurate TTF time, the error needs to be subtracted from the measured TTF value.

$$T_{TrgToFrame} = T_{Meas\_Analyzer} - T_{Error}$$

- where:
- $T_{TrgToFrame}$  - correct TTF time
  - $T_{meas\_Analyzer}$  - TTF time displayed by the analyzer (K72/K73 result summary)
  - $T_{error}$  - absolute error

### 2.8.3 Trace statistic in the result summary display

The trace statistic functions can be enabled by selecting SCREEN B. After screen B is selected, the trace menu can be called (press hardkey TRACE). In the trace menu, the kind of trace statistic can be selected.



## Measurement 7: Measurement of the Trigger To Frame Time

The parameter SWEEP COUNT determines the number of sweeps. The result values in the result summary of screen B are tagged with an abbreviation to indicate which kind of trace statistic is applied to the results. If measured with the trace statistic, the channel table is automatically switched to predefined mode. The last measured channel table is used and stored to "RECENT". In this case, any change in the signal channel configuration does not influence the displayed channel table.

The following trace statistic functions can be applied and are tagged with the corresponding abbreviations shown in the last column:

- 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>)

## Test setup

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

## Settings on the R&amp;S SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           2.1175 GHz]
DIGITAL STD
  WCDMA 3GPP
    TEST MODELS ...
      TEST1_32
        STATE: ON
```

## Settings on the R&amp;S Analyzer:

```
[PRESET]
[CENTER:         2.1175 GHz]
[REF:             0 dBm]
[3G FDD BS]
[TRIG             EXTERN]
[RESULTS         RESULT SUMMARY]
[SCREEN           SCREEN B]
[TRACE:          AVERAGE]
[                 CLEAR / WRITE]
[SWEEP COUNT]    <numeric value>
```

## Measurement on the R&amp;S Analyzer:

The following is displayed:

- Screen A: Code domain power of signal  
(test model 1 with 32 channels)
- Screen B: Result summary with trace statistic evaluation

## 3 Setup for Base Station Tests

### **CAUTION**

#### **Damaging to the instrument**

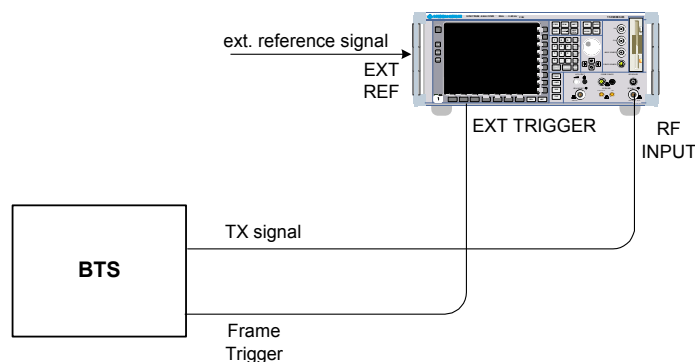
Before turning the instrument on, the following conditions must be met:

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

**Noncompliance with these instructions may cause damage to the instrument.**

This section describes how to set up the analyzer for 3GPP FDD base station tests. As a prerequisite for starting the test, the instrument must be correctly set up and connected to the AC power supply as described in chapter 1 of the operating manual for the analyzer. Furthermore, application firmware module R&S FS-K72 and, in the case of measurements on test model 5 and test model 6, R&S FS-K74 and R&S FS-K74+, respectively, must be properly installed following the instructions provided in chapter 1 of this manual.

### 3.1 Standard-Test Setup



**Fig. 1** *BTS test setup*

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

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

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

2. 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*).
3. To ensure that the error limits specified by the 3GPP standard are met, the analyzer should use an external reference frequency for frequency measurements on base stations. For instance, a rubidium frequency standard may be used as a reference source.
4. If the base station is provided with a trigger output, connect this output to the rear trigger input of the analyzer (*EXT TRIG GATE*).

## 3.2 Presetting

1. Enter external attenuation (REF LVL OFFSET)
2. Enter reference level
3. Enter center frequency
4. Set the trigger
5. Select standard and measurement

## 4 3GPP FDD Test Models

For measurements on base-station signals in line with 3GPP, test models with different channel configurations are specified in the document "Base station conformance testing (FDD)" (3GPP TS 25.141 V5.7.0). An overview of the test models is provided in this chapter.

The channel configurations of test models 1 to 3 contain the special channel SCCPCH. With an analyzer equipped with R&S FS-K72, this channel can only be automatically detected in CDP analysis if it contains pilot symbols. For measurements on signals with SCCPCH without pilot symbols, CDP analysis must be performed in the *CODE CHAN PREDEFINED* mode if the analyzer is equipped with R&S FS-K72 only. In this mode, the 3GPP test models 1 to 4 can be used for the measurement at a keystroke (see softkey *CODE CHAN PREDEFINED* for a detailed description). If the analyzer is also equipped with R&S FS-K74, SCCPCH will be detected properly as well in *CODE CHAN AUTOSEARCH* mode.

The channel configuration for test model 5 according to 3GPP contains channels in which the modulation type can vary. If only QPSK and 16QAM is used as in test model 5, these channels can be measured both in *CODE CHAN AUTOSEARCH* and *CODE CHAN PREDEFINED* mode, if the analyzer is equipped with R&S FS-K74. If 64QAM is used as in test model 6, these channels can be measured, if the analyzer is equipped with R&S FS-K74+. In both cases, test model 5 and test model 6 can be used as well at a keystroke in mode *CODE CHAN PREDEFINED*.

**Table 2 Test-Model 1**

Channel type	Number of channels	Power (%)	Level (dB)	Spreading Code	Timing Offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	1.6	-18	16	120
SCCPCH (SF=256)	1	1.6	-18	3	0
DPCH (SF=128)	16/32/64	76.8 total	see TS 25.141	see TS 25.141	see TS 25.141

**Table 3 Test-Model 2**

Channel type	Number of channels	Power(%)	Level (dB)	Spreading code	Timing offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	10	-10	1	0
Primary CPICH	1	10	-10	0	0
PICH	1	5	-13	16	120
SCCPCH (SF=256)	1	5	-13	3	0
DPCH (SF=128)	3	2 x 10, 1 x 50	2 x -10, 1 x -3	24, 72, 120	1, 7, 2

Table 4 Test-Model 3

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	12,6/7,9	-9 / -11	1	0
Primary CPICH	1	12,6/7,9	-9 / -11	0	0
PICH	1	5/1.6	-13 / -18	16	120
SCCPCH (SF=256)	1	5/1.6	-13 / -18	3	0
DPCH (SF=256)	16/32	63,7/80,4 total	see TS 25.141	see TS 25.141	see TS 25.141

Table 5 Test-Model 4

Channel type	Number of channels	Power (%) 16/32	Level (dB) 16/32	Spreading code	Timing offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	50 to 1.6	-3 to -18	1	0
Primary CPICH*	1	10	-10	0	0

\* The CPICH is optional.

Table 6 Test-Model 5

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	7,9	-11	1	0
Primary CPICH	1	7,9	-11	0	0
PICH	1	1.3	-19	16	120
SCCPCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=256)	30/14/6(*)	14/14.2/14.4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_SCCH	2	4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_PDSCH (16QAM)	8/4/2(*)	63.6/63.4/63.2 total	see TS 25.141	see TS 25.141	see TS 25.141

\* 2 HS\_PDSCH correspond to 6 DPCH, 4 HS\_PDSCH to 14 DPCH and 8 HS\_PDSCH to 30 DPCH  
This test model can be measured with an analyzer equipped with R&S FS-K74.

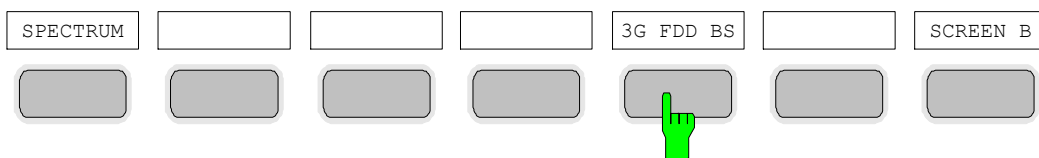
Table 7 Test-Model 6

Channel type	Number of channels	Power (%)	Level (dB)	Spreading code	Timing offset (x256T <sub>chip</sub> )
PCCPCH+SCH	1	7.9	-11	1	0
Primary CPICH	1	7.9	-11	0	0
PICH	1	1.3	-19	16	120
SCCPCH (SF=256)	1	1.3	-19	3	0
DPCH (SF=256)	30	27.1 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_SCCH	2	4 total	see TS 25.141	see TS 25.141	see TS 25.141
HS_PDSCH (64QAM)	8	50.5 total	see TS 25.141	see TS 25.141	see TS 25.141

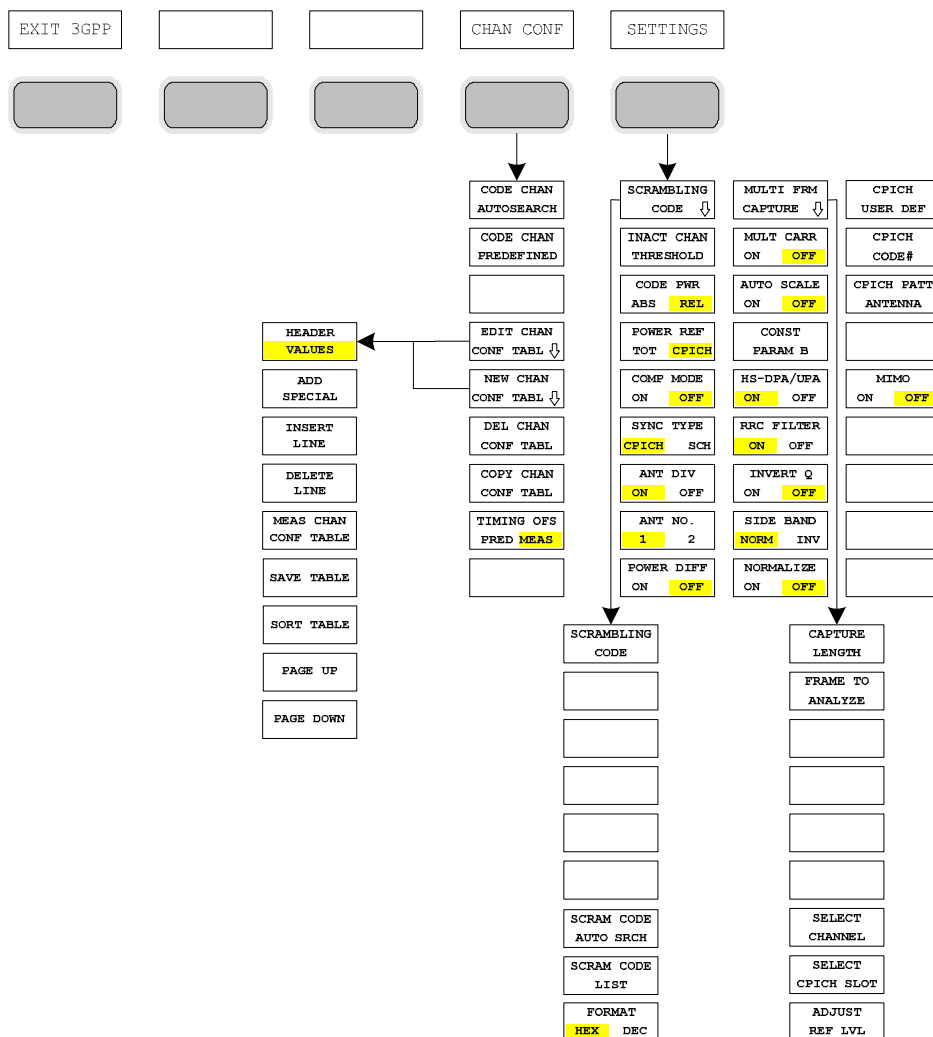
This test model can be measured with an analyzer equipped with R&S FS-K74+.

# 5 Menu Overview

Application Firmware Module FS-K72/K74/K74+ (3GPP FDD base station test) extends the analyzer by the code domain measurement mode for the 3GPP FDD standard. Additional softkeys are available that allow overview measurements in the analyzer mode. The FS-K72/K74/K74+ application is started by clicking the 3G FDD BS hotkey:



The main settings of the code domain power measurements can be directly selected via the hotkey bar which changes after the application has been started. When one of the hotkeys *CHAN CONF*, *SETTINGS*, *RESULTS* is selected, measurement is automatically switched to the Code Domain Power measurement mode. If the *EXIT 3GPP* hotkey is selected, FS-K72/K74/K74+ is exited. The hotkey bar of the base unit is displayed again.





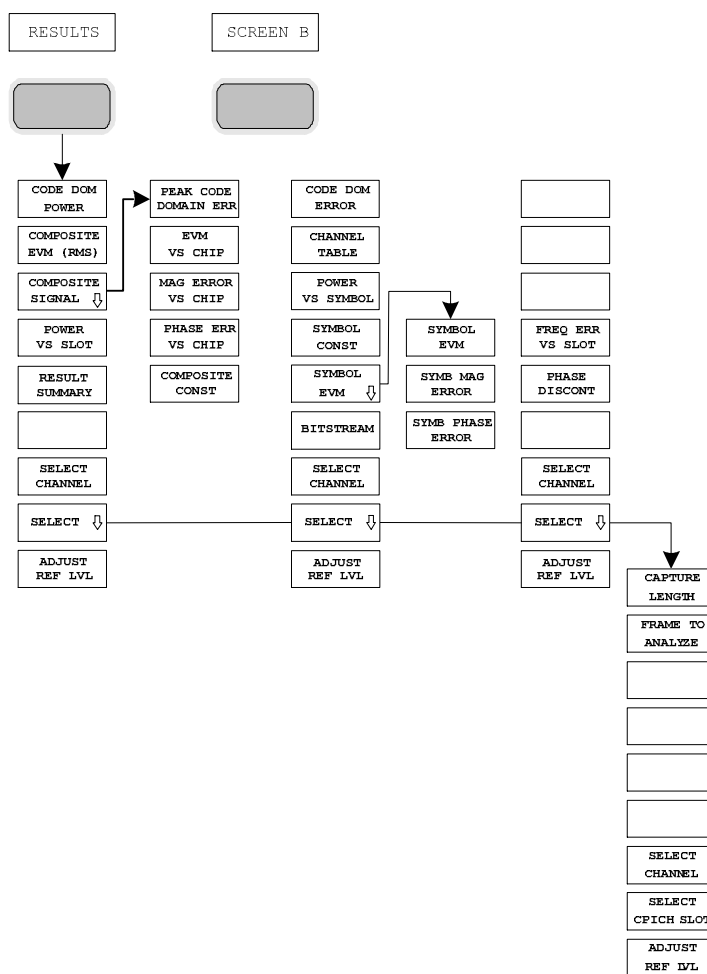


Fig. 2 Overview of menus - code domain power

The measurements available in FS-K72/K74/K74+ can be selected by means of the MEAS key:

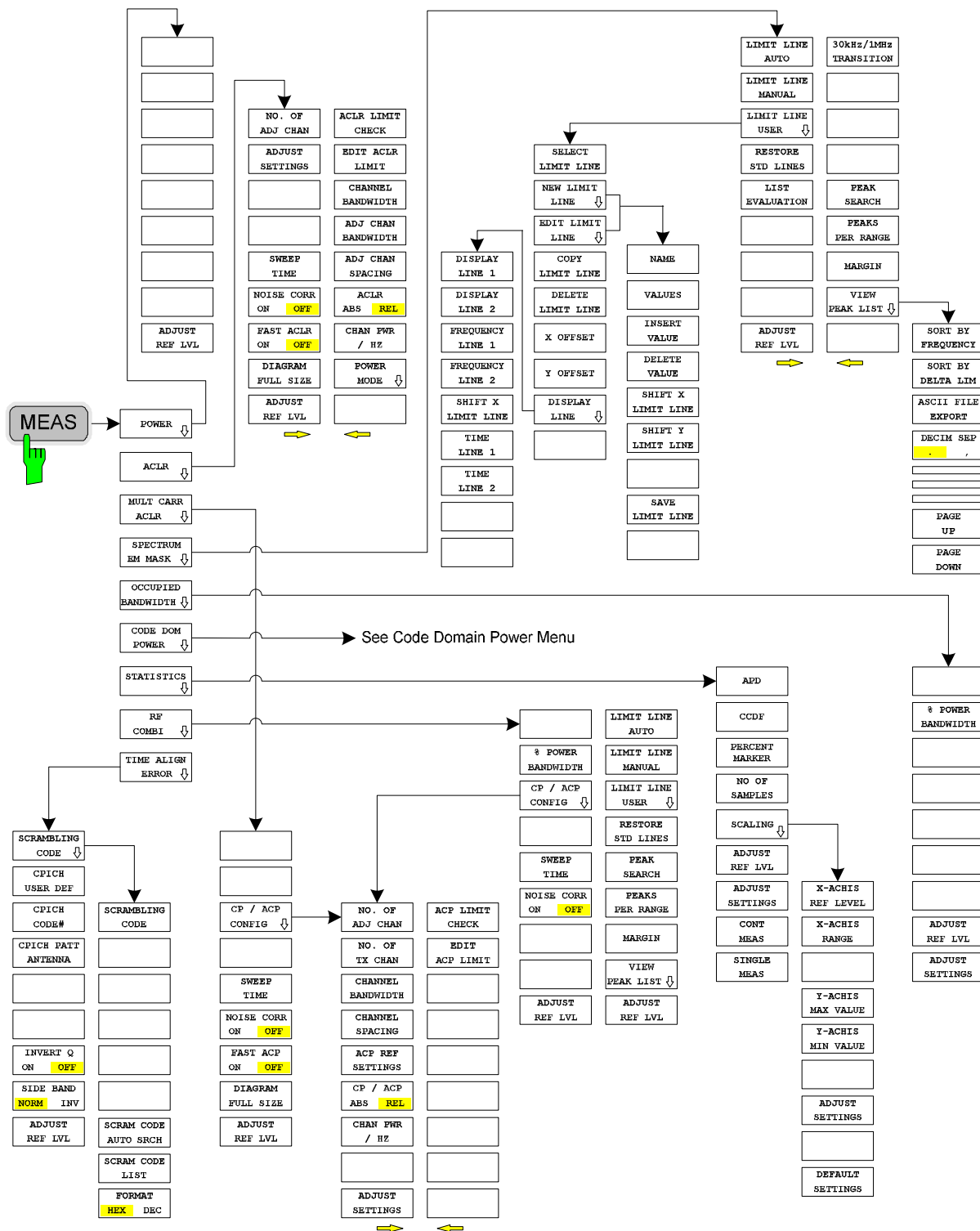


Fig. 3 Overview of menus - code domain power

## 6 Configuration of 3GPP FDD Measurements

The most important parameters for the 3GPP FDD base station tests are summarized in the *MEAS* key submenu and explained below using the softkey functions. The measurements described for the softkeys can be performed both with an analyzer equipped with R&S FS-K72 only and with an analyzer that also has R&S FS-K74 or R&S FS-K74+. The description of measurement functions and the corresponding graphics refer to R&S FS-K72. If different behaviour for the measurement functions or additional information can be achieved by equipping the analyzer with R&S FS-K74 or R&S FS-K74+, this will be stated within the text.

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 *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH* and *STATISTICS* softkeys activate base station tests in the analyzer mode. Pressing the associated softkey performs the settings required by 3GPP specifications. A subsequent modification of settings is possible. The other menus of the R&S Analyzer correspond to the menus of this mode and are described in the operating manual for the R&S Analyzer.

### Taste *MEAS*

The *MEAS* key opens a submenu for setting the various measurement modes of option FS-K72/K74/K74+:

- *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.
- *MULT CARR ACLR* activates the adjacent-channel power measurement for multi carrier signals 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 R&S 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).
- *RF COMBI* activates the RF combination measurement of adjacent channel leakage error (ACLR), spectrum emission mask (SEM) and occupied bandwidth (OBW).
- *TIME ALIGN ERROR* activates the time alignment error measurement between combined antenna branches.

## 6.2 Measurement of Channel Power

### POWER

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

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

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

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

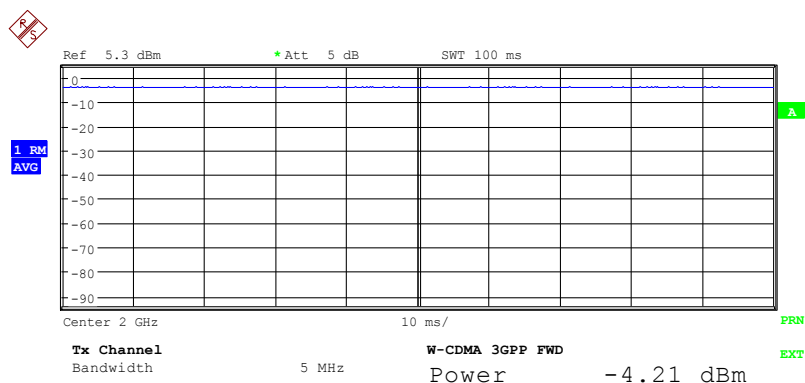


Fig. 4 Power measurement in the 3.84 MHz transmission channel

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET, the following user-specific settings are restored, thus retaining the adaptation to the DUT:	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 FWD	
CP / ACP CONFIG	NO. OF ADJ CHAN	0

Remote: CONF:WCDP:MEAS POW

Query of results: CALC:MARK:FUNC:POW:RES? CPOW

### ADJUST REF LVL

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 the RF attenuation and reference level are optimally adapted to the signal level so that the R&S Analyzer is not overdriven or the dynamic range reduced by too low an S/N ratio.

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.

Remote: SENS:POW:ACH:PRES:RLEV

### 6.3 Measurement of Adjacent-Channel Power - ACLR

The ACLR softkey activates the adjacent-channel power measurement in the default setting according to 3GPP specifications (adjacent-channel leakage ratio).

NO. OF ADJ CHAN
ADJUST SETTINGS
SWEEP TIME
NOISE CORR ON/OFF
FAST ACLR
DIAGRAM FULL SIZE
ADJUST REF LVL
ACLR LIMIT CHECK
EDIT ACLR LIMITS
CHANNEL BANDWIDTH
ADJ CHAN BANDWIDTH
ADJ CHAN SPACING
ACLR ABS/REL
CHAN PWR / HZ
POWER MODE

The R&S Analyzer measures the channel power and the relative power of the adjacent channels and of the alternate channels. The results are displayed below the screen.

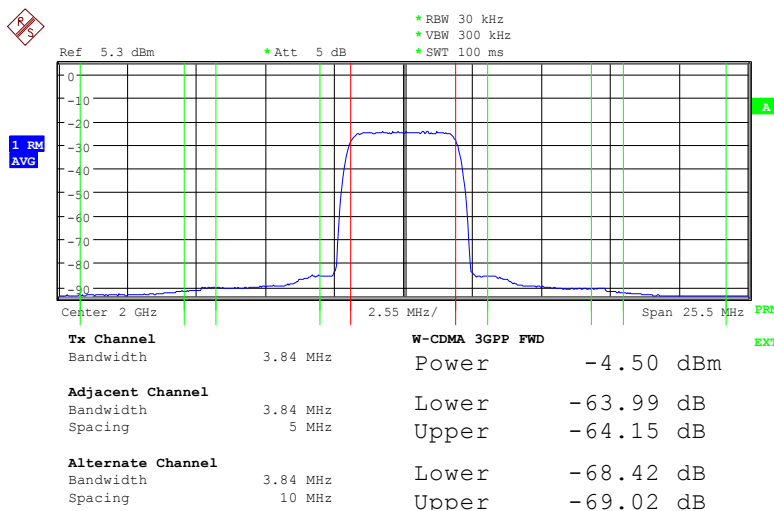


Fig. 5 Adjacent-channel power measurement of a 3GPP FDD base station

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored, thus retaining the adaptation to the DUT: 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 FWD	
CP / ACP CONFIG	NO. OF ADJ CHAN	2

## Measurement of Adjacent-Channel Power - ACLR

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

```
Level parameters
RBW, VBW
Sweep time
SPAN
NO OF ADJ. CHANNELS
FAST ACLR MODUS
```

Remote: CONF:WCDP:MEAS ALCR

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

**NO. OF ADJ CHAN**

The *NO. OF ADJ CHAN* softkey activates the entry of the number  $\pm n$  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 channels are measured.
- 2 The channel power, the power of the upper and lower adjacent channels and of the next higher and lower channels (alternate channel 1) are measured.
- 3 The channel power, the power of the upper and lower adjacent channels, the power of the next higher and lower channels (alternate channel 1) and of the next but one higher and lower adjacent channels (alternate channel 2) are measured.

With higher numbers the procedure is expanded accordingly.

Remote: SENS:POW:ACH:ACP 2

Query: SENS:POW:ACH:ACP ?

This increased number of adjacent channels is realized all for the relevant settings like:

**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
```

## ADJUST SETTINGS

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 bandwidth RBW:  $\leq 1/40$  of channel bandwidth
- Video bandwidth:  $VBW \geq 3 \times RBW$
- 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.

```
Remote: SENS:POW:ACH:PRES ACP|CPOW|OBW
```

## SWEEP TIME

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.

```
Remote: SWE:TIM <value>
```

## NOISE CORR ON/OFF

The *NOISE CORR ON/OFF* softkey switches on correction of measurement results by the residual instrument noise. When the softkey is switched on, first the residual instrument noise is measured. 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.

```
Remote: SENS:POW:NCOR ON
```

## FAST ACLR

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

Measurement of Adjacent-Channel Power - ACLR

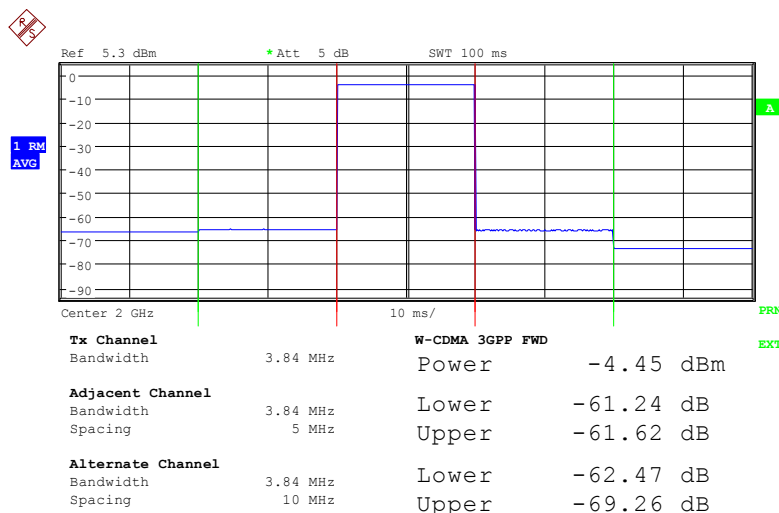
With *FAST ACLR ON* selected, the power is measured in the various channels in the time domain. The R&S Analyzer sets its center frequency to the different channel center frequencies one after the other, and then measures the power at these frequencies with the set measurement time (= sweep time/number 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 a correct power measurement. Software correction factors are not required in this case.

Measured values are output in 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 of 0.5 dB (99% of the measurements are 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.



Remote: SENS:POW:HSP ON

**DIAGRAM FULL SIZE**

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

Remote: DISP:WIND1:SIZE LARG|SMAL



**ADJUST REF LVL**

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 the RF attenuation and reference level are optimally adapted to the signal level so that the R&S Analyzer is not overdriven or the dynamic range reduced by too low an S/N ratio. 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.

Remote: SENS:POW:ACH:PRES:RLEV

**ACLR LIMIT CHECK**

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

Remote: CALC:LIM:ACP ON

Query of LIMIT CHECK results for

Adjacent Ch: CALC:LIM:ACP:ACH:RES?

Alternate Ch<1..2>: CALC:LIM:ACP:ALT<1..2>:RES?

Result format:

Left Sideband [PASSED, FAILED]

Right Sideband [PASSED, FAILED]

**EDIT ACLR LIMITS**

*EDIT ACLR LIMIT* softkey 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	x	0 dBm	
ALT1	-70 dBc	x	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.



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

Remote: CALC:LIM:ACP ON  
 CALC:LIM:ACP:ACH 0dB,0dB  
 CALC:LIM:ACP:ACH:STAT ON

## Measurement of Adjacent-Channel Power - ACLR

```

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

```

**CHANNEL BANDWIDTH**

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 selection of the channel bandwidth. Deviating channel bandwidths cannot be set. If deviating channel bandwidths are required, the IBW method should be used.

```
Remote: SENS:POW:ACH:BWID 3.84MHz
```

**ADJ CHAN BANDWIDTH**

The *ADJ CHAN BANDWIDTH* softkey opens a table in which 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 the 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.



The bandwidths can be selected independently of 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.

## Measurement of Adjacent-Channel Power - ACLR

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

**ADJ CHAN SPACING**

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 the case of equal channel spacing. The same holds true for the ALT2 channels when the bandwidth of the ALT1 channel is entered.



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

```
Remote: SENS:POW:ACH:SPAC:ACH 5MHz
        SENS:POW:ACH:SPAC:ALT1 10MHz
        SENS:POW:ACH:SPAC:ALT2 15MHz
```

**ACLR ABS/REL**

The *ACLR 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 the 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  $10 \lg (CP/CP_{ref})$  is displayed.

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

```
Remote: SENS:POW:ACH:MODE ABS
```

**CHAN PWR / HZ**

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  $10 \cdot \lg \frac{1}{\text{Channel} \cdot \text{Bandwidth}}$

```
Remote: CALC:MARK:FUNC:POW:RES:PHZ ON | OFF
```

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

Frequency span	<p>Frequency span The frequency span has to cover at least all channels to be measured.</p> <p>This is the channel bandwidth for channel power measurement.</p> <p>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.</p>
Resolution bandwidth (RBW)	<p>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 that is selected must not be 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.</p>
Video bandwidth (VBW)	<p>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 power indication that is too low (-2.51 dB at very low video bandwidths). The video bandwidth should therefore be selected at least three times the resolution bandwidth.</p> <p>The <i>ADJUST SETTINGS</i> softkey sets the video bandwidth (VBW) as a function of the channel bandwidth as follows:</p> $VBW \geq 3 \times RBW.$
Detector	<p>The <i>ADJUST SETTINGS</i> softkey selects the RMS detector.</p> <p>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 an indication level that is too low 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.</p>

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**POWER MODE**

The *POWER MODE* sub menu allows to change between the normal (*CLEAR/WRITE*) and the max hold power mode. In the *CLEAR/WRITE* 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 remained.

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

## 6.4 Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**MULT CARR ACLR**

The *MULT CARR ACLR* softkey activates adjacent-channel power measurement for several carrier signals. In addition, it opens a submenu for defining the parameters for channel power measurement. The softkey selected is shown in color to indicate that an adjacent-channel power measurement is active.

CP/ACP CONFIG
SWEEP TIME
NOISE CORR ON/OFF
FAST ACP ON/OFF
DIAGRAM FULL SIZE
ADJUST REF LVL

Remote: CONF:WCDP:MEAS MCAC

SYSTEM PRESET		
The following user-specific settings are not modified on the first access following presetting: Level parameters All trigger settings The center frequency setting is adjusted on first entry by ½ of the TX spacing, thus the measurement on the TX channel can continue.		
ADJACENT CHAN POWER	ACP ON	
ACP STANDARD	W-CDMA 3GPP FWD	
NO OF TX CHANNELS	4	0
NO OF ADJ. CHANNELS	2	
Further band class depended settings are identical to the ACLR measurement.		

Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement: Level parameters RBW, VBW Sweep time SPAN NO OF TX CHANNELS NO OF ADJ. CHANNELS FAST ACLR MODUS
------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**CP/ACP CONFIG**

The *CP/ACP CONFIG* softkey opens a submenu for configuration of the channel power and adjacent channel power measurement independently of the offered standards.

NO. OF ADJ CHAN
NO. OF TX CHAN
CHANNEL BANDWIDTH
CHANNEL SPACING
ACP REF SETTINGS
ACP REF SETTINGS
CP/ACP ABS/REL
CHAN PWR / HZ
POWER MODE
ADJUST SETTINGS
ACP LIMIT CHECK
EDIT ACP LIMITS

The channel configuration includes the number of channels to be measured, the channel bandwidths (*CHANNEL BANDWIDTH*), and the channel spacings (*CHANNEL SPACING*).

Limit values can additionally be specified for the adjacent-channel power (*ACP LIMIT CHECK* and *EDIT ACP LIMITS*) which are checked for compliance during the measurement.

**NO. OF ADJ CHAN**

The *NO. OF ADJ CHAN* softkey activates the entry of the number  $\pm n$  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 powers are measured.
- 1 The channel powers and the power of the upper and lower adjacent channel are measured.
- 2 The channel powers, the power of the upper and lower adjacent channel and of the next higher and lower channel (alternate channel 1) are measured.
- 3 The channel power, the power of the upper and lower adjacent channel, the power of the next higher and lower channel (alternate channel 1) and of the next but one higher and lower adjacent channel (alternate channel 2) are measured.

With higher numbers the procedure is expanded accordingly.

Remote: SENS:POW:ACH:ACP 1

This increased number of adjacent channels is realized all for the relevant settings like:

**ACLR LIMIT CHECK**

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

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**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
```

**NO. OF TX CHAN**

The *NO. OF TX CHAN* softkey enables the entry of the number of carrier signals to be considered in channel and adjacent-channel power measurements. Numbers from 1 to 12 can be entered.

The softkey is available only for multicarrier ACP measurements.

```
Remote: SENS:POW:ACH:TXCH:COUN 4
```

**CHANNEL BANDWIDTH**

The *CHANNEL BANDWIDTH* softkey opens a table for defining the channel bandwidths for the transmission channels and the adjacent channels.

TX/ACP CHANNEL BW	
CHAN	BANDWIDTH
TX	3.84 MHz
ADJ	3.84 MHz
ALT1	3.84 MHz
ALT2	3.84 MHz

The transmission-channel bandwidth is normally defined by the transmission standard. The correct bandwidth is set automatically for the selected standard (see *CP/ACP STANDARD* softkey).

With the IBW method (*FAST ACP OFF*), the channel bandwidth limits are marked by two vertical lines right and left of the channel center frequency. It can in this way be visually checked whether the entire power of the signal under test is within the selected channel bandwidth.

Measurements in the time domain (*FAST ACP ON*) are performed in the zero span mode. The channel limits are indicated by vertical lines. For measurements requiring channel bandwidths deviating from those defined in the selected standard the IBW method is to be used.

Refer to section "Setting of Bandwidths and Sweep Time – *BW* key" for a list of available channel filters.

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

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.



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

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

### CHANNEL SPACING

The *CHANNEL SPACING* softkey opens a table for defining the TX channel spacings. The spacing between every TX channels can be defined separately. Therefore a TX spacing 1-2 for the spacing between the first and the second carrier, a TX spacing 2-3 for the spacing between the second and the third carrier and so on can be defined. In order to allow a convenient setup for the system with equal TX channel spacing, the value of TX spacing 1-2 will be copied in all the spacing below after entry, the TX spacing 2-3 will be copied in all the spacing below after entry and so forth. For different spacings a setup from top to bottom is necessary.

TX/ACP CHANNEL SPACING	
CHAN	SPACING
TX1-2	5 MHz
TX2-3	5 MHz
TX3-4	6 MHz
TX4-5	6 MHz
TX5-6	5 MHz
TX6-7	5 MHz
TX7-8	5 MHz
TX8-9	5 MHz
TX9-10	5 MHz
TX10-11	5 MHz
TX11-12	5 MHz
ADJ	5 MHz
ALT1	10 MHz
ALT2	15 MHz

Since all the 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.



## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR



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

The entry "TX" is only available for the multicarrier ACP measurement.

```
Remote: SENS:POW:ACH:SPAC:CHAN2 5MHz
        SENS:POW:ACH:SPAC:ACH 5MHz
        SENS:POW:ACH:SPAC:ALT1 10MHz
        SENS:POW:ACH:SPAC:ALT2 15MHz
```

### ACP REF SETTINGS

The *ACP REF SETTINGS* softkey opens a table for selecting the transmission channel to which the adjacent-channel relative power values should be referenced.

ACP REFERENCE CHANNEL	
<input checked="" type="checkbox"/>	TX CHANNEL 1
<input type="checkbox"/>	TX CHANNEL 2
<input type="checkbox"/>	TX CHANNEL 3
<input type="checkbox"/>	TX CHANNEL 4
<input type="checkbox"/>	TX CHANNEL 5
<input type="checkbox"/>	TX CHANNEL 6
<input type="checkbox"/>	TX CHANNEL 7
<input type="checkbox"/>	TX CHANNEL 8
<input type="checkbox"/>	TX CHANNEL 9
<input type="checkbox"/>	TX CHANNEL 10
<input type="checkbox"/>	TX CHANNEL 11
<input type="checkbox"/>	TX CHANNEL 12
<input type="checkbox"/>	MIN POWER TX CHANNEL
<input type="checkbox"/>	MAX POWER TX CHANNEL
<input type="checkbox"/>	LOWEST & HIGHEST CHANNEL

TX CHANNEL 1-12 Selection of one of channels 1 to 12.

MIN POWER TX CHANNEL The transmission channel with the lowest power is used as a reference channel.

MAX POWER TX CHANNEL The transmission channel with the highest power is used as a reference channel.

LOWEST & HIGHEST CHANNEL The outer lefthand transmission channel is the reference channel for the lower adjacent channels, the outer righthand transmission channel that for the upper adjacent channels.

```
Remote: SENS:POW:ACH:REF:TXCH:MAN 1
        SENS:POW:ACH:REF:TXCH:AUTO MIN
```

### CP/ACP ABS/REL

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

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

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**CP/ACP REL** For 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.

For channel power measurements (*NO. OF ADJ CHAN* = 0) with a single carrier, the power of the transmission channel is displayed relative to the power of a reference channel defined by *SET CP REFERENCE*. This means:

1. Declare the power of the currently measured channel as the reference value, using the *SET CP REFERENCE* softkey.
2. Select the channel of interest by varying the channel frequency center frequency).

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

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

Remote: SENS:POW:ACH:MODE ABS

### CHAN PWR / HZ

The *CHAN PWR / HZ* softkey toggles between the measurement of the total channel power and the measurement of the channel power referenced to a 1-Hz bandwidth.

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

By means of this function it is possible e.g. to measure the signal/noise power density or use the additional functions *CP/ACP REL* and *SET CP REFERENCE* to obtain the signal to noise ratio.

Remote: CALC:MARK:FUNC:POW:RES:PHZ ON|OFF

### POWER MODE

The *POWER MODE* softkey opens the submenu for selecting the power mode.

**CLEAR/WRITE** In the *CLEAR/WRITE* mode the channel power and the adjacent channel powers are calculated directly from the current trace (default mode).

**MAX HOLD** In *MAX HOLD* mode the power values are still derived from the current trace, but they are compared with the previous power value using a maximum algorithm. The higher value is remained.

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

### ADJUST SETTINGS

The *ADJUST SETTINGS* softkey automatically optimizes the instrument settings for the selected power measurement (see below).

Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

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 should cover at least all channels to be considered in a measurement.

For adjacent-channel power measurements, the frequency span is set as a function of the number of transmission channels, the transmission channel spacing, the adjacent-channel spacing, and the bandwidth of one of adjacent-channels ADJ, ALT1 or ALT2, whichever is furthest away from the transmission channels.

```
Remote: SENS:POW:ACH:PRES MCAC
```

**ACP LIMIT CHECK**

The *ACP LIMIT CHECK* softkey switches the limit check for the ACP measurement on and off.

```
Remote CALC:LIM:ACP ON
        CALC:LIM:ACP:ACH:RES?
        CALC:LIM:ACP:ALT:RES?
```

**EDIT ACP LIMITS**

The *EDIT ACP LIMITS* softkey opens a table for defining the limits for the ACP measurement.

ACP LIMITS				
CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK	
	VALUE	ON	VALUE	ON
ADJ	-45 dB	√		
ALT1	-60 dB	√		
ALT2				

The following rules apply for the limits:

- A separate limit can be defined for each adjacent channel. The limit applies to both the upper and the lower adjacent channel.
- A relative and/or absolute limit can be defined. The check of both limit values can be activated independently.
- The checks adherence to the limits irrespective of whether the limits are absolute or relative or whether the measurement is carried out with absolute or relative levels. If both limits are active and if the higher of both limit values is exceeded, the measured value is marked accordingly.



Measured values exceeding the limit are marked by a preceding asterisk.

```
Remote: 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
```

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

```
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
```

**SWEEP TIME**

The *SWEEP TIME* softkey activates the entry of the sweep time. With the RMS detector, a longer sweep time increases the stability of the measurement results.

The function of the softkey is identical to the softkey *SWEEP TIME MANUAL* in the menu *BW*.

```
Remote: SWE:TIM <value>
```

**NOISE CORR ON/OFF**

If the *NOISE CORR ON/OFF* softkey is activated, the results will be corrected by the instrument's inherent noise, which increases the dynamic range.

When the function is switched on, a reference measurement of the instrument's inherent noise is carried out. The noise power measured is then subtracted from the power in the channel that is being examined.

The inherent noise of the instrument depends on the selected center frequency, resolution bandwidth and level setting. Therefore, the correction function is disabled whenever one of these parameters is changed. A disable message is displayed on the screen.

To enable the correction function in conjunction with the changed setting, press the softkey once more. A new reference measurement is carried out.

```
Remote: SENS:POW:NCOR ON
```

## Measurement of Multi Carrier Adjacent-Channel Power – MULT CARR ACLR

**FAST ACP ON/OFF**

The *FAST ACP* softkey switches between the IBW method (*FAST ACP OFF*) and the time domain method (*FAST ACP ON*).

With *FAST ACP ON* the power measurement is performed in the different channels in the time domain. The analyzer sets the center frequency consecutively to the different channel center frequencies and measures the power with the selected measurement time (= sweep time/number of channels). The RBW filters suitable for the selected standard and frequency offset are automatically used (e.g. root raised cos with W-CDMA). The list of available channel filters is included in section "Setting of Bandwidths and Sweep Time – *BW key*".

The RMS detector is used for obtaining correct power measurement results. Therefore this requires no software correction factors.

Measured values are output as a list. The powers of the transmission channels are output in dBm, the powers of the adjacent channels in dBm (*CP/ACP ABS*) or dB (*CP/ACP REL*).

The sweep time is selected depending on the desired reproducibility of results. Reproducibility increases with sweep time since power measurement is then performed over a longer time period.

As a general approach, it can be assumed that approx. 500 non-correlated measured values are required for a reproducibility of 0.5 dB (99% of the measurements are within 0.5 dB of the true measured value). This holds true for white noise. The measured values are considered as non-correlated when their time interval corresponds to the reciprocal of the measured bandwidth.

Remote: SENS:POW:HSP ON

**DIAGRAM FULL SIZE**

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

Remote: DISP:WIND1:SIZE LARG|SMAL

**ADJUST REF LVL**

The *ADJUST REF LVL* softkey adjusts the reference level of the instrument 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.

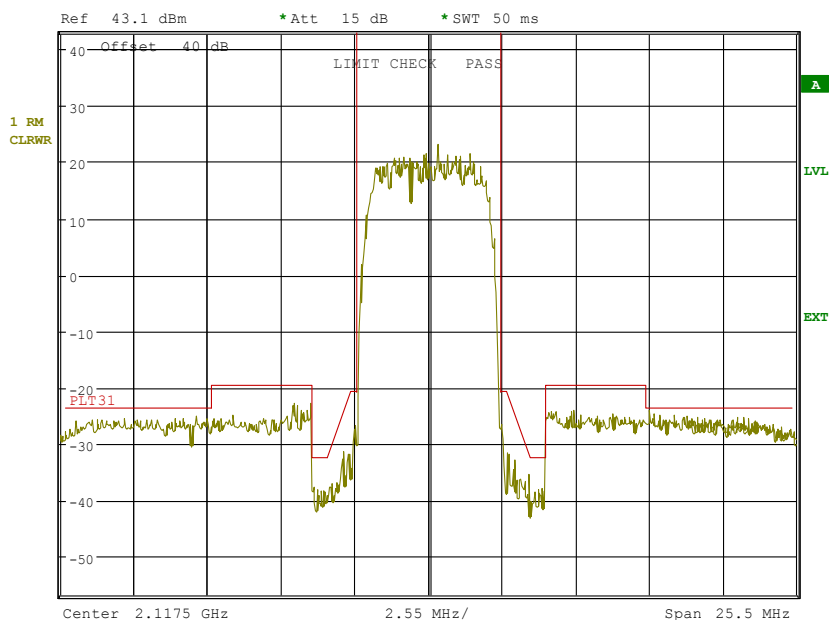
Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

Remote: SENS:POW:ACH:PRES:RLEV

## 6.5 Signal Power Check – SPECTRUM EM MASK

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.

LIMIT LINE AUTO
LIMIT LINE MANUAL
LIMIT LINE USER
RESTORE STD LINES
LIST EVALUATION
ADJUST REF LVL
30kHz/1MHz TRANSITION
PEAK SEARCH
MARGIN
VIEW PEAK LIST



**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, thus retaining the adaptation to the DUT:		
Reference Level + Rev 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
SPAN		25.5 MHz
BW	SWEEP TIME MANUAL	50 ms

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode. Changing of the RBW and the VBW is limited because they are set by the definition of the limits.

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

Level parameters  
Sweep time  
SPAN

Remote: CONF:WCDP:MEAS ESP  
Query of results: CALC:LIM:FAIL? and visual evaluation

### LIMIT LINE AUTO

The *LIMIT LINE AUTO* softkey automatically selects the limit line to be checked according to the 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.

Remote: CALC:LIM:ESP:MODE AUTO

### LIMIT LINE MANUAL

The *LIMIT LINE MANUAL* softkey activates the manual selection of a predefined limit line. If this softkey is selected, the channel power measurement is not used to select the limit line, but only to determine its relative components. The power at the different frequency offsets is compared with the user-defined limit line.

The softkey opens a table with all the limit lines predefined in the device:

- Name of the limit line
- $P \geq 43$  dBm
- $39 \text{ dBm} \leq P < 43$  dBm
- $31 \text{ dBm} \leq P < 39$  dBm
- $P < 31$  dBm

The name of the limit line indicates the expected power range for which the limit line has been defined.

Remote: CALC:LIM:ESP:MODE MAN  
CALC:LIM:ESP:VAL 31

### LIMIT LINE USER

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 base unit.

In contrast to the predefined limit lines supplied with the R&S Analyzer which correspond to the standard specifications, the user-defined limit line can be specified for the entire frequency range ( $\pm 12.5$  MHz from carrier) either relatively (referenced to the channel power) or absolutely.

Remote: CALC:LIM<1>:NAME <string>  
CALC:LIM<1>:UNIT DBM  
CALC:LIM<1>:CONT <num\_value>, <num\_value>, ...  
CALC:LIM<1>:CONT:DOMain FREQ  
CALC:LIM<1>:CONT:TRAC 1  
CALC:LIM<1>:CONT:OFF <num\_value>  
CALC:LIM<1>:CONT:MODE REL

```

CALC:LIM<1>:UPP:DATA <num_value>, <num_value>..
CALC:LIM<1>:UPP:STAT ON | OFF
CALC:LIM<1>:UPP:OFF <num_value>
CALC:LIM<1>:UPP:MARG <num_value>
CALC:LIM<1>:UPP:MODE ABS
CALC:LIM<1>:UPP:SPAC LIN

```

### RESTORE STD LINES

The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the factory-set state. This prevents inadvertent overwriting of the standard lines.

```
Remote: CALC:LIM:ESP:REST
```

### LIST EVALUATION

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.

```
Remote: CALC1:PEAK:AUTO ON | OFF
TRAC:DATA? LIST
```

### ADJUST REF LVL

The *ADJUST REF LVL* softkey adjusts the R&S 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 R&S Analyzer signal path is not overdriven and that the dynamic range is not limited by a reference level that is too low.

```
Remote: SENS:POW:ACH:PRES:RLEV
```

### 30kHz/1MHz TRANSITION

The *30kHz/1MHz TRANSITION* softkey specifies the offset frequency at which the resolution bandwidth is switched between 30k and 1MHz.

The default value is 4.0 MHz.

For multicarrier spectrum emission mask measurement this value can be extended. It is recommended to define user specific limit lines.

```
Remote: CALC2:LIM:ESP:TRAN 3 MHz
```



## PEAK SEARCH

The *PEAK SEARCH* softkey activates a single measurement of spectrum emission mask. The limit mask - reduced by an overall margin - is checked against the trace. The fail positions are marked by crosses. Every value is added to a peak list which can be opened and saved in ASCII format or read out via an IEC/IEEE command. The peaks are calculated using the same peak search algorithm like markers do. It is possible to define the peak excursion value via *MKR->NEXT*, softkey *PEAK EXCURSION*. Additionally the worst fail of each fail area without a peak is marked and added to the peak list.

Remote: CALC:PEAK

## PEAKS PER RANGE

The *PEAKS PER RANGE* softkey defines how many peaks are searched for within one range. The 11 x-axis sections (including carrier) from the standard limits are defined as own ranges ( $\pm 7.500$  MHz,  $\pm 4.000$  MHz,  $\pm 3.515$  MHz,  $\pm 2.715$  MHz,  $\pm 2.515$  MHz from the carrier frequency.) With a high MARGIN of e.g. 200 dB and a PEAKS PER RANGE of 1 it is possible to obtain the worst point of each section. The default value of *PEAKS PER RANGE* is 25.

Remote: CALC:PEAK:SUBR 1...50

## MARGIN

The *MARGIN* softkey defines an overall margin which is subtracted from the limit line to make the peak search more stronger. If the values of the trace are above the limit line minus margin value it will be marked with a cross as shown in the peak list. The DELTA LIMIT of the list will be positive thus indicating that only the margin and not the limit itself is reached. A negative sign would indicate the real fail. The default value of *MARGIN* is 6 dB.

Remote: CALC:PEAK:MARG -200dB...200dB

## VIEW PEAK LIST

The *VIEW PEAK LIST* softkey opens the peak list. The list is empty if either now peak search (see softkey *PEAK SEARCH*) has been done, or if no peaks/fails have been found. The list shows for every peak value the following entries:

- the trace,
- the frequency,
- the level and
- the delta level to the limit (negative deltas indicate a fail).

The following figure shows a peak list containing 6 entries:

VIEW PEAK LIST			
TRACE / DETECTOR	FREQUENCY	LEVEL dBm	DELTA LIMIT dB
1 RMS	2.1200 GHz	-19.75	0.74
1 RMS	2.1204 GHz	-26.65	-3.04
1 RMS	2.1203 GHz	-25.78	-3.71
1 RMS	2.1202 GHz	-25.69	-4.53
1 RMS	2.1204 GHz	-29.24	-4.71
1 RMS	2.1203 GHz	-28.22	-5.23

Fig. 7 Peak list of spectrum emission mask

Remote: TRAC? FIN

The comma separated values are :

<freq1>, <level1>, <delta level 1>,  
<freq2>, <level2>, <delta level 2>, ...

This softkey also opens the following softkey menu:

### **SORT BY FREQUENCY**

The *SORT BY FREQUENCY* softkey sorts the list in ascending order according to the column FREQUENCY.

Remote--

### **SORT BY DELTA LIM**

The *SORT BY DELTA LIM* softkey sorts the list in descending order according to the column DELTA LIMIT.

Remote: - -

### **ASCII FILE EXPORT**

The *ASCII FILE EXPORT* softkey exports the peak list in ASCII format to a file.

The complete output format is similar to the trace export. The peak values within the file are comma separated in the format:

<trace no 1>, <freq1>, <level1>, <delta level 1>, <trace no 2>,  
<freq2>, <level2>, <delta level 2>, ...

The trace no is always 1.

Remote: MMEM:STOR:FIN 'A:\final.dat'

### **DECIM SEP**

Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between default separators '.' (decimal point) and ',' (comma) using softkey *DECIM SEP*.

Remote: FORM:DEXP:DSEP POIN | COMM

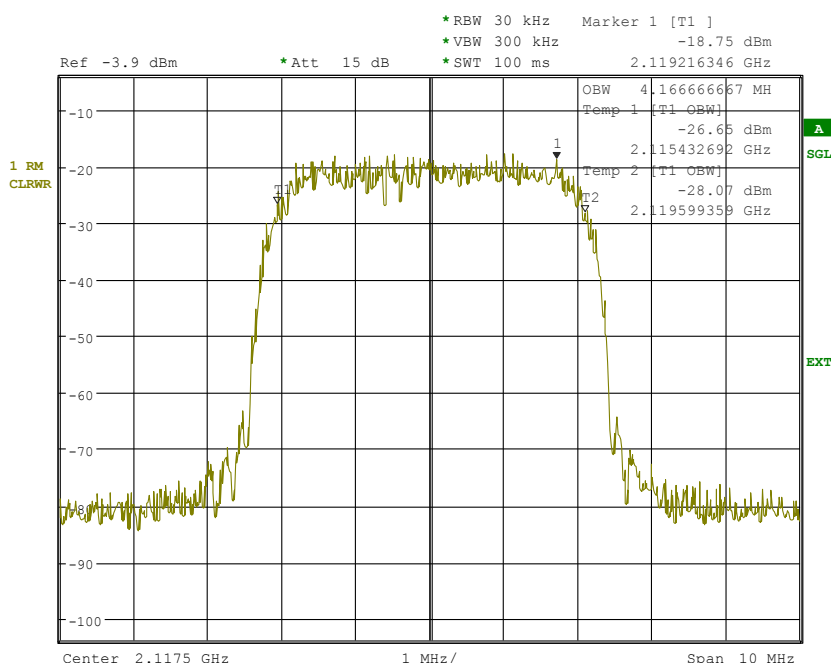
## 6.6 Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

<a href="#">% POWER BANDWIDTH</a>
<a href="#">ADJUST SETTINGS</a>
<a href="#">ADJUST REF LVL</a>

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

The occupied bandwidth is defined as the bandwidth in which – in default settings – 99% of the total signal power is to be found. The percentage of the signal power to be included in the bandwidth measurement can be changed.

The occupied bandwidth and the frequency markers are output in the marker info field at the top right edge of the screen.



**Fig. 8 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, thus retaining the adaptation to the DUT:		
Reference Level + Rev Level Offset		
Center Frequency + Frequency Offset		
Input Attenuation + Mixer Level		
All trigger settings		
OCCUPIED BANDWIDTH		
TRACE 1	DETECTOR	RMS

## Measurement of Occupied Bandwidth - OCCUPIED BANDWIDTH

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

Level parameters  
 RBW, VBW  
 Sweep time  
 SPAN

Remote: CONF:WCDP:MEAS OBAN

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

**% POWER BANDWIDTH**

The **% POWER BANDWIDTH** softkey opens the entry of the percentage of power relative 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 %.

Remote: SENS:POW:BWID 99PCT

**ADJUST REF LVL**

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 an S/N ratio that is too small.

Since the measurement bandwidth for channel power measurements is significantly lower than the signal bandwidth, the signal path may be overloaded although the trace is still significantly below the reference level.

Remote: SENS:POW:ACH:PRES:RLEV

**ADJUST SETTINGS**

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: 3 x channel bandwidth
- 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.

Remote: SENS:POW:ACH:PRES OBW

## 6.7 Signal Statistics

APD
CCDF
PERCENT MARKER
NO OF SAMPLES
SCALING
ADJUST REF LVL
ADJUST SETTINGS
CONT MEAS
SINGLE 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 user-definable 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.

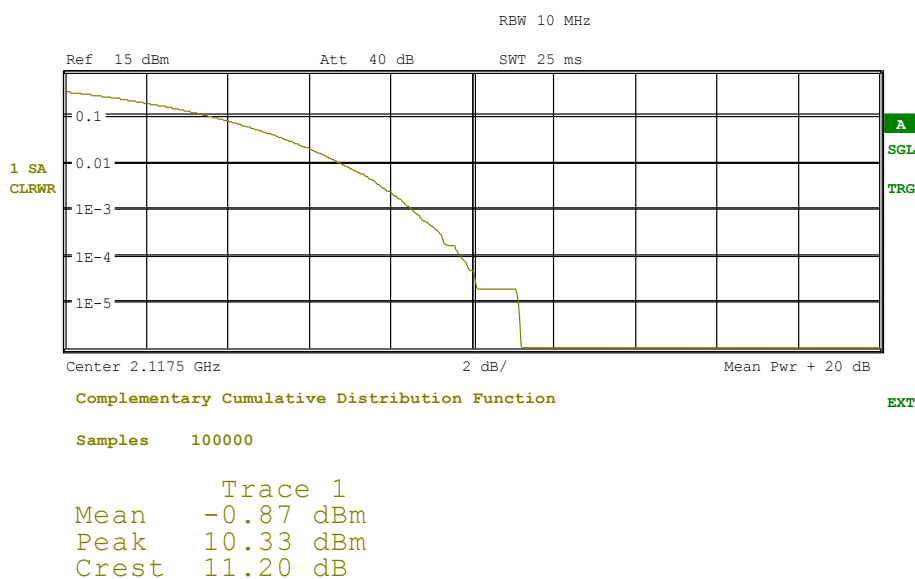


Fig. 9 CCDF of a 3GPP FDD signal

Pressing the softkey activates the analyzer mode with defined settings:

SYSTEM PRESET		
After PRESET the following user-specific settings are restored, thus retaining the adaptation to the DUT: Reference Level + Rev 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

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

Level parameters  
 RBW  
 NO OF SAMPLES

Starting from these settings, the R&S Analyzer 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.

```
Remote: CONF:WCDP:MEAS CCDF
        or
        CALC:STAT:CCDF ON
```

```
Query of results: CALC:MARK:X?
                  CALC:STAT:RES? MEAN | PEAK | CFAC | ALL
```

### APD

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

```
Remote: ALC:STAT:APD ON
```

### CCDF

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

```
Remote: CALC:STAT:CCDF ON
```

### PERCENT MARKER

If the CCDF function is active, the *PERCENT MARKER* softkey allows marker 1 to be positioned by entering a probability value. Thus, the power that is exceeded with a specified probability can be determined very easily.

If marker 1 is in the switched-off state, it will be switched on automatically.

```
Remote: CALC:MARK:Y:PERC 0...100%
```

### NO OF SAMPLES

*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 since the resolution bandwidth directly influences the sampling rate.

```
Remote: CALC:STAT:NSAM <value>
```

## SCALING

The *SCALING* softkey opens a submenu that allows the scaling parameters for both the x axis and y axis to be changed.

X-AXIS REF LEVEL
X-AXIS RANGE
Y-UNIT %/ABS
Y-AXIS MAX VALUE
Y-AXIS MIN VALUE
ADJUST SETTINGS
DEFAULT SETTINGS

### X-AXIS REF LEVEL

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 because the x axis is scaled relative to the *MEAN POWER* measured.

Remote: `CALC:STAT:SCAL:X:RLEV <value>`

### X-AXIS RANGE

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*.

Remote: `CALC:STAT:SCAL:X:RANG <value>`

### Y-UNIT %/ABS

The softkey *Y-UNIT %/ABS* defines the scaling type on the y-axis. The default case are the absolute probability. This can be changed to percent values. The softkeys *Y-AXIS MIN* and *Y-AXIS MAX* are using values based on the *Y-UNIT* setting.

Remote: `CALC:STAT:SCAL:Y:UNIT PCT | ABS`

The 0.1 %, 1 % and 10 % value from the *CCDF* measurement are shown in the bottom screen half. Those values can also queried via remote.

Remote: `CALC:STAT:CCDF:X? P0_1 | P1 | P10`

### Y-AXIS MAX 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.

Since the y axis scaling has a logarithmic axis, the distance between the max and min values must be at least one decade.

Remote: `CALC:STAT:SCAL:Y:UPP <value>`

**Y-AXIS MIN VALUE**

The *Y-AXIS MIN VALUE* softkey defines the lower limit of the displayed probability range.

Since the y axis scaling has a logarithmic axis, the distance between the max and min values must be at least one decade. Valid values are in the range  $0 < \text{value} < 1$ .

Remote: CALC:STAT:SCAL:Y:LOW <value>

**ADJUST SETTINGS**

See below

**DEFAULT SETTINGS**

The *DEFAULT SETTINGS* softkey resets the x and y axis scales 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

Remote: CALC:STAT:PRES

**ADJUST REF LVL**

The *ADJUST REF LVL* softkey adjusts the reference level to get an optimized sensitivity. In opposite to the *ADJUST SETTINGS* softkey, only the reference level is changed all other setting parameters are kept.

Remote: CALC:STAT:PRES:RLEV

**ADJUST SETTINGS**

The *ADJUST SETTINGS* softkey optimizes the level settings of the R&S 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.

Remote: CALC:STAT:SCAL:AUTO ONCE

**CONT MEAS**

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").

Remote: INIT:CONT ON;  
INIT:IMM



**SINGLE MEAS**

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.

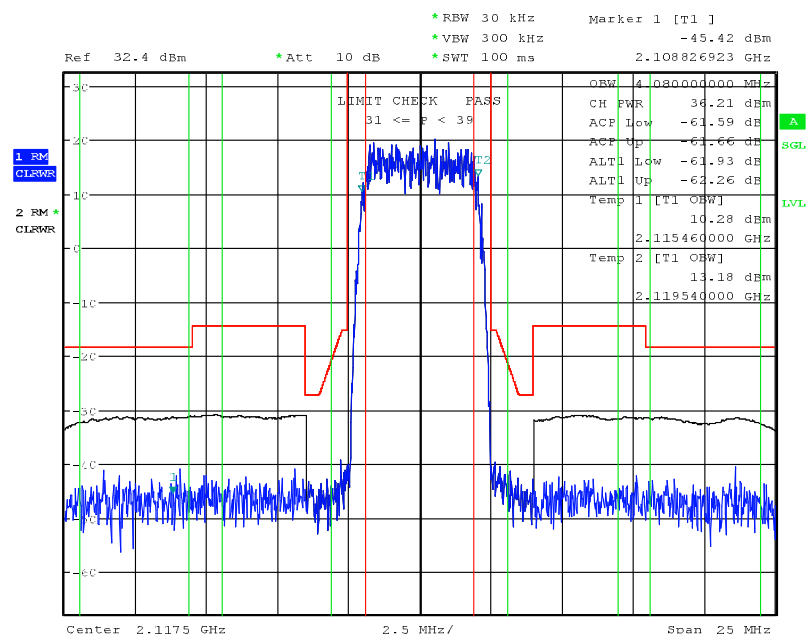
```
Remote: INIT:CONT OFF;
        INIT:IMM
```

**6.8 RF Combination Measurement**

The *RF COMBI* softkey activates the RF combination measurement of adjacent channel leakage error measurement (ACLR), spectrum emission mask measurement (SEM) and occupied bandwidth measurement (OBW).

The ACLR and OBW are measured on trace 1 from which the SEM trace 2 is derived with integration method.

The advantage of the RF COMBI measurement is that all RF results are measured with a single measurement process. This measurement is faster than the three single measurements.



**Fig. 10 Measurement of the RF combination measurement**

The softkey enables SPECTRUM mode with defined settings:

The following user-specific settings are not modified on the first access following presetting	
Level parameters Center Frequency + Frequency Offset All trigger settings	
CHAN PWR / ACP	CP / ACP ON (TRACE 1)
CP / ACP STANDARD	W-CDMA 3GPP REV

CP / ACP CONFIG	NO. OF ADJ CHAN	2
SPAN		25,5 MHz
DETECTOR		RMS
BW	RBW MANUAL	30 kHz
BW	SWEEP TIME MANUAL	100 ms
OCC BW	ACTIVE ON TRACE 1	
SEM	ACTIVE ON TRACE 2	

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement:

Level parameters  
 RBW, VBW  
 Sweep time  
 SPAN  
 NO OF ADJ. CHANNELS

Remote: CONF:WCDP:BTS:MEAS RFC

The softkeys and IEC/IEEE bus commands are as in the single measurements ACRL, SEM and OBW. The SEM trace can be queried from TRACE2.

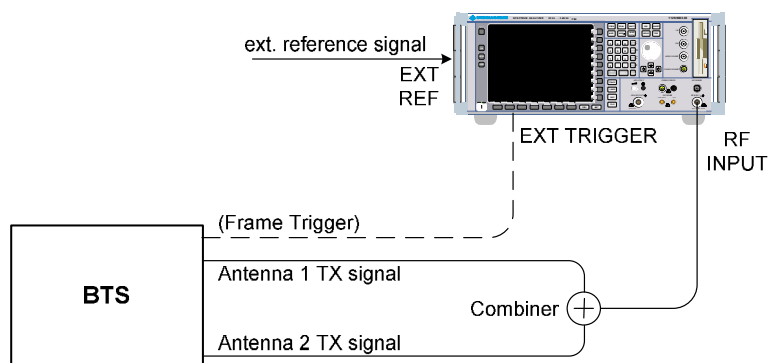
Remote: CONF:WCDP:BTS:MEAS RFC

## 6.9 Time Alignment Error Measurement

EDIT CARR TABLE
INSERT LINE
DELETE LINE
LOAD CARR TABLE
SAVE CARR TABLE
DELETE CARR TABLE
NEXT CARRIERS
PREVIOUS CARRIERS
PREVIOUS CARRIERS

The *TIME ALIGN ERROR* softkey activates the time alignment error (TAE) measurement. This mode is used to measure the timing difference between signals on different antennas in a base station and different base stations. This measurement is required by the standard for Tx diversity and MIMO signals. It can be performed for the two transmitter branches of a BTS as well as for the transmit signals of multiple base stations on different transmit frequencies.

For measuring the time alignment error between the two antennas of a BTS, the antenna signals of the two BTS transmitter branches are fed to the analyzer via a combiner. The two antennas must provide each a common pilot channel, i.e. P-CPICH for antenna 1 and P-CPICH or S-CPICH for antenna 2. The figure below illustrates the test setup.



**Fig. 11 Setup for Time Alignment measurement**

For measuring the time alignment error between transmit signals from multiple base stations, all of the signals must be superimposed in a similar way prior to feeding them into the spectrum analyzer's RF input. The signals from the different base stations can have, respectively, one or both of the transmit antennas. Here too, all of the signals on all of the antennas to be tested must provide a common pilot channel: P-CPICH for all signals on antenna 1, P-CPICH or S-CPICH for signals on antenna 2. The number of base stations and the transmit frequency of the base stations can be input using a table.

The FFT trace shown in the upper area of Fig. 12 provides an overview of the spectrum of the signal present at the RF input. The bandwidth of the displayed signal is dependent on the number of base stations set in the table.

In the lower area of Fig. 13, the results from the TAE measurement are output:

Antenna 1 of the BTS is at the currently set center frequency and serves as the reference antenna. All of the measured time offsets for the antennas and base stations are referenced to this antenna. Accordingly, the time alignment error shown for Ant 1 of Carrier 0 is always equal to 0.0. The status following this value indicates whether it was possible to synchronize to the antenna's signal.

If the measurement is performed for the signals from both transmit antennas of a BTS, then Ant 2 for Carrier 0 indicates the offset of the signal on antenna 2 of the BTS in comparison to the signal on antenna 1 of the same carrier. This offset represents the time alignment error between the two antennas. The status following this value indicates whether it was possible to synchronize to the signal from antenna 2.

If the measurement is performed for the signals from different antennas of multiple base stations on different frequencies, the entry for the respective antenna of the carrier of interest indicates the time offset for the signal with respect to the reference antenna. This time offset is the signal's time alignment error with respect to the reference antenna. If the time alignment error between the two antennas of a BTS is to be measured as part of the test for multiple base stations, the offsets for this BTS that are output for antenna 1 and antenna 2 must be subtracted from one another. For each antenna, a sync status is indicated after the offset.

The measurement can be performed for base station signals on different transmit frequencies for up to 21 signals. In this case, output of the time offsets is distributed across multiple pages. An overall status above the first outputs shows the combination of the statuses of all antenna or BTS signals. The overall status is SYNC OK only if the signals for all of the antennas for all of the base stations set in the table are showing SYNC OK.

A processing display is updated in the top right corner of screen B. The measurement is complete when a value of 100 % is displayed here.

The maximum number of channels that can be set in the table depends on the analyzer type:

The R&S FSU and R&S FSP only allow measurement of the time alignment error between the two antennas of a BTS.

Without the option B72 (I/Q bandwidth extension), the R&S FSQ allows measurement for up to five base stations or base stations which are separated by a maximum of  $\pm 10$  MHz from the set center frequency. The time alignment error of both transmit antennas of each base station is measured with respect to the reference antenna.

If the R&S FSQ is equipped with the option B72, it is possible to measure up to 21 base stations or base stations which are separated by a maximum of  $\pm 55$  MHz from the set center frequency. As before, the time alignment error for both transmit antennas is measured with respect to the reference antenna.

The following figure shows a signal with 15 base stations and the measured time alignment errors of the antennas:

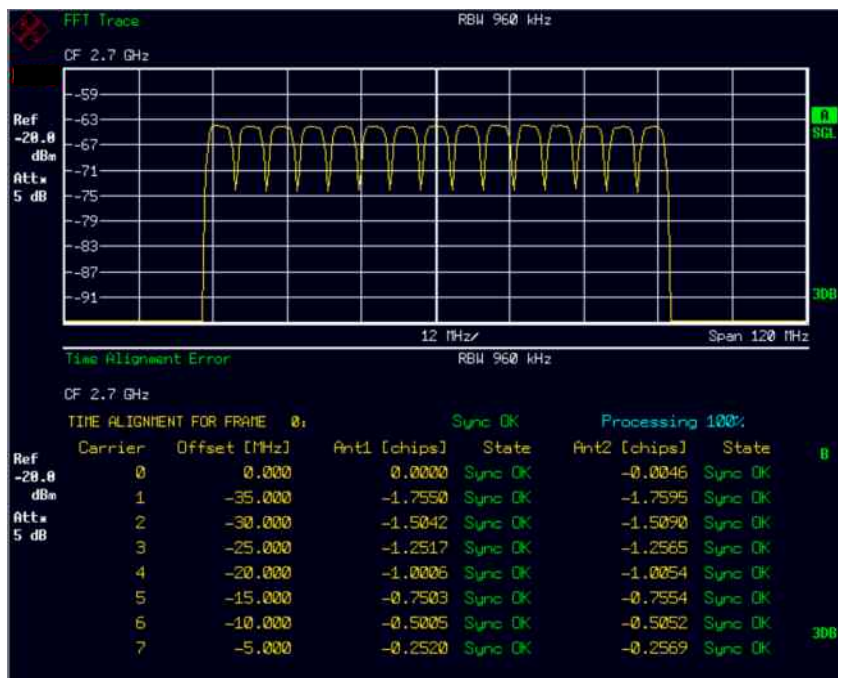


Fig. 12 Time Alignment Error measurement result display

```
Remote CONF:WCDP:BTS:MEAS TAER
Query of results CALC:MARK:FUNC:TAER:RES? TAER
STATUS:QUESTIONABLE:SYNC?
```

For each BTS to be tested, the scrambling code, CPICH number on antenna 2 and CPICH pattern on antenna 2 parameters must be known in order to enable synchronization to the signal for this antenna. If the user switches from CDP measurements to time alignment measurement, these parameters are transferred from the CDP measurement to the TAE: The TAE measurement begins by measuring the offset between the two antennas of a BTS. The scrambling code for this BTS is the same which was used previously for measurement in the CDP. For the CPICH on antenna 2, the code number and the pattern are transferred if the CPICH USER DEF softkey was activated in the CDP. If one of the parameters for the BTS is to be modified or more than one BTS tested (for R&S FSQ only), then this can be handled using the following table:

### EDIT CARR TABLE

The EDIT CARR TABLE softkey opens a table in which it is possible to input the necessary parameters for each of the base stations to be tested:

TIME ALIGNMENT ERROR CARRIER TABLE						
Carrier	Frequency	Scrambling Code	Antenna 1		Antenna 2	
	Offset		CPICH #	Pattern	CPICH #	Pattern
Ref	2.7000GHz	0	0	Pattern 1	0	Pattern 2
1	-35.0MHz	0	0	Pattern 1	0	Pattern 2
2	-30.0MHz	0	0	Pattern 1	0	Pattern 2
3	-25.0MHz	0	0	Pattern 1	0	Pattern 2
4	-20.0MHz	0	0	Pattern 1	0	Pattern 2
5	-15.0MHz	0	0	Pattern 1	0	Pattern 2
6	-10.0MHz	0	0	Pattern 1	0	Pattern 2
7	-5.0MHz	0	0	Pattern 1	0	Pattern 2
8	5.0MHz	0	0	Pattern 1	0	Pattern 2
9	10.0MHz	0	0	Pattern 1	0	Pattern 2
10	15.0MHz	0	0	Pattern 1	0	Pattern 2
11	20.0MHz	0	0	Pattern 1	0	Pattern 2
12	25.0MHz	0	0	Pattern 1	0	Pattern 2
13	30.0MHz	0	0	Pattern 1	0	Pattern 2
14	35.0MHz	0	0	Pattern 1	0	Pattern 2

Fig. 13 results from the TAE measurement

The BTS indicated under Ref is the one contained in the default state in the table, is measurable with every instrument and whose antenna 1 represents the reference antenna for the offset computation. More base stations than this reference base station can be entered in the table only for the R&S FSQ. Changes to the parameters for individual base stations and antennas can be made directly in the table.

### INSERT LINE

For the R&S FSQ, base stations can be added using the *INSERT LINE* softkey for computation of the time alignment error. The entry is added at the current cursor position (if possible). For an inserted BTS, a frequency offset with respect to the previous BTS of 5 MHz is always assumed by default and entered. This frequency offset can be modified subsequently. The maximum frequency offset which an added BTS can have with respect to the previous one is determined from the available bandwidth of the analyzer: Without the option B72, a maximum bandwidth of 30 MHz is available. In other words, the maximum positive and negative frequency offset which a base station can have from the reference is 10 MHz. With the option B72, a maximum

of 120 MHz is available. The maximum positive and negative frequency offset here is 55 MHz. The minimum spacing between two base stations is not restricted by the software. The scrambling code, CPICH code number and the CPICH pattern for antenna 2 can be entered separately for each BTS in addition to the frequency offset. If NONE is entered for a pattern, this antenna is considered to be unused. The time alignment error of this antenna is not measured and its status does not enter into the overall status for the overall signal.

Based on the maximum spacing for the base stations set in the table, the analyzer computes the necessary bandwidth and sampling rate. The smallest possible bandwidth and sampling rate are always used.

#### **DELETE LINE**

The *DELETE LINE* softkey is used with the R&S FSQ to delete the BTS which is currently located at the cursor position.

#### **LOAD CARR TABLE**

The *LOAD CARR TABLE* softkey can be used to load a previously saved table and use it as the basis for the measurement. When this softkey is pressed, a browser window opens up with all of the available tables.

#### **SAVE CARR TABLE**

Pressing the *SAVE CARR TABLE* softkey saves the currently active table under a user-defined name. This table can then be reloaded at a later point in time.

#### **DELETE CARR TABLE**

The *DELETE CARR TABLE* softkey can be used to delete any desired saved table. When this softkey is pressed, a browser menu opens up with all of the saved tables.

#### **NEXT CARRIERS**

The *NEXT CARRIERS* softkey can be used with the R&S FSQ to scroll through the result output. This softkey is available only if the table size exceeds the capacity of screen B.

#### **PREVIOUS CARRIERS**

The *PREVIOUS CARRIERS* softkey can be used with the R&S FSQ to scroll through the result output. This softkey is available only if the table size exceeds the capacity of screen B.

#### **ADJUST REF LVL**

The *ADJUST REF LVL* softkey allows execution of an auto-level routine in the time alignment error measurement. Note: For the auto-level routine, the bandwidth displayed in screen A is always used as the basis. If the number of base stations actually present in the signal exceeds this bandwidth, the routine can produce errors under certain circumstances. If such a case occurs, the number of entries in the table must be corrected.

Remote: SENS:POW:ACH:PRES:RLEV

**INVERT Q ON / OFF**

The *INVERT Q ON / OFF* softkey inverts the sign of the Q component of the signal. In the default setting, the softkey is deactivated.

Remote: SENS:CDP:QINV OFF | ON

**SIDE BAND NORM / IN**

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

**NORM** The normal position allows the measurement of RF signals from the base station.

**INV** The inverted position is useful for measurements on IF modules or components in the case of spectral inversion.

The default setting is *NORM*.

A more detailed description of this softkey can be found in the *SETTINGS* hotkey description.

Remote: SENS:CDP:SBAN NORM | INV

## 6.10 Code Domain Measurements on 3GPP FDD Signals

Application Firmware FS-K72/K74/K74+ provides the peak code domain error measurement and composite EVM specified by the 3GPP standard as well as the code domain power measurement and code domain error measurement of assigned and unassigned codes and a display of the composite constellation diagram of the entire signal. In addition, the symbols demodulated in a slot, their power, and the determined bits or the symbol EVM can be displayed for an active channel.

A signal section of approx. 20 ms is recorded for analysis and then searched through to find the start of a 3GPP FDD frame. If a frame start is found in the signal, CDP analysis is performed for a complete frame starting from slot 0.

Application firmware FS-K72/K74/K74+ offers two different ways of representing the code domain power measurement:

- Representation of all code channels
  - Option FS-K72/K74/K74+ 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 (512). Code channels with a lower spreading factor occupy correspondingly more channels of the highest code class. The power of a code channel is always measured according to its symbol rate. 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 512 at the respective code position.
  - To simplify identification, used and unused channels are displayed in different colors. Used channels are yellow and unused channels blue.
  - The measured power always refers to one slot. The time reference for the start of a slot is the CIPCH slot. If the signal contains channels with timing offsets, the start of a



slot of the channel may be different from the CPICH slot start. This leads to the power of the bar graphs normally being averaged over two adjacent slots in such cases. The power shown in the bar graphs thus does not necessarily correspond to the slot power of the channel the bar graph belongs to. If channels with a timing offset contain a power control circuit, the channel-power-versus-time display (slot spacing, see *POWER VS SLOT*) should preferably be used for power measurements (power control).

- Representation of channel power versus slots of a 3GPP FDD signal frame  
In this case, the power of a selectable code channel is indicated versus a frame. The power is always measured within one slot (PCG) of the selected channel. Power control is assumed to take time at the start of the pilot symbols of the previous slots.

If code channels contain a timing offset, the start of a specific slot of the channel differs from the start of the reference channel (CPICH). Timing offsets, counted from the start of a 3GPP FDD frame, can be as long as one complete frame. The display shows the relationship: The grid of the power versus slot diagram represents the CPICH slots. The bar graphs, containing the slot power information, are plotted shifted by the timing offset. Thus, the timing offset of the channels can directly be read from the diagram.

The code domain error is displayed analogously to code domain power at a spreading factor of 512 in a bar graph diagram.

For all measurements performed in a slot of a selected channel (bits, symbols, symbol power, EVM), the actual slot spacing of the channel is taken as a basis.

The composite EVM, peak code domain error and composite constellation measurements are always referenced to the total signal.

For code domain power (CDP) measurements, the display is operated in the *SPLIT SCREEN* mode. Only those display modes showing the code domain power of all channels (*CODE PWR RELATIVE*, *CODE PWR ABSOLUTE*, *CHANNEL TABLE*) are permitted in the upper part of the screen; all other display modes are assigned to the lower part of the screen.

FS-K72/K74/K74+ expects the following synchronization channels for the code domain power measurements:

- Primary common control physical channel (PCCPCH). This channel must always be contained in the signal.
- Primary synchronization channel (PSCH).
- Secondary synchronization channel (SSCH).
- Common pilot channel (CPICH). This channel is optional. If it is not contained in the signal configuration, the firmware application FS-K72/K74/K74+ must be switched to SYNC TYPE SCH (see softkeys).

There are two modes for CDP analysis: *CODE CHAN AUTOSEARCH* and *CODE CHAN PREDEFINED*. R&S FS-K72 and R&S FS-K74/K74+ differ in both modes:

- When operated in *CODE CHAN AUTOSEARCH* mode, R&S FS-K72 performs an automatic search for active channels (DPCH) throughout the entire code domain. The search is based on the presence of known symbol sequences (pilot sequences) in the despread symbols of a channel. Channels without or with incomplete pilot sequences cannot be detected as being active in this mode. In the *AUTOSEARCH* mode, only the special channel PICH can be detected as active, even though it does not contain pilot



symbols. In the *CODE CHAN PREDEFINED* mode, the user can define the active channels included in the signal via tables that can be selected and edited. For these channels, a channel search by comparison with pilot sequences is no longer performed. In this mode, special channels without pilot sequences (which should be in the code domain however) can therefore be taken into account by R&S FS-K72 for CDP analysis.

- When operated in *CODE CHAN AUTOSEARCH* mode, R&S FS-K74/K74+ performs an automatic search for channels throughout the entire code domain. This search is not based on the presence of any known symbol sequences. Therefore, with R&S FS-K74/K74+, channels of High Speed Data Packet Access (HSDPA) that do not contain pilot sequences can be detected as well. Additionally, the possibility of different modulation types within the channels is taken into account. Thus, with R&S FS-K74, channels with the modulation types QPSK and 16QAM, and with R&S FS-K74+, additionally channels with modulation type 64QAM and the single antenna MIMO configurations MIMO-QPSK and MIMO-16QAM are properly measured as well. In mode *CODE CHAN PREDEFINED*, the channels contained in the signal are considered as predefined analogously to FS-K72. Only the modulation type of each channel will be measured by the firmware application.

### 6.10.1 Display Mode – *RESULTS* hotkey

CODE DOM POWER
COMPOSITE EVM (RMS)
COMPOSITE SIGNAL
POWER VS SLOT
RESULT SUMMARY
COMPOSITE CONST
CODE DOM ERROR
CHANNEL TABLE
POWER VS SYMBOL
SYMBOL CONST
SYMBOL EVM
BITSTREAM
SELECT CHANNEL
FREQ ERR VS SLOT
PHASE DISCONT
SELECT CPICH SLOT
ADJUST REF LVL

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 menu contains more detailed display modes.

The following display modes are available:

- CODE DOM POWER  
Code domain power (screen A).
- COMPOSITE EVM (RMS)  
Square difference between test signal and ideal reference signal at the chip level (screen B).

## Code Domain Measurements on 3GPP FDD Signals

- PEAK CODE DOMAIN ERR  
Projection of the error between the test signal and the ideal reference signal onto the spreading factor of code class 8 and subsequent averaging using the symbols of each slot of the difference signal. The maximum value of all codes is displayed versus the CPICH slot number (screen B).
- POWER VS SLOT  
Power of the selected channel versus all slots of a 3GPP FDD signal frame (screen B).
- RESULT SUMMARY  
Tabular result display (screen B).
- COMPOSITE CONST  
Constellation diagram of descrambled chips (screen B).
- SELECT CHANNEL  
Marking of channel for the following display modes
- *POWER VS SLOT,*  
*RESULT SUMMARY*  
*POWER VS SYMBOL,*  
*SYMBOL CONST,*  
*SYMBOL EVM,*  
*BITSTREAM.*
- ADJUST REF LVL  
Optimum adaptation of the reference level in the instrument to the signal level.
- CODE DOM ERROR  
Projection of the error power between the test signal and the ideal reference signal onto the spreading factor of the highest code class (CC = 9) and subsequent averaging using the symbols of the selected channel slot of the difference signal. The error power is displayed versus all codes of code class 9 (screen A).
- CHANNEL TABLE  
Display of channel occupancy table (screen A).
- POWER VS SYMBOL  
Display of symbol power at the selected slot (screen B)
- SYMBOL CONST  
Display of constellation diagram (screen B).
- SYMBOL EVM  
Display of error vector magnitude diagram (screen B).
- *SYMBOL EVM*  
*SYMBOL Mag Error*  
*SYMBOL Phase Error*
- BITSTREAM  
Display of the determined bits (screen B)

- SELECT CPICH SLOT (submenu SELECT CPICH SLOT)  
Selection of CPICH SLOTS in a frame for display of:  
*CODE DOMAIN POWER*  
*PEAK CODE DOMAIN ERROR*  
*RESULT SUMMARY*  
*COMPOSITE CONST,*  
*CODE DOMAIN ERROR POWER*  
*CHANNEL TABLE*  
*POWER VS SYMBOL,*  
*SYMBOL CONST,*  
*SYMBOL EVM,*  
*BITSTREAM*
- *FREQ ERR VS SLOT*  
Display of frequency error versus slot.
- *PHASE DISCONT*  
Display mode of phase discontinuity versus slot.

The most important measurement settings which form the basis of the display modes are summarized above the diagram:

Code Power Relative	SR 30 ksp
	Chan Code 69
CF 2.11 GHz	CPICH Slot 4 Chan Slot 11

**Fig. 14** Indication of measurement parameters

The different elements are:

1st column:	Name of selected display mode {empty}	Code Power Relative
	Center frequency of signal:	CF 2.11 GHz
2nd column :	{empty}	
	{empty}	
	CPICH slot number (value of SELECT CPICH SLOT softkey):	CPICH Slot 4
3rd column :	Symbol rate of selected channel	SR 30 ksp
	Spreading code of selected channel	Chan Code 69
	Slot number of selected channel	Chan Slot 11



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)

**CODE DOM POWER**

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 the case of a relative display (**REL**), the power of the channels is referenced to a reference power of the selected slot. The values are specified in dB. In the case of an absolute display (**ABS**), the absolute power values are specified in dBm.

In default mode, the power of the channels is referenced to the CPICH power (**SETTINGS** → **POWER REF** → **CPICH**). This power reference was selected since the total power may vary depending on the slot due to the capability to control the power in the different code channels. In contrast to the variable total power, the power of the CPICH is the same in all slots so that it can form the constant reference for the display. The reference can be switched to total power by selecting **SETTINGS** → **POWER REF** → **TOT**.

The measurement interval for determining the power of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chips referenced to the beginning of the signal frame).

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

- yellow: active channels
- blue: unassigned codes

If the analyzer is equipped with R&S FS-K72 and operated in *CODE CHAN AUTOSEARCH* (automatic channel search mode) mode, a data channel is considered to be active if the pilot symbols as specified by the 3GPP standard are found at the end of each slot. In this mode, channels without pilot symbols are therefore not recognized by R&S FS-K72. An exception to this rule is seen in the special channels PICH and SCCPCH, which can be recognized as active in the automatic search mode although they do not contain pilot symbols. In addition, the channel must exceed a minimum power (see **INACT CHAN THRESHOLD** softkey). In *CODE CHAN PREDEFINED* mode, each data channel that is included in the user defined channel table is considered to be active.

If the analyzer is additionally equipped with R&S FS-K74 or R&S FS-K74+, all channels that meet special quality criteria are recognized as active. The detection of channels does not depend on pilot sequences or other previously known symbol sequences in R&S FS-K74/K74+. An active channel merely has to exceed a minimum power (see **INACT CHAN THRESHOLD** softkey).

In the case of an analyzer equipped with R&S FS-K72, the effect of missing or incomplete pilot symbols in a data channel can be shown in the CDP diagram by operating in analyzer mode *CODE CHANNEL AUTOSEARCH*. At the points of the CDP diagram where the channel should appear due to its spreading code, a power value higher than the noise occurs. The associated bars, however, are displayed in blue (black in the figure). In such a case, the channel should be checked for its pilot symbols. In *CODE CHANNEL PREDEFINED* mode, the channel should be included in the user-defined channel table. If the analyzer is additionally equipped with R&S FS-K74 or R&S FS-K74+, channels without pilot sequences are also recognized as active if they meet special quality criteria.

The following figures show how the CDP is displayed when all active channels contained in the signal have been found (analyzer equipped with R&S FS-K72).

Code Domain Measurements on 3GPP FDD Signals

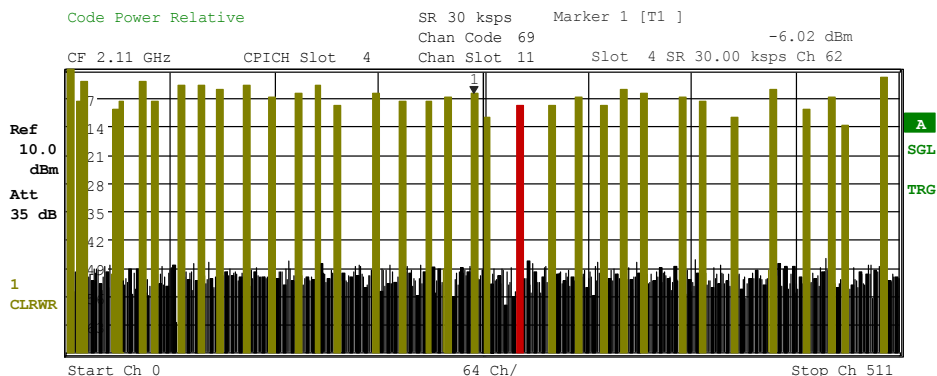


Fig. 15 CDP diagram with all channels recognized as active

In the CDP diagram, the effect of missing or incomplete pilot symbols in a data channel can be shown in analyzer mode *CODE CHANNEL AUTOSEARCH*. At the points of the CDP diagram where the channel should appear due to its spreading code, a power value higher than the noise occurs. The associated bars, however, are displayed in blue. In such a case, the channel should be checked for its pilot symbols. In *CODE CHANNEL PREDEFINED* mode, the channel should be included in the user-defined channel table.

With the R&S FS-K74 or R&S FS-K74+ options enabled, channels with missing pilot sequences are also detected as being active if they meet specific quality criteria.

The following figures show the CDP diagram if one of the channels was not recognized as active, e.g. due to missing pilot symbols (only R&S FS-K72 is installed on the instrument).

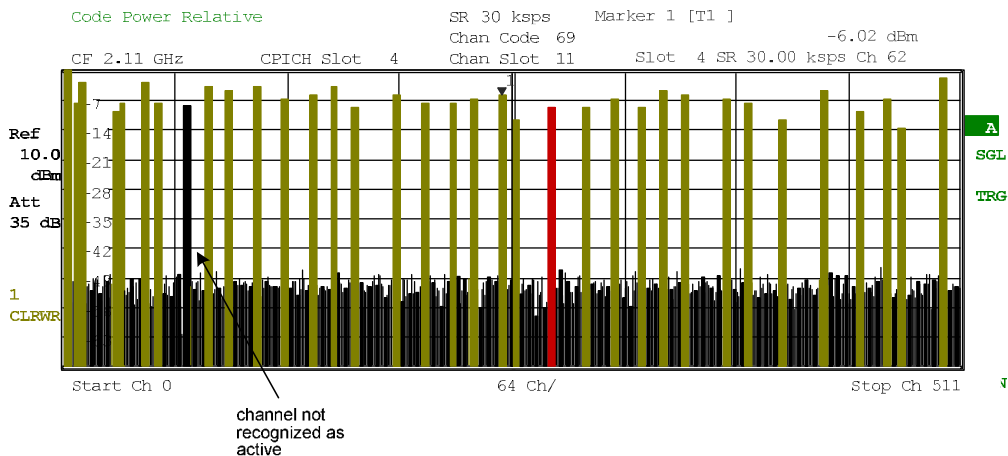


Fig. 16 CDP diagram with one of the channels recognized as inactive

If some of the DPCH contains incorrect pilot symbols, these channels are marked with the color green, and a message "INCORRECT PILOT" is displayed. The incorrect pilot symbol can be determined by using the *POWER VS SLOT* and the *BITSTREAM* display.

Code Domain Measurements on 3GPP FDD Signals

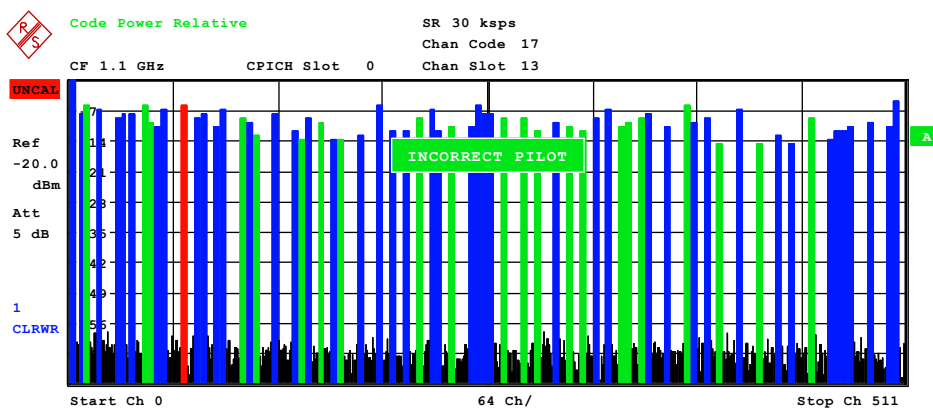


Fig. 17 CDP diagram with some channels including an incorrect pilot sequence

In the case of an analyzer equipped with R&S FS-K74 or R&S FS-K74+, channels without pilot symbols, e.g. channels of type HS-PDSCH, are recognized as active. The following figure shows test model 5 with eight HS-PDSCH channels and 30 DPCH channels.

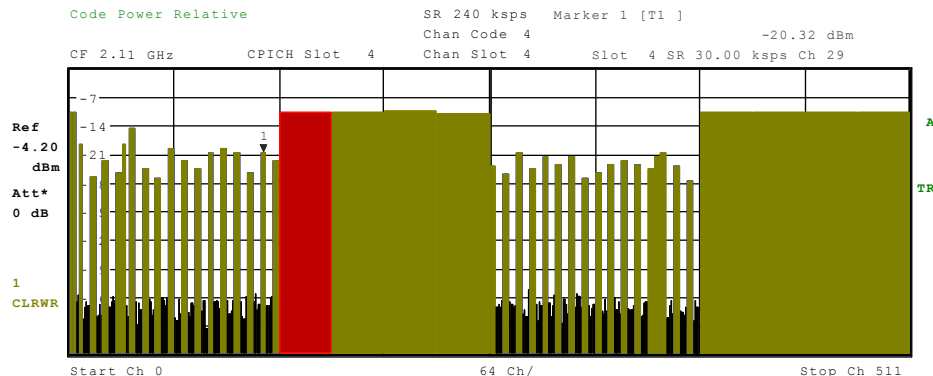


Fig. 18 CDP diagram for test model 5

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 entire channel is marked if it is an assigned channel; only the entered code is marked in the case of an unassigned code.

Selecting other display modes (e.g. *SYMBOL CONSTELLATION*) for unassigned codes is possible but irrelevant since the results are not valid.

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

```
Query of results: TRAC1:DATA? TRACE1 | PWCD | CTAB | CWCD
```

**COMPOSITE EVM (RMS)**

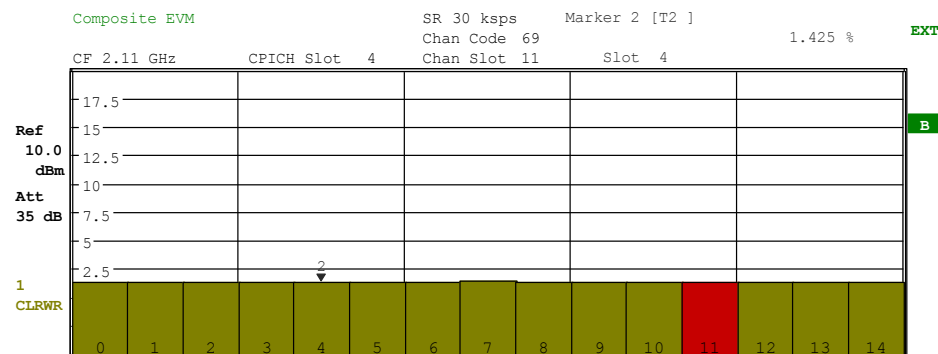
The *COMPOSITE EVM RMS* softkey selects the root mean square composite EVM (modulation accuracy) display mode according to the 3GPP specification. During the composite EVM measurement, the square root of the mean squared errors between the real and imaginary components of the received signal and an ideal reference signal (EVM referenced to the total signal) is determined. Thus, composite EVM is a measurement of the composite signal.

$$EVM_{RMS} = \sqrt{\frac{\sum_{n=0}^N |s_n - x_n|^2}{\sum_{n=0}^{N-1} |x_n|^2}} \cdot 100\% \quad | \quad N = 2560$$

- where:  $EVM_{RMS}$     root mean square of the vector error of the composite signal
- $s_n$             complex chip value of received signal
- $x_n$             complex chip value of reference signal
- $n$               index number for mean power calculation of received and reference signal.
- $N$               number of chips at each CPICH slot

The measurement result consists of one composite EVM measurement value per slot. In this case, the measurement interval is the slot spacing of the CPICH (timing offset of 0 chips referenced to the beginning of the frame).

Only the channels recognized as active are used to generate the ideal reference signal. If an assigned channel is not recognized as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal and the composite EVM is very high (see figures).



**Fig. 19 Composite EVM - all channels are recognized as active**

Code Domain Measurements on 3GPP FDD Signals

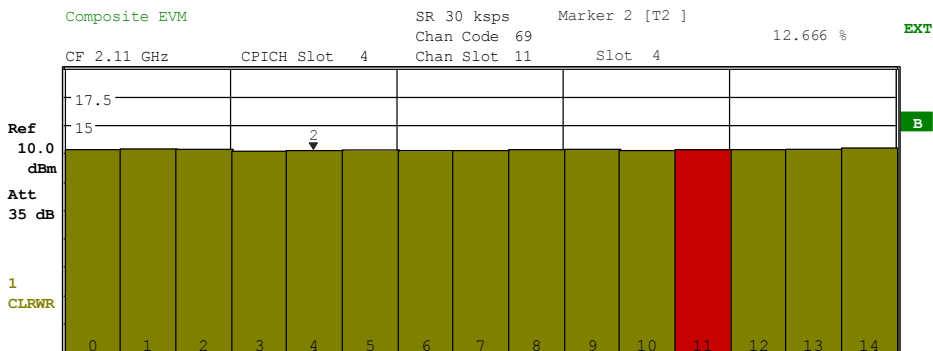


Fig. 20 Composite EVM - one channel is recognized as inactive

```
Remote: CALC2:FEED "XTIM:CDP:MACC"
Query of results: TRAC:DATA? TRACE2
```

**COMPOSITE SIGNAL**

- PEAK CODE DOMAIN ERR
- EVM VS CHIP
- MAG ERROR VS CHIP
- PHASE ERROR VS CHIP
- COMPOSITE CONST

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

**PEAK CODE DOMAIN ERR:**

Projection of the error between the received signal and the ideal reference signal onto the spreading factor of code class 8 and subsequent averaging using the symbols of each slot of the difference signal. The maximum value of all codes is displayed versus the CPICH slot number [screen B].

**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 ERROR 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) [screen B].

**PEAK CODE DOMAIN ERR**

The *PEAK CODE DOMAIN ERR* softkey selects the peak code domain error display mode.



Code Domain Measurements on 3GPP FDD Signals

In line with the 3GPP specifications, the error between the measurement signal and the ideal reference signal is projected onto the various spreading factors. The desired spreading factor is selected by a table which is opened when the softkey is activated.

The result consists of one numerical value per slot for the peak code domain error value. The measurement interval is the slot spacing of the CPICH (timing offset of 0 chips referenced to the beginning of the 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 as active since pilot symbols are missing or incomplete, the difference between the measurement and reference signal is very high. FS-K72/K74/K74+ consequently indicates a peak code domain error that is too high (see Fig. 21 and Fig. 22).

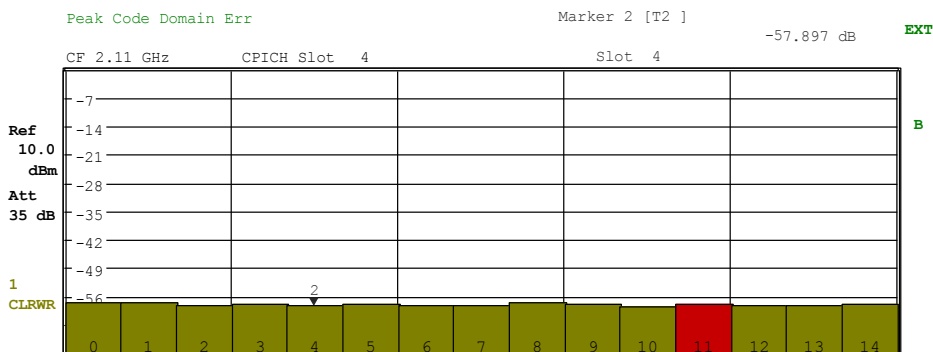


Fig. 21 Peak domain error - all channels are recognized as active

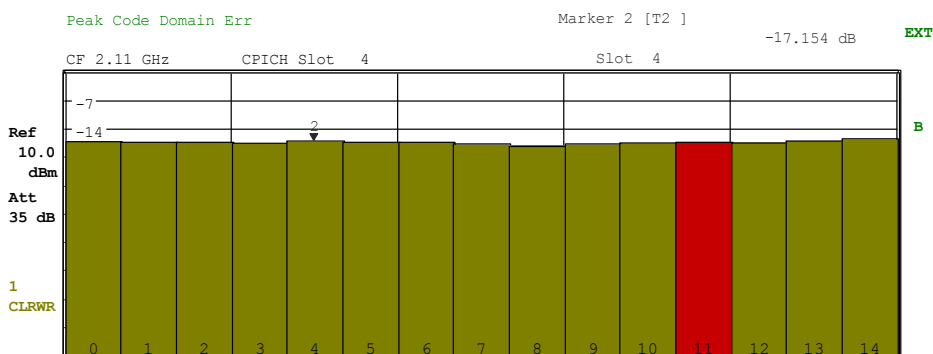


Fig. 22 Peak domain error - one channel is not recognized as active

Remote: CALC2:FEED "XTIM:CDP:ERR:PCD"  
 Query of results: TRAC:DATA? TRACE2

EVM VS CHIP

The EVM VS CHIP softkey activates the Error Vector Magnitude (EVM) versus chip display. The EVM is displayed for all chips of the selected slot. The selected slot can be varied by the SELECT CPICH SLOT softkey. The EVM is calculated by the root of the square difference of received signal and reference signal. The reference signal is estimated from the channel configuration of all active channels. The EVM is related to the square root of the mean power of reference signal and given in percent.

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

- Mit:
- $EVM_k$  - 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

The value are displayed as trace in screen B (Fig. 23)) and can be read by IEC bus command.

```
Remote: CALC1:FEED 'XTIM:CDP:CHIP:EVM'
Query of results: TRAC:DATA? TRACE2
```

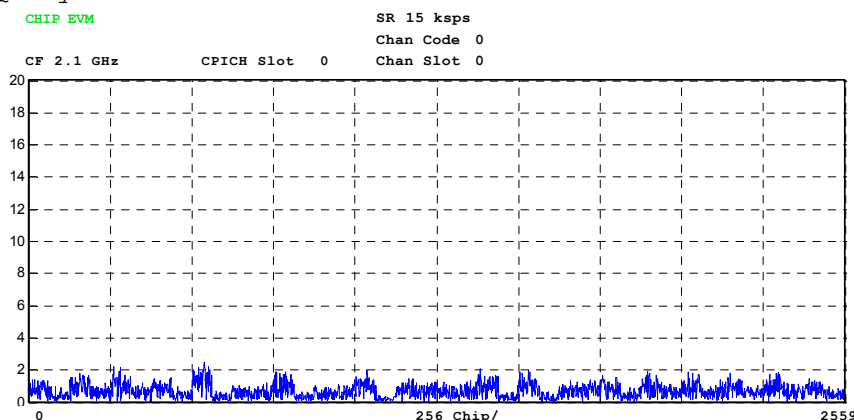


Fig. 23 Display of vector error of the EVM versus chip measurement

### MAG ERROR VS CHIP

The *MAG ERROR VS CHIP* softkey activates the Magnitude Error versus chip display. The magnitude error is displayed for all chips of the selected slot. The selected slot can be varied by the *SELECT CPICH SLOT* softkey. The magnitude error is calculated by the difference of the magnitude of received signal and magnitude of reference signal (Fig. 25). The reference signal is estimated from the channel configuration of .all active channels. The magnitude error is related to the square root of the mean power of reference signal and given in percent.

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

- 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

The value are displayed as trace in screen B (Fig. 24) and can be read by IEC bus command.

Remote: CALC1:FEED 'XTIM:CDP:CHIP:MAGN'

Query of results: TRACe1:DATA? TRACe2

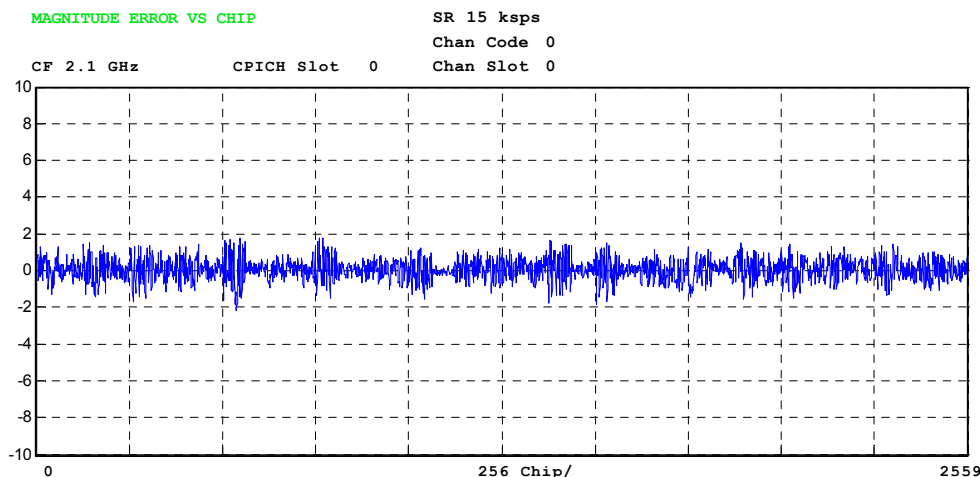


Fig. 24 Display of magnitude error versus chip measurement

**PHASE ERROR VS CHIP**

The PHASE ERROR VS CHIP softkey activates the Phase Error versus chip display. The phase error is displayed for all chips of the selected slot. The selected slot can be varied by the SELECT CPICH SLOT softkey. The phase error is calculated by the difference of the phase of received signal and phase of reference signal Fig. 25. The reference signal is estimated from the channel configuration of .all active channels. The phase error is given in grad in a range of ±180°.

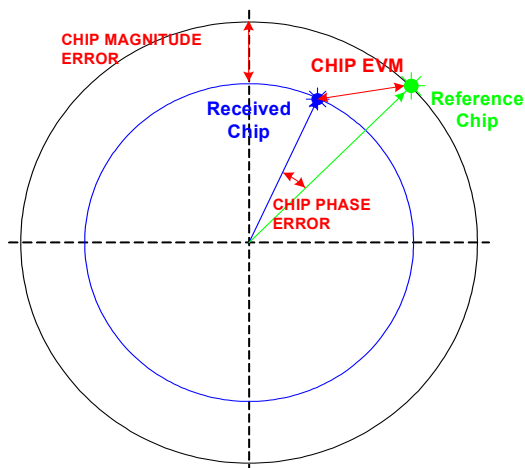


Fig. 25 Schematic of reference signal chip and received signal chip to calculate the magnitude, phase and vector error.

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

where: PHI<sub>k</sub> - 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

The value are displayed in screen B (Fig. 26) and can be read by IEC bus command.

Remote: CALC1:FEED :CALC1:FEED 'XTIM:CDP:CHIP:PHAS'

Query of results: TRAC1:DATA? TRACE2

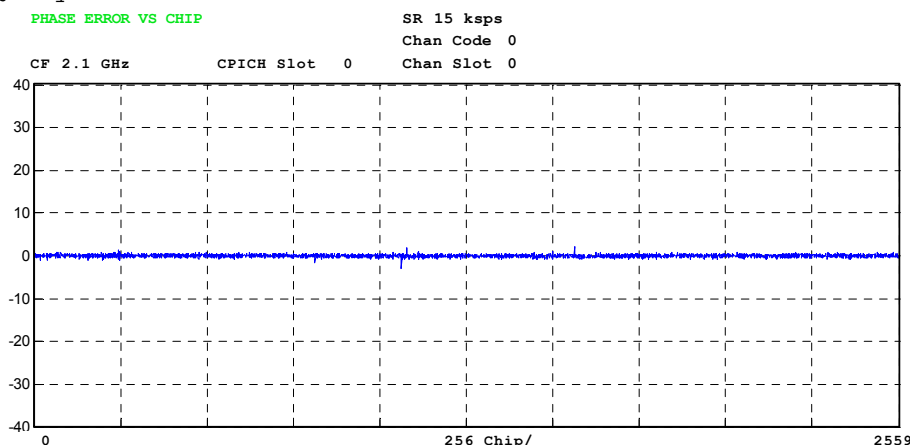


Fig. 26 Display of phase error versus chip

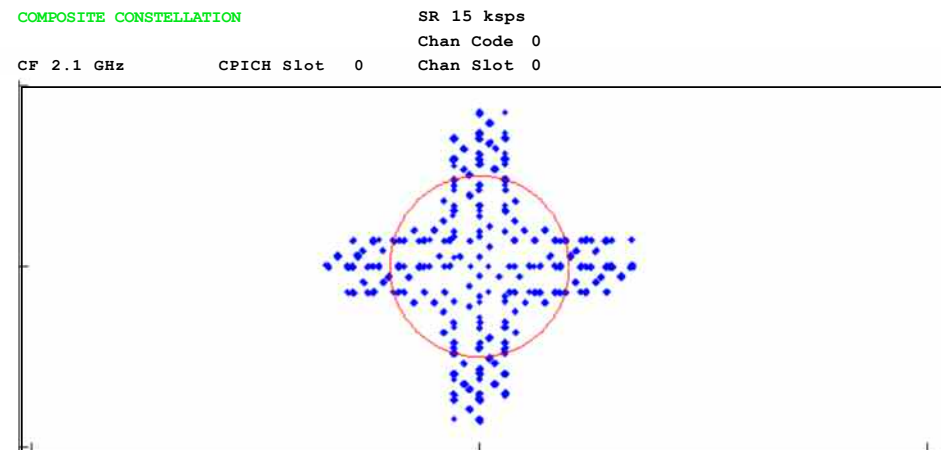
**COMPOSITE CONST**

The *COMPOSITE CONST* softkey displays the constellation diagram for the chips of all channels. The displayed constellation points are normalized with the square root of the total power (Fig. 27).

Remote: CALC1:FEED "XTIM:CDP:COMP:CONS"

Query of results: TRAC1:DATA? TRACE2

Output: List of I/Q values of all chips per slot  
 Format:  $Re_1, Im_1, Re_2, Im_2, \dots, Re_{2560}, Im_{2560}$   
 Unit: [1]  
 Quantity: 2560

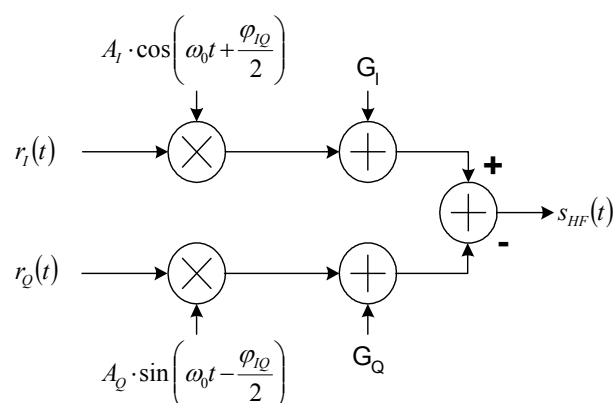


**Fig. 27 Composite Constellation diagram of received signal (scrambled chips)**

### Explanation of displayed IQ impairments

#### *IQ impairment model*

In RF devices including analog mixers such as up-converters, the analog complex baseband signal ( $r(t)=r_I(t)+j*r_Q(t)$ ) is shifted to a real high frequency signal ( $s_{HF}(t)$ ). Each non-ideal complex mixer adds IQ impairments to the baseband signal. Two of them, the IQ offset and the IQ imbalance are estimated by the R&S FS-K72. Both values are given in the Result Summary display. The equations to explain these impairment parameters are described in the following paragraph. 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. 28 Basic model of possible IQ impairment parameters in complex up-converters.**

**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:

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

where:  g	- magnitude of the relative IQ offset
g <sub>I</sub>	- relative IQ offset of the real part
g <sub>Q</sub>	- relative IQ offset of the imaginary part
G <sub>I</sub>	- absolute IQ offset of the real part
G <sub>Q</sub>	- absolute IQ offset of the imaginary part
r(t)	- complex baseband signal (reference signal matching with optimum EVM assuming that AWGN is given)
T	- evaluation time (T=666 μs → 1 slot)
offsetIQ	- 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 baseband signal r(t) is multiplied by a complex analog oscillator with radian frequency  $\omega_0 = 2\pi \cdot f_0$ . The complex signal r(t) can be split into a real part {r<sub>I</sub>(t)} and an imaginary part {r<sub>Q</sub>(t)}. Using this assumption, an ideal complex local oscillator (LO<sub>ideal</sub>) can also be described by two real sinusoidal signals with a phase offset of 90°. These signals are described as cos(ω<sub>0</sub> t) and sin(ω<sub>0</sub> 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<sub>I</sub> and A<sub>Q</sub>) in each path. Moreover, an unwanted phase shift (φ<sub>IQ</sub>) between the real part and the imaginary part of the local oscillator (LO<sub>impairment</sub>) 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:

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

where: A <sub>I</sub>	- amplitude mixer gain of the real part
A <sub>Q</sub>	- amplitude mixer gain of the imaginary part
φ <sub>IQ</sub>	- additional phase shift between real part and imaginary part
imbalance <sub>IQ</sub>	- IQ imbalance parameter

## POWER VS SLOT

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.

Fifteen (15) slots of a WCDMA frame are displayed. When the power is averaged versus the symbols of a slot, the time of the power control is assumed to be at the beginning of the pilot symbols of the previous slot (power group).

The following has to be taken into account:

Due to the timing offset (up to one frame) admissible for the channels, the beginning of slot 0 of the selected channel is shifted with reference to the start of the frame (reference: CPICH slot 0). The timing offset therefore also has to be applied to the power-versus-slot display. To show the correlation between timing offset and CDP analysis in the diagram, the X axis reflects the slot spacing of the channel as well as of the CPICH.

- The grid of the power-versus-slot display reflects the spacing of the CPICH slots. The slots are always labelled at the grid line where the slot in question begins (top labelling of x axis in diagram). The first CPICH slot is always slot 0. The grid and the labels of the grid lines thus do not change.
- Shifted by the timing offset, the power versus channel slots are entered in a bar graph. The slot numbers of the channel are labelled within the bar associated with the slot. The position of the bars in relation to the grid and the slot numbering within the bar vary as a function of the timing offset of the channel selected.

The following figure shows a channel with power control (power decrease of 2 dB for each slot). Since the channel has a timing offset (22528 chips), the display does not start with slot 0 of the channel but is shifted by the timing offset. The slot that is marked red is the selected CPICH slot. As shown in the display, the CPICH slot covers two adjacent slots.

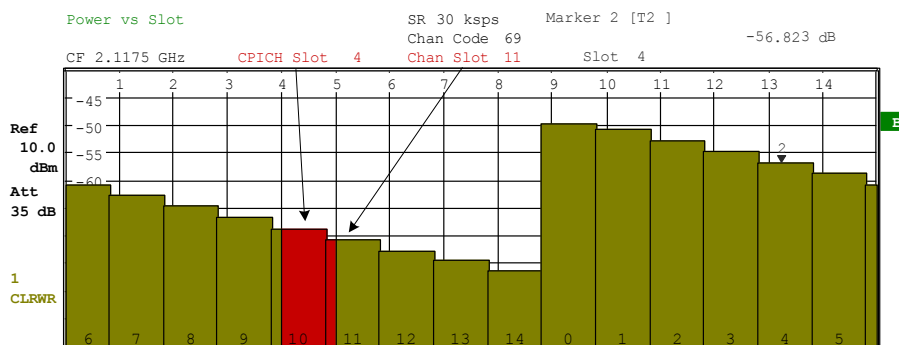


Fig. 29 Power versus slot for a channel with power control (timing offset 22528 chips)

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 CPICH slot number (see *SELECT CPICH SLOT* softkey) and the selected CPICH slot is marked in red. If the channel displayed has a timing offset with respect to the CPICH, the marked slot is usually shifted against the slot grid of the channel, i.e. the red marking of a slot covers two of the bars below. The timing offset can be directly read from the shifting. For more detailed displays, the slot of the channel is selected that starts within the red slot marking (see *CHAN SLOT* entry in the function panels above the diagrams in the figures). Modifying a slot number has the following effects:

Code Domain Measurements on 3GPP FDD Signals

- The CDP diagram in the upper half of the display is updated relative to the entered CPICH slot number.
- Starting from the CPICH slot, all dependent results are calculated for the actual slot of the selected channel. The relevant graphics are updated. The slot of the channel that starts within the CPICH slot displayed in red is considered marked.

If one of the channel slots of a DPCH contains incorrect pilot symbols, these symbols are indicated in the color green (figure below). By selecting this slot by SELECT CPICH Slot, the incorrect pilot symbol can be evaluated in the "Bitstream" display.

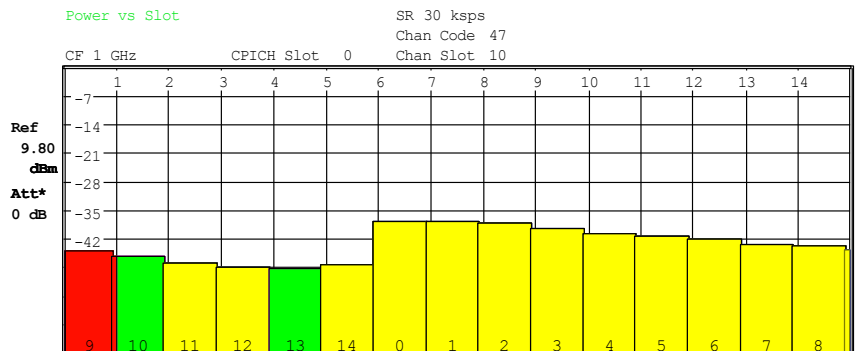


Fig. 30 Power versus slot for a channel with incorrect pilot symbols at channel slots 10 and 13.

Remote: CALC2:FEED "XTIM:CDP:PVSL"  
 Query of results: :TRAC:DATA? TRACE2

RESULT SUMMARY

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

GLOBAL RESULTS FOR FRAME 0:		Carrier Freq Error 402.64 mHz	
Total Power	-24.42 dBm	Trigger to Frame	344.179089 µs
Chip Rate Error	-0.84 ppm	Avg Pow Ina Chan	-58.44 dB
IQ Offs / Imb	0.06 / 0.07 %	Pk CDE (15 ksps)	-49.72 dB
Composite EVM	3.66 %	Avg RCDE (64QAM)	-29.30 dB
Rho	0.99866	No of Active Chan	44
CHANNEL RESULTS		RCDE	-29.34 dB
Symbol Rate	240.00 ksps	Timing Offset	0 Chips
Channel Code	12	Channel Slot No	0
No of Pilot Bits	0	Modulation Type	64QAM
Channel Power Rel	-0.97 dB	Channel Power Abs	-35.57 dBm
Symbol EVM	3.37 % rms	Symbol EVM	7.14 % PK

Fig. 31 Result summary

The upper part contains the results for the total signal:

- Total Power: Outputs the total signal power (average power of total evaluated 3GPP FDD frame).
- CPICH Slot No: Outputs the number of the CPICH slot at which the measurement is performed (see SELECT CPICH SLOT softkey).
- 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



## Code Domain Measurements on 3GPP FDD Signals

FDD signal. The result is valid even if synchronization of the analyzer and signal failed.

- IQ Offs/lmb:** DC offset and I/Q imbalance of signals in %
- 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 specified in the *RESULT SUMMARY*.
- RHO:** Quality parameter rho for every slot.
- Carrier Freq Error:** Outputs the frequency error relative to the center frequency of the analyzer. The absolute frequency error is the sum of the analyzer and DUT frequency error. The specified value is averaged via one slot; the frequency offset of the slot selected under *SELECT CPICH SLOT* applies.

The maximum frequency error that can be compensated is specified in the table below as a function of the sync mode. Transmitter and receiver should be synchronized as far as possible (see chapter 2, Getting Started).

**Table 8 Maximum compensated frequency error**

SYNC TYPE	ANTENNA DIV	Max. Freq. Offset
CPICH	X	5.0 kHz
SCH	OFF	1.6 kHz
SCH	ANT 1	330 Hz
SCH	ANT 2	330 Hz
SYNC TYPE	ANTENNA DIV	Max. Freq. Offset

- Trigger to Frame:** This result outputs the time difference between the beginning of the recorded signal section to the start of the analyzed 3GPP FDD frame. In the case of triggered data collection, this difference is identical with the time difference of frame trigger (+ trigger offset) – frame start. If synchronization of the analyzer and W-CDMA signal fails, the value of Trigger to Frame is not significant.

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

- Pk CDE:** The *PEAK CODE DOMAIN ERROR* measurement specifies a projection of the difference between the test signal and the ideal reference signal onto the selected spreading factor (see *PEAK CODE DOMAIN 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.

## Code Domain Measurements on 3GPP FDD Signals

Avg RCDE (64QAM) :

Average RCDE of the complete frame for all channel slots with 64QAM modulation

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 diagram) are displayed in the lower part of the RESULT SUMMARY.

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

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

No of Pilot Bits: Number of pilot bits of the selected channel.

Chan Pow Rel. / Abs.:

Channel power, relative (referenced to CPICH or total signal power) 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 the symbol level.

RCDE: RELATIVE CODE DOMAIN ERROR for the complete frame of the selected channel.

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

Modulation Type : Modulation type of an HSDPA channel. High speed physical data channels can be modulated with QPSK, 16QAM or 64QAM modulation. In case the base station is operated in single antenna MIMO mode there are two additional modulation types possible: MIMO-QPSK and MIMO-16QAM. The modulation type is measured only if the HSDPA option (K74 or K74+) is installed.

Channel Slot No: The channel slot number is obtained by combining the value of the *SELECT CPICH SLOT* softkey and the channel's timing offset.

```
Remote: CALC2:FEED "XTIM:CDP:ERR:SUMM"
```

```
Query of results: CALC1:MARK1:FUNC:WCDP:RES?
```

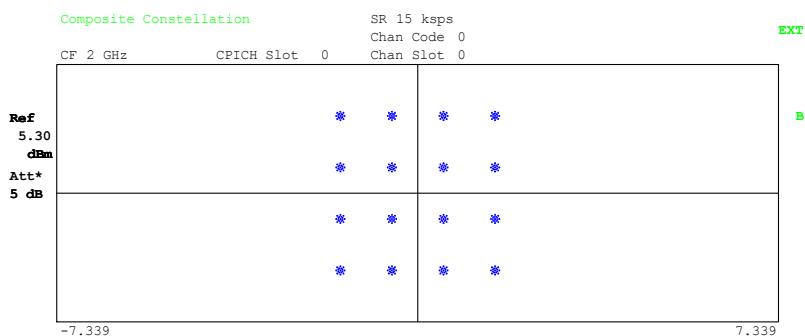
```
PTOT | FERR | TFR | TOFF | MACC | PCD | EVMR |
EVMP | CERR | CSL | SRAT | CHAN | CDP | CDPR |
IQOFF | IQIM | MTyp | RHO | MPIC | RCD: | PSYM |
ACH | ARCD
:TRACE2:DATA? TRACE2
:SENS:CDP:SLOT?
```

## COMPOSITE CONST

Display of constellation diagram for the chips of all channels. The displayed constellation points are normalized with the square root of the total power.

Value range:

$$Z = [0 \dots 2.5] \cdot (\pm 1 \pm j)$$



**Fig. 32** Composite constellation diagram

Remote: CALC1:FEED "XTIM:CDP:COMP:CONS"

Query of results: TRAC1:DATA? TRACE2

Output: List of I/Q values of all chips per slot

Format:  $Re_1, Im_1, Re_2, Im_2, \dots, Re_{2560}, Im_{2560}$

Unit: [1]

Quantity: 2560

## CODE DOM ERROR

The *CODE DOM ERROR* softkey displays the code domain error power (CDEP) versus the code channels of code class 9. The error power is always referenced to the total power.

The code domain error power (CDEP) is calculated by subtracting the received chips ( $chip_{rec}$ ) from a chip-stream of a generated reference signal ( $chip_{ref}$ ). This difference or error signal is despread to all (512) code channels of CC9 ( $Dspr_n$ ). The average power of the error signal of each CC9 code channel is relative to the total power of the selected slot. The measurement interval for determining the CDEP of the channels is a slot in the CPICH (corresponding to a timing offset of 0 chips referenced to the beginning of the signal frame).

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

- yellow: active channels
- blue: unassigned codes

The CDEP is calculated for each channel of code class 9 (CC9). In the case of active or inactive channels, only the color is changed. In contrast to the code domain power measurement, the code domain error power of active channels is not subsumed to a common value.

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. Only the first CC9 code channel of an assigned channel is marked.

Code Domain Measurements on 3GPP FDD Signals

In the case of a correct WCDMA signal, the code domain error power (CDEP) of all CC 9 channels should be equal. The maximum error power of a channel should not be much higher than the average noise.

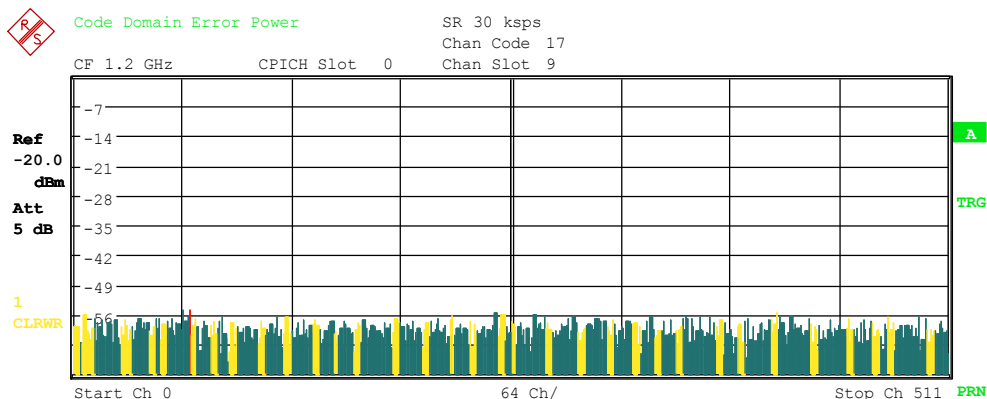


Fig. 33 Code domain error display of a correct WCDMA signal

In the case of an incorrect WCDMA signal, the code domain error power (CDEP) of the affected channel is much higher than the average error power. It can be determined at which code number the error occurs.

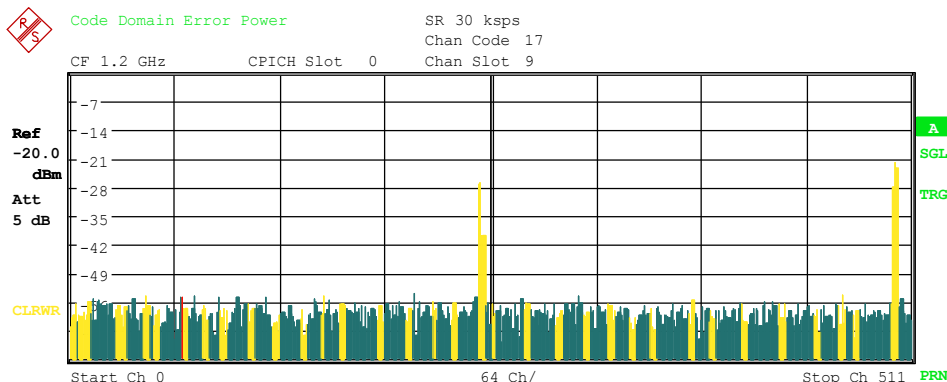


Fig. 34 Code domain error display of an incorrect WCDMA signal

```
Remote: CALC1:FEED "XPOW:CDEP"
Query of results: TRACe<1>:DATA? TRACe1
Query of result: TRACe<1>:DATA? TRACe2
```

Output: CDEP list of each CC9 channel  
Format: <code class><sub>1</sub>, <code number><sub>1</sub>, <CDEP><sub>1</sub>, <channel flag><sub>1</sub>, <code class><sub>2</sub>, <code number><sub>2</sub>, <CDEP><sub>2</sub>, <channel flag><sub>2</sub>,

.....  
<code class><sub>512</sub>, <code number><sub>512</sub>, <CDEP><sub>512</sub>, <channel flag><sub>512</sub>

Unit: < [1] >, < [1] >, < [dB] >, < [1] >  
Range: < 9 >, < 0...511 >, < -∞ ... ∞ >, < 0 ; 1 ; 3 >  
Quantity: 512

Code class: Highest code class of a WCDMA signal is always set to 9 (CC9)  
code number: Code number of the evaluated CC9 channel  
CDEP: Code domain error power value of the CC9 channel

## Code Domain Measurements on 3GPP FDD Signals

Channel flag: Denotes whether the CC9 channel belongs to an assigned code channel or not:

Range:	0b00	0d0	- CC9 is inactive
	0b01	0d1	- CC9 channel belongs to an active code channel
	0b11	0d3	- CC9 channel belongs to an active code channel with incorrect transmitted pilot symbols

**CHANNEL TABLE**

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 512 codes that can be assigned within the class of spreading factor 512.

The upper part of the table indicates the channels that have to be present in the signal to be analyzed:

- CPICH: The **C**ommon **P**ilot **C**hannel is used to synchronize the signal in the case of CPICH synchronization. It is expected at code class 8 and code number 0.
- PSCH: The **P**rietary **S**ynchronization **C**hannel is used to synchronize the signal in the case of SCH synchronization. It is a nonorthogonal channel. Only the power of this channel is determined.
- SSCH: The **S**econdary **S**ynchronization **C**hannel is a nonorthogonal channel. Only the power of this channel is determined.
- PCCPCH: The **P**rietary **C**ommon **C**ontrol **P**hysical **C**hannel is also used to synchronize the signal in the case of SCH synchronization. It is expected at code class 8 and code number 1.
- SCCPCH: The **S**econdary **C**ommon **C**ontrol **P**hysical **C**hannel is a QPSK-modulated channel without any pilot symbols. In the 3GPP test models, this channel can be found in code class 8 and code number 3. However, the code class and code number need not to be fixed and can vary. For this reason, the following rules are used to indicate the SCCPCH.
- K72:
  - Only one QPSK-modulated channel without pilot symbols is detected and displayed as the SCCPCH. Any further QPSK-modulated channels without pilot symbols are not detected as active channels.
  - If the signal contains more than one channel without pilot symbols, the channel that is received in the highest code class and with the lowest code number is displayed as the SCCPCH. It is expected that only one channel of this type is included in the received signal. According to this assumption, this channel is probably the SCCPCH

## K74/K74+:

All QPSK-modulated channels without pilot symbols are detected. If one of these channels is received at code class 8 and code number 3, it is displayed as the SCCPCH. Any other QPSK-modulated channels without pilot symbols and a code class higher than or equal to 7 are marked with the channel type CHAN. All further QPSK-modulated channels without pilot

Code Domain Measurements on 3GPP FDD Signals

symbols and a code class lower than 7 are marked with channel type HSPDSCH.

PICH: The **P**aging **I**ndication **C**hannel is expected at code class 8 and code number 16.

The lower part of the table indicates the data channels contained in the signal. A data channel is any channel that does not have a predefined channel number and symbol rate. There are different types of data channels, which can be indicated by the entry in the column "Chan Type":

DPCH: The **D**edicated **P**hysical **C**hannel is a data channel that contains pilot symbols. The displayed channel type is DPCH.

Chan Type: DPCH

Status: inactive channel is not active

Active channel is active and all pilot symbols are correct

Pilotf channel is active but it contains incorrect pilot symbols

Channel Table

SR 30 kspss  
Chan Code 69  
CF 2.11 GHz CPICH Slot 4 Chan Slot 11

Channel Table									
Type	Symb Rate	Chan#	Status	TFCI	PilotL	Pwr Abs	Pwr Rel	T Offs	
CPICH	15.0 kspss	0	active	---	---	-10.70	0.00	---	A
PSCH	-. kspss	---	active	---	---	-13.69	-2.99	---	SGL
SSCH	-. kspss	---	active	---	---	-13.72	-3.02	---	TRG
PCCPCH	15.0 kspss	1	active	---	---	-10.70	-0.00	---	
SCCPCH	15.0 kspss	3	active	ON	8	-18.71	-8.01	0	
PICH	15.0 kspss	16	active	---	---	-18.67	-7.97	30720	
DPCH	30.0 kspss	69	active	ON	8	-19.68	-8.98	22528	
DPCH	30.0 kspss	74	active	ON	8	-19.72	-9.02	16640	
DPCH	30.0 kspss	78	active	ON	8	-17.71	-7.01	7680	
DPCH	30.0 kspss	82	active	ON	8	-19.71	-9.01	9472	

Fig. 35 Channel table of R&S FS-K72 and measuring test model 1.

CPRSD Compressed mode channels usually does not transmit valid symbols in all slots. There are different lengths of the transmitting gap. One to fourteen slots can be switched off in each frame. In some cases outside the gap the data rate is increased by 2 to ensure a constant average data rate of this channel. In any case all of the transmitted slots contain a pilot sequence defined in the 3GPP specification. There are different types of compressed mode channels:

Chan Type: CPRSD Dedicated Physical Channel (DPCH) in compressed mode

CPR-TPC DPCH in compressed mode where TPC symbols are sent in the first slot of the transmitting gap

CPR-SF/2 DPCH in compressed mode using half spreading factor (SF/2) to increase the data rate of the active slots by two.

CPR-SF/2-TPC DPCH in compressed mode using half spreading factor (SF/2) to increase the data rate of the active slots by two, where TPC symbols are sent in the first slot of the transmitting gap.

Status: inactive channel is not active

active channel is active

## Code Domain Measurements on 3GPP FDD Signals

To evaluate compressed mode channels, the associated measurement mode needs to be activated by using the COMP MODE ON/OFF softkey.

Channel Table

SR 120 ksps  
Chan Code 4  
Chan Slot 0

CF 1 GHz CPICH Slot 0

Chan Type	Symb Rate [ksps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-70.40	-13.49	---
PSCH	-.-	---	active	---	---	-74.67	-17.77	---
SSCH	-.-	---	active	---	---	-73.07	-16.16	---
PCCPCH	15.0	1	active	---	---	-70.40	-13.49	---
SCCPCH	15.0	3	active	OFF	0	-60.41	-3.50	0
PICH	15.0	16	active	---	---	-75.35	-18.45	30720
CPRSD	120.0	8	active	ON	8	-70.37	-13.47	1792
CPRSD-TPC	120.0	10	active	ON	8	-71.80	-14.04	1792
CPR-SF/2	240.0	6	active	ON	16	-70.50	-0.01	1792
CPR-SF/2-TPC	240.0	8	active	ON	16	-71.84	-14.05	1792

Fig. 36 Channel table including compressed mode channels in case of activated Compressed Mode measurement.

If the analyzer is equipped with R&S FS-K74 or R&S FS-K74+, the channels of HSDPA will be found among the data channels. If the type of a channel can be fully recognized, as for example with a DPCH (based on pilot sequences) or HS-PDSCH (based on modulation type), the type will be entered in the field *TYPE*. The E-HICH and E-RGCH are mapped to the same physical channel. In the channel table display, the common channel of carrying HICH and ERGCH is named "EHICH-ERGCH". All other channels without pilot symbols are of type CHAN. The channels are in descending order according to symbol rates and, within a symbol rate, in ascending order according to the channel numbers. Therefore, the unassigned codes are always to be found at the end of the table.

If the modulation type for a channel can vary, the measured value of the modulation type will be appended to the type of the channel.

**HS-PDSCH** The **High Speed Physical Downlink Shared Channel** (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes lower than 7. The modulation type of these channels can be varied depending on the selected slot.

Chan Type:

HSPDSCH-QPSK	QPSK-modulated slot of an HS-PDSCH channel
HSPDSCH-16QAM	16QAM-modulated slot of an HS-PDSCH channel
HSPDSCH-64QAM	64QAM-modulated slot of an HS-PDSCH channel
HSPDSCH-NONE	slot without power of an HS-PDSCH channel
HS-MIMO-QPSK	QPSK modulated slot of a channel in single antenna MIMO mode
HS-MIMO-16QAM	16QAM modulated slot of a channel in single antenna MIMO mode
Status: inactive	channel is not active
active	channel is active

Code Domain Measurements on 3GPP FDD Signals

**HS-SSCH** The **H**igh **S**peed **S**hared **C**ontrol **C**hannel (HSDPA) does not contain any pilot symbols. It is a channel type that is expected in code classes equal to or higher than 7. The modulation type should always be QPSK. The channel does not contain any pilot symbols.

Chan Type:

CHAN QPSK-modulated channel without any pilot symbols

Status: inactive channel is not active

active channel is active

**CHANNEL** Any arbitrary channel which does not carry a valid pilot symbol sequence is displayed as an arbitrary channel. In this case it is not possible to decide which channel type is transmitted. The only prerequisite is that the channel carries symbols of a sufficient signal to noise ratio.

Chan Type:

CHAN QPSK-modulated channel without any pilot symbols

Status: inactive channel is not active

active channel is active

**E-HICH:** Enhanced HARQ Hybrid Acknowledgement Indicator Channel Carries Hybrid ARQ ACK/NACK

**E-RGCH:** Enhanced Relative Grant Channel Carries relative grant allocation for a UE

**E-AGCH:** Enhanced Absolute Grant Channel Carries absolute grant allocation for a UE

Channel Table SR 240 ksp/s  
Chan Code 4  
Chan Slot 0

CF 2.11 GHz CPICH Slot 0 Chan Slot 0

	Chan Type	Symb Rate [ksp/s]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]	
Ref	CPICH	15.0	0	active	---	---	-25.78	-10.96	---	A
-4.20 dBm	PSCH	---	---	active	---	---	-29.03	-14.21	---	
	SSCH	---	---	active	---	---	-28.51	-13.69	---	
Att* 0 dB	PCCPCH	15.0	1	active	---	---	-25.78	-10.96	---	TRG
	SCCPCH	---	---	inactv	---	---	---	---	---	
	PICH	15.0	16	active	---	---	-33.82	-18.99	30720	
	HSPDSCH-16QAM	240.0	4	active	---	---	-25.78	-10.95	0	
	HSPDSCH-16QAM	240.0	5	active	---	---	-25.94	-11.12	0	
	HSPDSCH-16QAM	240.0	6	active	---	---	-25.63	-10.81	0	
	HSPDSCH-16QAM	240.0	7	active	---	---	-26.01	-11.19	0	

Fig. 37 Channel table including HSDPA channels of R&S FS-K74/FS-K74+ and measuring test model 5.

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

Type: Type of channel (active channels only). If the modulation type of a channel can vary (HS-PDSCH, in the case of an analyzer equipped with R&S FS-K74/FS-K74+ only), the value of the modulation type measured by the firmware application will be appended to the channel type. Data channels that do not have a type that can be fully recognized are of type CHAN.



## Code Domain Measurements on 3GPP FDD Signals

- Symbol Rate: Symbol rate at which the channel is transmitted (7.5 ksps to 960 ksps).
- Chan #: Number of the channel spreading code (0 to [spreading factor-1])
- Status: Status display. Unassigned codes are considered to be inactive.
- TFCI: Indication whether the data channel uses TFCI symbols.
- PilotL: Number of pilot bits of the channel.
- Pwr Abs / Pwr Rel: Indication of the absolute and relative channel power (referenced to the CPICH or the total power of the signal).
- T Offs: Timing offset. Offset between the start of the first slot of the channel and the start of the analyzed 3GPP FDD frame.

In *CODE CHAN AUTOSEARCH MODE*, a data channel is considered to be active if the required pilot symbols (see 3GPP specification, exception: PICH) are to be found at the end of each slot. In addition, the channel should have minimum power (see *INACT CHAN THRESHOLD* softkey). In *CODE CHAN PREDEFINED* mode, all channels that are included in the user-defined channel table are marked as active.

Within the evaluation channel table the following new HSUPA channels are detected.

Chan Type	Symb Rate [ksps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-45.99	0.00	---
PSCH	-. .	---	active	---	---	-49.75	-3.77	---
SSCH	-. .	---	active	---	---	-48.12	-2.13	---
PCCPCH	15.0	1	active	---	---	-45.95	0.04	---
SCCPCH	15.0	3	active	OFF	0	-35.96	10.03	0
PICH	15.0	16	active	---	---	-50.91	-4.93	30720
DPCH	30.0	2	active	OFF	8	-45.96	0.03	22016
EHICH-ERGCH	30.0	6	active	OFF	0	-45.00	0.99	512
EHICH-ERGCH	30.0	14	active	OFF	0	-45.00	0.99	1536
EAGCH	15.0	8	active	OFF	0	-88.36	-42.37	0

Fig. 38 Channel table including HSUPA-channels

```
Remote: CALC1:FEED "XTIM:CDP:ERR:CTAB1"
        TRAC:DATA? CWCD
```

## POWER VS SYMBOL

The *POWER VS SYMBOL* softkey selects the "power versus symbol" display mode.

'Power versus symbol' represents the relative symbol power in a selected channel within a selected slot. The number of symbols depends on the code class of the selected channel.

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

The displayed value is the ratio of the symbol power and the reference power. The total power of the selected channel or the power of the CPICH is used as the reference power. The reference power depends on the position of the *POWER REF [TOT] / CPICH* softkey in the SETTINGS menu.

Code Domain Measurements on 3GPP FDD Signals

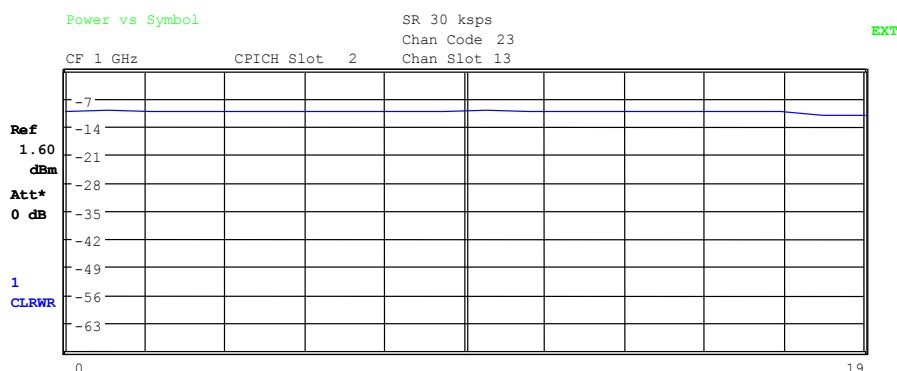


Fig. 39 Power versus symbol for one slot of a channel with 20 symbols

Remote: CALC1:FEED "XTIM:CDP:PVSY"  
Query of results: TRAC1:DAT? TRACE2

Output: List of symbol power values deviating from the reference power  
Format: Val<sub>1</sub>, Val<sub>2</sub>, ..., Val<sub>NOF</sub>  
Unit: [dB]  
Quantity:  $NOF_{Symbols} = 10 \cdot 2^{(8-CodeClass)}$

SYMBOL CONST

The SYMBOL CONST softkey selects the display of the 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).

It is possible to display the constellation diagram for unassigned codes (red marking in the CDP diagram for a code represented in blue), but the results are not meaningful, as the unassigned code channel does not contain data.

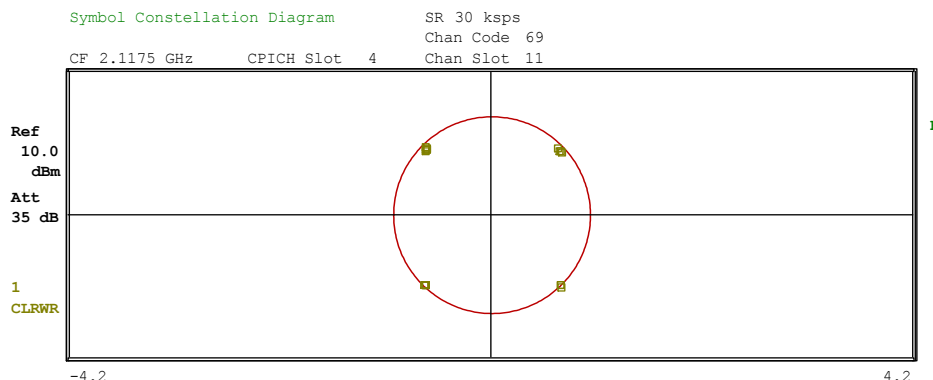


Fig. 40 Symbol constellation diagram

For HSDPA data channels, the modulation type can vary according to 3GPP. If the analyzer is equipped with FS-K74 or FS-K74+, this will be taken into account by switching the diagram according to the modulation type of the channel.

Code Domain Measurements on 3GPP FDD Signals

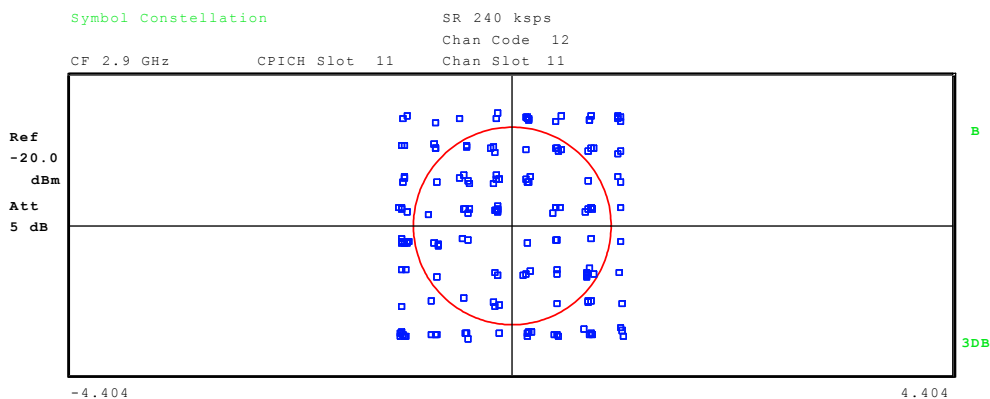


Fig. 41 Symbol constellation diagram for 64QAM

For orientation, the unit circle is added to the figure.

If the base station is operated in single antenna MIMO mode on antenna 2 the display is rescaled to 2.0 / div instead of 1.5 / div.

```
Remote: CALC2:FEED "XTIM:CDP: SYMB:CONS"
```

```
Query of results: TRAC1:DATA? TRACE2
```

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

SYMBOL EVM
SYMB MAG ERROR
SYMB PHASE ERROR

**SYMBOL EVM**

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).

It is possible to display the symbol error vector magnitude for unassigned codes (red marking in the CDP diagram for a code represented in blue), but the results are not valid.

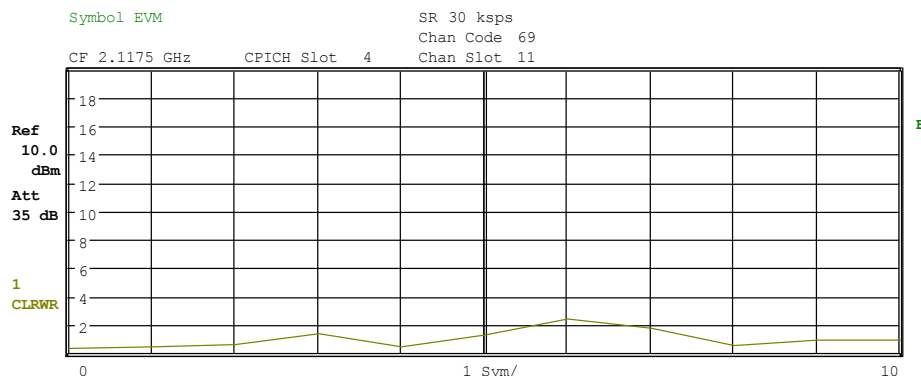


Fig. 42 Error vector magnitude for the selected slot of the selected channel

```
Remote: CALC2:FEED "XTIM:CDP:SYMB:EVM"
```

```
Query of results: TRAC:DATA? TRACE2
```

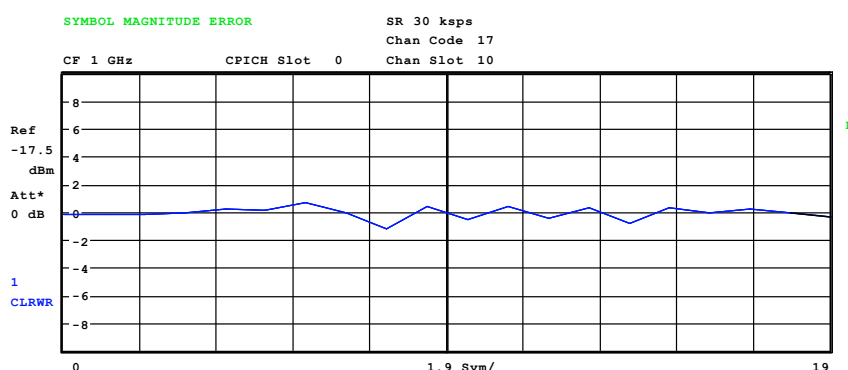
**SYMB MAG ERROR**

The *SYMB MAG ERROR* softkey selects the display mode of symbol magnitude error.

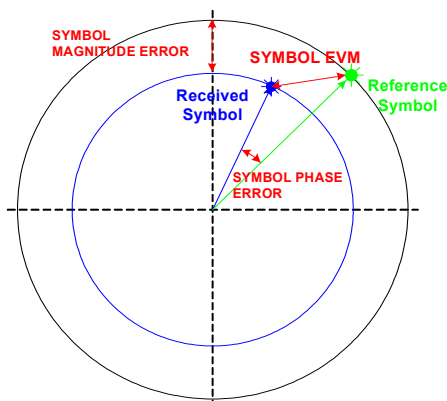
The symbol magnitude error is calculated analogous to symbol EVM. The result of calculation is one symbol magnitude error value for each symbol of the slot of a special channel. Positive values of symbol magnitude error indicate a symbol magnitude that is larger than the expected ideal value, negative symbol magnitude errors indicate a symbol magnitude that is less than the ideal one.

Symbol magnitude error can, as symbol EVM too, be calculated for both active and inactive slots of a channel. For inactive slots of a channel the results are, however, meaningless.

The values of *SYMB MAG ERROR* are displayed in %.



**Fig. 43** Display of the symbol magnitude error



**Fig. 44** Schematic of reference symbol and received symbol to calculate the symbol magnitude error.

The symbol magnitude error is the difference of the magnitude of the received symbol and that of the reference symbol, related to the magnitude of the reference symbol. In Fig. 45 the magnitude error is calculated by the difference of the blue and the black circle.

```
Remote: CALC2:FEED "XTIM:CDP:SYMB:EVM:MAGN"
Query of results: TRAC:DATA? TRACE2
```

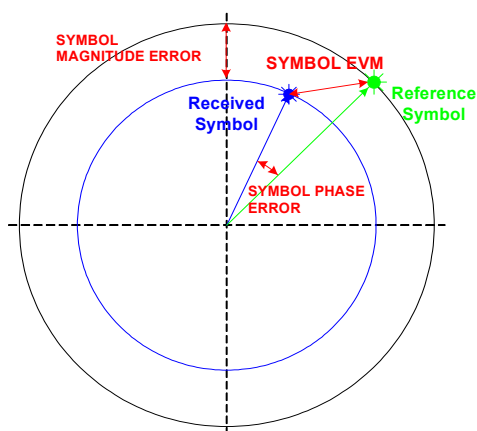
## SYMB PHASE ERROR

The *SYMB PHASE ERROR* softkey selects the display mode of symbol phase error.

The symbol phase error is calculated analogous to symbol EVM. The result of calculation is one symbol phase error value for each symbol of the slot of a special channel. Positive values of symbol phase error indicate a symbol phase that is larger than the expected ideal value, negative symbol phase errors indicate a symbol phase that is less than the ideal one.

Symbol phase error can, as symbol EVM too, be calculated for both active and inactive slots of a channel. For inactive slots of a channel the results are, however, meaningless.

The values of *SYMB PHASE ERROR* are displayed in ° (deg).



**Fig. 45** Schematic of reference symbol and received symbol to calculate the symbol phase error.

The symbol phase error is the difference of the phase of the received symbol and that of the reference symbol. In Fig. 45 the phase error is calculated by the difference of the blue and the green vector.

```
Remote: CALC2:FEED "XTIM:CDP:SYMB:EVM:PHAS"
Query of results: TRAC:DATA? TRACE2
```

## BITSTREAM

The *BITSTREAM* softkey activates the bit stream display.

The determined 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).

Depending on the channel type and the symbol rate at which the channel is transmitted, specific symbols can be "switched off" in a slot, i.e. power 0 is transmitted instead of these symbols. The results of the bit determination are invalid for such symbols. Such invalid bits are marked with "x" in the diagram.

While it is possible to display the bit stream for unused codes (red marking in the CDP diagram for 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 of the bits are invalid.

In the bit stream diagram, the bits of the individual fields of active data channels are marked in different colors. The color legend is displayed in the header of the figure.

Code Domain Measurements on 3GPP FDD Signals

```

Bitstream
SR 30 kbps
Chan Code 23
Chan Slot 13
CF 1 GHz          CPICH Slot 2
    
```

Format	DPCH 10:	6xData1	2xTPC	0xTFCI	24xData2	8xPilot
0	10 00 11 00	11 10 10 11	10 00 00	11 01 01	10 11	
32	11 00 11 11					
64						
96						
128						
160						
192						
224						
256						
288						
320						
352						

Fig. 46 Demodulated bits for the selected slot of the selected channel

If some of the pilot symbols of the selected slot of the DPCH are not correct, these symbols are marked with the color magenta.

```

Bitstream
SR 30 kbps
Chan Code 23
Chan Slot 13
CF 1 GHz          CPICH Slot 2
    
```

Format	DPCH 10:	6xData1	2xTPC	0xTFCI	24xData2	8xPilot
0	10 00 11 00	11 10 10 11	10 00 01	-- 01 01	-- 11	
32	01 00 11 11					
64						
96						
128						
160						
192						
224						
256						
288						
320						
352						

Fig. 47 Demodulated bits with pilot symbols

For HSDPA data channels, the modulation type can vary. Depending on the modulation type, the number of bits that belong to one symbol will change. In the case of an analyzer equipped with R&S FS-K74 or R&S FS-K74+, the diagram will be switched according to the modulation type of the channel.

```

Bitstream
SR 240 kbps
Chan Code 12
Chan Slot 11
CF 2.9 GHz       CPICH Slot 11
    
```

Format	HSPDSCH:	960xData1	0xTPC	0xTFCI	0xData2	0xPilot
Ref	0	000111 111001 000100	101011	100110		
-20.0	30	011100 100001 000101	101010	101010		
dBm	60	100011 001101 110110	001011	101100		
	90	100110 101110 010111	001110	101011		
Att	120	011100 001111 000001	100010	001110		
5 dB	150	110101 011101 100100	100000	100010		
	180	011000 000111 100011	000111	111011		
	210	100110 010000 011110	100011	110101		
	240	010000 000010 011111	100000	011000		
	270	010010 011101 110110	110001	111011		
	300	111111 001101 000111	011010	000001		
	330	111111 010111 011101	101100	101000		

Fig. 48 Demodulated bits for the selected slot of the selected channel in the case of 64QAM

If a channel has modulation type MIMO-QPSK or MIMO-16QAM the following bit sequences represent the constellation points of the channel:

MIMO-QPSK

## Code Domain Measurements on 3GPP FDD Signals

Constellation point (normalized)	Bit-sequence
0,0	0,1,0,1
1,0	0,1,0,0
-1,0	0,1,1,1
0,1	0,0,0,1
1,1	0,0,0,0
-1,1	0,0,1,1
0,-1	1,1,0,1
1,-1	1,1,0,0
-1,-1	1,1,1,1

## MIMO-16QAM

The bit sequence is the same in both I and Q, only one dimension is given here.

Constellation point (normalized)	Bit-sequence
-3	1,1,1
-2	1,1,0
-1	1,0,0
0	1,0,1
1	0,0,1
2	0,0,0
3	0,1,0

```
Remote: CALC2:FEED "XTIM:CDP:BSTR"
Query of results: TRAC:DATA? TRACE2 | ABIT
```

**SELECT CHANNEL**

The *SELECT CHANNEL* softkey activates the selection of a channel for the display modes *CDP PWR RELATIVE/ABSOLUTE*, *POWER VS SLOT*, *SYMBOL CONST* and *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 involved. For the display, the channel number entered is converted on the basis of spreading factor 512. For unused channels, the code resulting from the conversion is marked. Example:  
Entry 5.128  
Channel 5 is marked at spreading factor 128 (30 kbps) if the channel is active, otherwise code 20 at spreading factor 512.

- Entry of a channel number without a decimal point.  
 In this case, FS-K72/K74/K74+ interprets the entered code as based on spreading factor 512. If the code entered corresponds to a used channel, the entire associated channel is marked. If the code corresponds to an unused channel, only the code entered is marked.  
 Example:  
 Entry 20  
 Code 20 is marked at spreading factor 512 if there is no active channel on this code. If for instance channel 5 is active at spreading factor 128, the entire channel 5 is marked.

If the entered code corresponds to an active channel, the entire associated channel is marked. If it corresponds to a gap between the channels, only the entered code is marked. If the code number is modified using the rotary knob, the red marking changes its position in the diagram only if the code number no longer belongs to the marked channel. The step width of the changed rotary knob position refers to a spreading factor of 512.

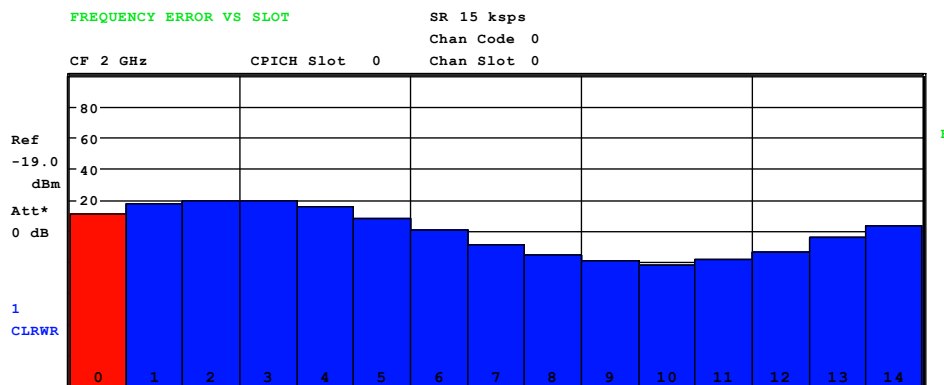
Remote: SENS:CDP:CODE 0...511

**FREQ ERR VS SLOT**

The *FREQ ERR VS SLOT* softkey selects the display mode of frequency error versus slot.

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 to the frequency error of the first (zero) slot is calculated. This will help to eliminate a static frequency offset of the whole signal to achieve a better display of a real time-depending frequency curve.

The values of *FREQ ERR VS SLOT* are displayed in Hz.



**Fig. 49** 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

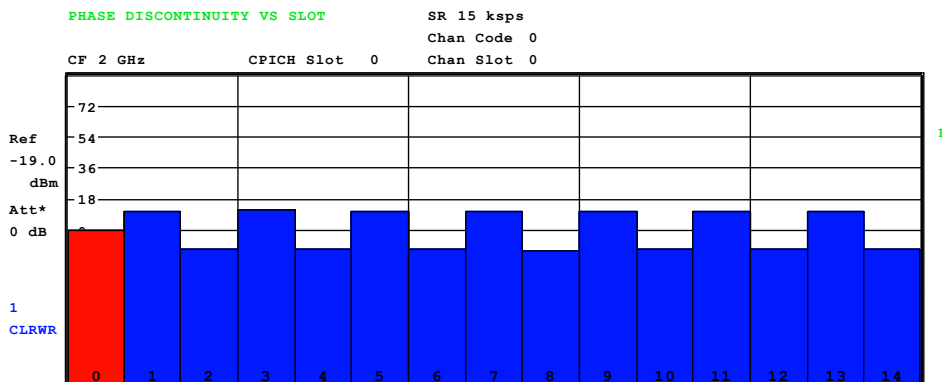
Remote: CALC2:FEED "XTIM:CDP:FVSL"  
 Query of results: TRAC:DATA? TRACE2

**PHASE DISCONT**

The *PHASE DISCONT* softkey selects the display mode of phase discontinuity versus slot.

The phase discontinuity is calculated according to 3GPP specifications. The phase calculated for each slot is interpolated to both ends of the slot using the frequency shift of that slot. The difference between the phase interpolated for the beginning of one slot and the end of the preceding slot is displayed as the phase discontinuity of that slot.

The values of *PHASE DISCONT* are displayed in ° (deg).



**Fig. 50 Phase discontinuity versus slot**

The phase discontinuity  $\phi_{disc}(i)$  is displayed versus slot. The values are given in degree. 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  $[\phi_{slot\_start}(i)]$  Fig. 49). 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. 51 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

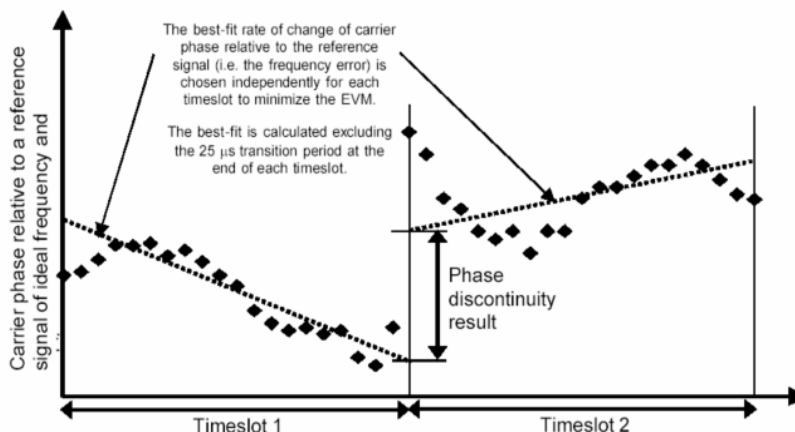


Figure 5.13.3.1 Graphical description of phase discontinuity

**Fig. 51 Measurement of phase discontinuity**

```
Remote: CALC2:FEED XTIM:CDP:PSVS
Query of results: TRAC:DATA? TRACE2
```

**SELECT CPICH SLOT**

The *SELECT CPICH SLOT* softkey activates the selection of the slot number for the display modes *POWER VS SLOT*, *SYMBOL CONST*, *SYMBOL EVM* and *BITSTREAM*.

To avoid ambiguities that may occur due to the permissible timing offsets, the slot number is defined on the basis of the CPICH (i.e. calculated in steps of 2560 chips starting from the beginning of the frame). The desired slot of the selected channel has to be converted according to its timing offset.

**Example:**

Slot 0 of the CPICH is set. The selected channel (red marker in the CDP diagram) has a timing offset of 2816 chips, i.e. slot 0 of the channel is delayed by 2816 chips with respect to the frame start. Slot 0 of the CPICH therefore corresponds to slot 14 of the last frame of the channel.

When the slot number is entered, the red marking in the power-versus-slot diagram changes its position in steps of 2560 chips.

```
Remote: SENS:CDP:SLOT 0 ... 14
```

**ADJUST REF LVL**

The *ADJUST REF LVL* softkey adjusts the reference level of the R&S 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 R&S Analyzer or limiting the dynamic range by an S/N ratio that is too small.

```
Remote SENS:POW:ACH:PRES:RLEV
```

## 6.10.2 Measurement Configuration – *CHAN CONF* Hotkey

CODE CHAN AUTOSEARCH
CODE CHAN PREDEFINED
CHAN TABLE COMPARE
EDIT CHAN CONF TABL
NEW CHAN CONF TABL
DEL CHAN CONF TABL
COPY CHAN CONF TABL
TIMING OFS PRED/MEAS

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 merely provides an overview; a table for the measurement can be selected only after actuating the *CODE CHAN PREDEFINED* softkey.

Remote: CONF:WCDP:BTS:CTABL:CAT?

### CODE CHAN AUTOSEARCH

The *CODE CHAN AUTOSEARCH* softkey allows code domain power measurements in the automatic search mode. In this mode, the entire code domain (all permissible symbol rates and channel numbers) is searched for active channels. Detecting an active channel is performed by a comparison with the pilot symbols to be expected after despreading. Only channels with pilot symbols can be detected as active channels. If the pilot symbols of a channel are either missing or incomplete, the channel is not recognized as active. An exception to this rule is the special channel PICH which can be recognized as active channel also in the automatic search mode.

Synchronization channels CPICH, PCCPCH, PSCH and SSCH are assumed to be present by CDP analysis and are added to the channel table for each measurement.

The *CODE CHAN AUTOSEARCH* mode is the preset search mode when starting CDP analysis. Its main purpose is to provide the user with 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, CDP analysis can be performed with the channel configurations predefined by the user by switching to *CODE CHAN PREDEFINED* mode.

Remote: CONF:WCDP:BTS:CTABL:STAT OFF

### CODE CHAN PREDEFINED

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.

When the softkey is selected, a table containing all channel tables stored in the measuring instrument is opened. CDP analysis is switched to the 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. Starting with the next measurement, the selected channel table is taken as a basis for the sweep. A check mark indicates the selected channel table.

In the factory-ready state, FS-K72/K74/K74+ has the following channel tables stored on the measuring instrument:

- Channel model 1 to 3GPP with 16/32/64 channels
- Channel model 2 to 3GPP
- Channel model 3 to 3GPP with 16/32 channels
- Channel model 4 containing CPICH and PCCPCH

If the analyzer is equipped with R&S FS-K74, the following tables will be offered additionally:

Channel model 5 to 3GPP with 2/4/8 HS-PDSCH and 6/14/30 DPCH

```
Remote: CONF:WCDP:BTS:CTAB1:STAT ON
        CONF:WCDP:BTS:CTAB1:SEL "3GB_1_32"
```

### CHAN TABLE COMPARE

The *CHAN TABLE COMPARE* softkey switches between normal predefined mode and predefined channel table compare mode.

In the compare mode a predefined channel table model can be compared against the measurement in respect of power, pilot length and timing offset of the active channels.

Comparison is a sub mode from predefined channel table measurement. It only influences the measurement if the softkey *CODE CHAN PREDEFINED* is active. If the compare mode is selected the power values, pilot lengths and timing offsets are measured and are compared against the values from the predefined channel table. The softkey *TIMING OFS PREDMEAS* becomes unavailable. These results are visualized in the corresponding columns of the measurement evaluation CHANNEL TABLE. The table can be switched on with the hotkey *RESULT*, *NEXT* and the softkey *CHANNEL TABL*. The columns are then titled PIL L, PWR and T OFS.

- PIL L is the subtraction of PilotLengthMeasured – PilotLengthPredefined.
- PWR is the subtraction of PowerRelMeasured – PowerRelPredefined.

The column POWER of the predefined channel table can be edited and via IEC/IEEE bus the value power of the definition of the channel table will be used to set the estimated power.

T OFS is the subtraction of TimingOffsetMeasured – TimingOffsetPredefined

For non active channels dashes are shown.

```
Remote: CONF:WCDP:BTS:CTAB:COMP ON | OFF
```

## EDIT CHAN CONF TABL

HEADER/VALUES
ADD SPECIAL
INSERT LINE
DELETE LINE
MEAS CHAN CONF TABLE
SAVE TABLE
SORT TABLE

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

EDIT CHANNEL TABLE							
NAME :	RECENT						
COMMENT :	generated by WCDMA						
CHANNEL	SYMBOL	CHAN #	USE	TIMING OFFS.	PILOT	CDP REL.	STATUS
TYPE	RATE [ksps]		TFCI	[CHIPS]	BITS	[dB]	
CPICH		0			---	0.0000	ACTIVE
PCCPCH	15	1			---	0.0397	ACTIVE
SCCPCH	15	3		0	0	10.0263	ACTIVE
PICH		16		30720	---	-4.9251	ACTIVE
DPCH	30	2	NO	22016	8	0.0316	ACTIVE
EHICH/ERGCH	30	6		512	---	0.9899	ACTIVE
DPCH	30	11	NO	34304	8	-1.9661	ACTIVE
EHICH/ERGCH	30	14		1536	---	0.9869	ACTIVE
DPCH	30	17	NO	13312	8	-1.9560	ACTIVE
EHICH/ERGCH	30	20		2048	---	1.0081	ACTIVE
DPCH	30	23	NO	11520	8	-3.9675	ACTIVE
EAGCH	15	8		0	---	-42.3704	ACTIVE
DPCH	7.5	4	NO	0	0	-42.7871	INACTIVE
DPCH	7.5	5	NO	0	0	-46.5249	INACTIVE

Fig. 52 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 the *SAVE TABLE* softkey is pressed. This prevents a table from being overwritten inadvertently (e.g. a channel model).

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. Thus, any modifications to the table are immediately shown. 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.

If the *SYMBOL RATE* or the *CHAN #* of a channel is changed, the instrument checks for code domain conflicts after confirmation of the entry with one of the unit keys. If a code domain conflict is detected, the channels involved are marked with an asterisk. The user has the possibility of eliminating the code domain conflict. If a table with code domain conflicts is used in CDP analysis, the results obtained are not valid.

**HEADER/VALUES**

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

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

```
Remote: CONF:WCDP:BTS:CTAB1:NAME "NEW_TAB"
```

*VALUES* allows the entries of a channel table to be edited. 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 cannot be edited for channels whose symbol rate is defined by the standard (e.g. synchronization channels). In the case of special channels, the channel type is entered instead of the symbol rate.

**CHAN NO:** Number of channel in the associated transmission class. The validity of the entered channel number for the selected transmission rate is checked when entered; invalid entries are rejected.

**USE TFCI:** Indicates whether a channel contains TFCI symbols. This information is required for determining the slot format of a channel. The entry cannot be edited for channels that do not contain any TFCI information.

**TIMING OFFSET:** Timing offset of a channel. The expected timing offset is the channel offset relative to the CPICH, specified in chips. This entry cannot be edited for channels that have no timing offset.

**PILOT BITS:** Number of pilot bits of a channel. This information is required for determining the slot format. The entry cannot be edited for channels containing no pilot symbols. The entry is made in bits..

**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 active status are taken into account in CDP analysis.

```
Remote: CONF:WCDP[:BTS]:CTAB:DATA
8,0,0,0,0,0,1,0.00,8,1,0,0,0,1,0.00,7,1,0,256,8,
0,1,0.00
CONF:WCDP[:BTS]:CTAB:COMM "Comment for new table"
```

**ADD SPECIAL**

The *ADD SPECIAL* softkey is used to add special channels to the channel table. For an analyzer equipped with R&S FS-K72, the PICH and SCCPCH special channels, which are included in the 3GPP test models, can presently be added. Only one channel of each type may be added per channel table.

If the analyzer is equipped with R&S FS-K74, the channel types of HSDPA

(HSSCCH and HSPDSCH) or HSUPA (EAGCH and EHICH-ERGCH) can be selected and added to the channel table as well.

Remote: -- (included in command `CONF:WCDP:CTAB:DATA`)

### INSERT LINE

The *INSERT LINE* softkey inserts a new line into the table. In this line, entries can be made in any order. A channel is included in CDP analysis only if all required entries have been made in the list

Remote: --

### DELETE LINE

The *DELETE LINE* softkey deletes a marked line from the table.

Remote: --

### MEAS CHAN CONF 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.

Remote: --

### SAVE TABLE

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.

Remote: -- (automatic storage with remote control)

### SORT TABLE

The *SORT TABLE* softkey sorts a channel table according to symbol rates (in descending order) and, for channels of the same symbol rate, according to channel numbers (in ascending order).

Remote: --

### NEW CHAN CONF TABL

The *NEW CHAN CONF TABL* 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 synchronization channels are entered; the table name is not yet defined.

Code Domain Measurements on 3GPP FDD Signals

EDIT CHANNEL TABLE							
NAME:							
COMMENT:							
CHANNEL TYPE	SYMBOL RATE [kps]	CHAN #	USE TFCI	TIMING OFFS. [CHIPS]	PILOT BITS	CDP REL. [dB]	STATUS
CPICH		0			---	0.0000	ACTIVE
PCCPCH	15	1			---	0.0000	ACTIVE

Fig. 53 Creating a new channel configuration

DEL CHAN CONF TABL

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

Remote: CONF:WCDP:BTS:CTABL:DEL

COPY CHAN CONF TABL

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


Remote: CONF:WCDP:BTS:CTABL:COPY "CTAB2"

TIMING OFS PRED/MEAS

The TIMING OFS PRED/MEAS softkey specifies whether the timing offset and pilot length are measured or if the values are taken from the predefined table.

PRED The timing offset and pilot length values from the predefined table are used.

MEAS The timing offset and the pilot length are measured by the application. The channel configuration is specified via the predefined channel table.



Channel Table

SR 15 kpsps  
Chan Code 0  
CF 1 GHz CPICH Slot 0 Chan Slot 0

Chan Type	Symb Rate [kps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-59.64	-0.00	---
PSCH	---	---	active	---	---	-62.46	-2.83	---
SSCH	---	---	active	---	---	-62.59	-2.95	---
PCCPCH	15.0	1	active	---	---	-59.65	-0.02	---
SCCPCH	15.0	3	active	OFF	0	-67.64	-8.00	0
PICH	15.0	16	active	---	---	-67.65	-8.01	30720
DPCH	30.0	2	active	OFF	8	-59.63	0.00	22016
DPCH	30.0	11	active	OFF	8	-61.64	-2.00	34304
DPCH	30.0	17	active	OFF	8	-61.61	-1.98	13312
DPCH	30.0	23	active	OFF	8	-63.65	-4.02	11520

Fig. 54 Predefined channel table display. The timing offset marked can be measured from the signal (MEAS) or set to the predefined value (PRED).

Remote: CONF:WCDP:BTS:CTAB:TOFF PRED|MEAS



### 6.10.3 Configuration of CDP Measurement – *SETTINGS* Hotkey

SCRAMBLING CODE
INACT CHAN THRESH
CODE PWR ABSJREL
POWER REF TOT / CPICH
COMP MODE ON/OFF
SYNC TYPE CPICH/SCH
ANT DIV ON/OFF
ANT NO. 1/2
POWER DIFF ON/OFF
MULTI FRM CAPTURE
MULT CARR ON/OFF
AUTO SCALE ON/OFF
CONST PARAM B
HS-DPA/UPA ON/OFF
RRC FILTER ON / OFF
INVERT Q ON / OFF
SIDEBAND NORM / INV
NORMALIZE ON / OFF
CPICH USER DEF
CPICH CODE#
CPICH PATT ANTENNA   PATTERN 1   PATTERN 2
NORMALIZE ON / OFF

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

#### SCRAMBLING CODE

SCRAM CODE AUTOSRCH
SCRAM CODE LIST
FORMAT HEX/DEC

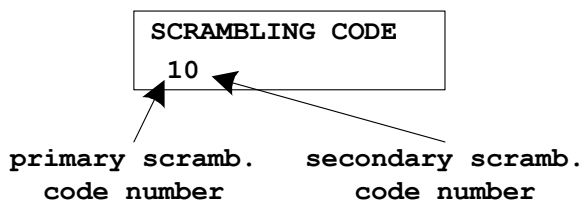
The *SCRAMBLING CODE* softkey opens a submenu for entering the scrambling code.

The scrambling codes are divided into 512 sets, each consisting of a primary scrambling code and 15 secondary scrambling codes.

The primary scrambling codes consist of scrambling codes  $n=16*i$  where  $i=0$  to 511. The  $i$ :th set of secondary scrambling codes consists of scrambling codes  $16*i+k$ , where  $k=1$  to 15. The scrambling code is input in hex format. According to the 3GPP specification, the last digit denotes the number of the secondary scrambling code ( $k \in [1 \dots 15] = [1 \dots F]$ ). The digit before the last digit denotes the primary scrambling code ( $k = 0, i \in [0 \dots 511] = [0 \dots FF]$ ).

Example: To enter the primary scrambling code number '1', the digits '10' need to be entered. ( $i = 1, k = 0$ )

## Code Domain Measurements on 3GPP FDD Signals



Hence, according to the above, scrambling codes  $k = 0, 1, \dots, 8191$  ( $k \in [1 \dots 0x1FFF]$ ) are used. Each of these codes is associated with a left alternative scrambling code and a right alternative scrambling code, that may be used for compressed frames. The left alternative scrambling code corresponding to scrambling code  $k$  is scrambling code number  $k+8192$  ( $k+0x2000$ ), while the right alternative scrambling code corresponding to scrambling code  $k$  is scrambling code number  $k+16384$  ( $k+0x4000$ ). The alternative scrambling codes can be used for compressed frames. In this case, the left alternative scrambling code is used if  $n < SF/2$  and the right alternative scrambling code is used if  $n \geq SF/2$ , where  $c_{ch,SF,n}$  is the channelization code used for non-compressed frames.

The entered scrambling code has to coincide with that of the signal. Otherwise, a CDP measurement of the signal is not possible. The scrambling code range is  $[0x0 \dots 0x5FFF]$

```
Remote:          SENS:CDP:LCOD:VAL #H2
```

### SCRAM CODE AUTOSRCH

The *SCRAM CODE AUTOSRCH* softkey activates the automatic detection of the scrambling code. Precondition is that the correct center frequency and level are set. The scrambling code search can automatically determine the primary scrambling code number. The secondary scrambling code number is expected to be 0. Other scrambling codes can not be detected.

Therefore, the range for detection is  $0x0000 - 0x1FF0h$ , where the last digit is always 0.

When the routine starts, a message box 'in progress' appears. The data capturing is carried out and the scrambling code is determined. If a valid scrambling code is found the message 'found code xxxx' appears. This found scrambling code is stored as the scrambling code parameter (softkey *SCRAMBLING CODE*) and is used for further measurements. If no code is found the message 'No Code found' is displayed.

```
Remote:  SENS:CDP:LCOD:SEAR:IMM?
          Delivers PASSED if scrambling code was found and FAILED
          if no code was found.
```

### SCRAM CODE LIST

The *SCRAM CODE LIST* softkey can be used after a scrambling code search to show the result of that search process. All found codes are listed. The order of the listing is in such a way that the strongest scrambling code (with the highest power) is shown first. The power shown is a coarse value for the CPICH power.

## Code Domain Measurements on 3GPP FDD Signals

SCRAMBLING CODE LIST	
CODE	POWER [dBm]
0x10	-19.48
0x20	-22.49
0x30	-25.81
0x40	-27.48

Remote: SENS:CDP:LCOD:SEAR:LIST?

The result is returned comma separated for each found scrambling code:

<decimal scrambling code value>, <hexadecimal scrambling code value>, <power in dBm>, ...

### FORMAT HEX/DEC

The *FORMAT HEX/DEC* softkey selects either hexadecimal or decimal format for the entry of the *SCRAMBLING CODE*. Default is hexadecimal.

```
Remote: SCRAMBLING CODE HEX
        SENS:CDPower:LCOD:VAL <hex>
        SCRAMBLING CODE DEC
        SENS:CDP:LCOD:DVAL <numeric_value>
```

### INACT CHAN THRESH

The *INACT CHAN THRESH* softkey activates the entry of the minimum power which a single channel should have as compared to the total signal in order to be considered an active channel.

Channels that are below the specified threshold are considered to be not active irrespective of whether they contain pilot symbols. Channels that are not active appear in blue in the CDP diagram.

The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR*, specified as measurements on the total signal, are performed with the aid of the list of active channels. These two measurements are falsified whenever active channels are recognized as not active (see above example) or if unassigned codes receive the status "assigned channel". *INACT CHAN THRESH* is therefore used to influence the results of the two measurements.

The default value is -60 dB, which allows all channels of signals such as the 3GPP test signals to be detected in CDP analysis. If not all channels in the signal are automatically detected, *INACT CHAN THRESH* has to be decremented.

```
Remote: SENS:CDP:ICTR -100 dB ... +10 dB
```

### CODE PWR ABS|REL

The *CODE PWR ABS|REL* softkey selects the absolute or relative power display. If the power versus slot measurement is active, the slot power is given in absolute or relative values.

Code Domain Measurements on 3GPP FDD Signals

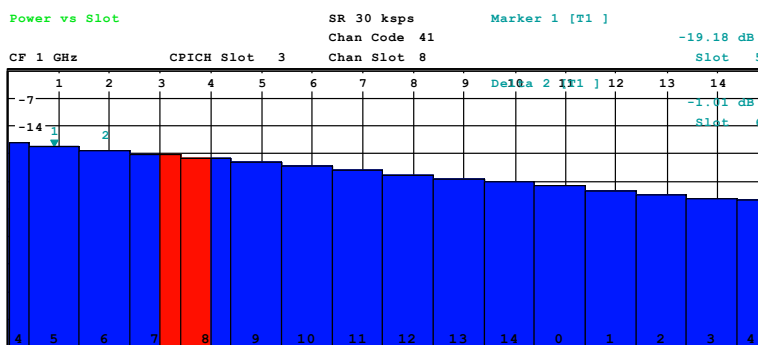


Fig. 55 Relative lot power of a decreasing slot power pattern.

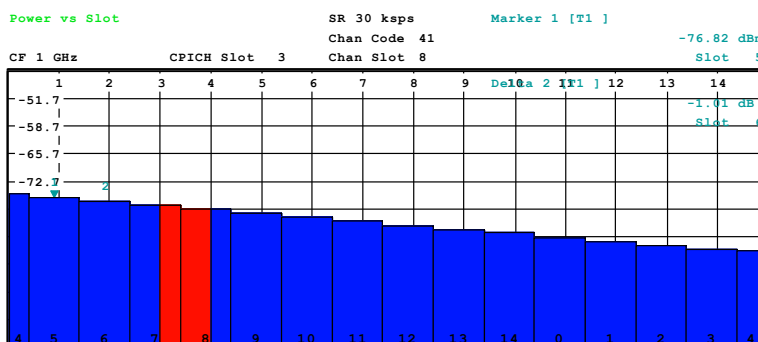


Fig. 56 Absolute slot power of a decreasing slot power pattern.

Absolute slot power of an decreasing slot power pattern

```
Remote: CALC1:FEED "XTIM:CDP:PVSL:ABS"
        CALC1:FEED "XTIM:CDP:PVSL:RAT"
```

**POWER REF TOT / CPICH**

The *POWER REF TOT / CPICH* softkey determines the reference power for the relative power displays:

**TOT** All the relative powers (display modes *CDP RELATIVE* and *POWER VS SLOT*) are referenced slot by slot to the total signal power in the slot involved.

**CPICH** The reference power is that of the CPICH in the relevant slot.

The default setting of the softkey is *CPICH*.

Since 3GPP specifies a slot-specific power control for every channel, the total power of the signal will change from slot to slot in accordance with the power control of the individual channels. As a result, with activated power control and reference to the total power of the signal, a relative CDP display versus the slot number (*POWER VS SLOT*) does not necessarily represent the power control of the selected channel.

Example:

If the signal (theoretically) contains only one data channel whose power is controlled, and if the power is referenced to the total power of the signal (which is formed only by the contribution of this data channel), a straight line appears in the *POWER VS SLOT* diagram instead of the expected power staircase. Consequently, the reference value *TOT* of the relative displays is informative only if the signal does not contain power control.

By contrast, the *CPICH* setting also reflects the exact characteristic of the power versus the slot number in a selected channel for signals with power control. Since the CPICH is never power controlled, this yields the same reference value in every slot.

Remote: SENS:CDP:PREF TOT | CPIC

### COMP MODE ON/OFF

The *COMP MODE ON/OFF softkey* enables an extended channel search to evaluate compressed mode channels. In the frame of compressed mode channels, some slots can be suppressed. Furthermore the spreading factor of the compressed channels can be decreased and an varied pilot sequence is sent. By enabling the compressed mode measurement, this channel properties are considered.

Default setting is OFF.

**OFF:** Standard channel search.

The slot power (POWER VS SLOT display) of each slot is averaged to the symbols of one slot starting with the pilot symbols of the previous slot.

Remote: CDP:PCON PILOT

**ON:** Extended channel search considering the properties of compressed mode channels

The slot power (POWER VS SLOT display) of each slot is averaged to the symbols of one slot starting with the first data symbol of the slot.

Remote: CDP:PCON SLOT

In compressed mode some slots of a channel are suppressed. To keep the overall data rate, the slots just before or just behind a compressed gap can be sent with half spreading factor (SF/2). Further more the TPC symbols can be sent in the first slot of the gap. Within this version these properties are given by four different channel types.

The following compressed mode channel types can be detected:

- CPRSD dedicated physical data channel with compressed mode gap (without any SF reduction) [Fig. 57]
- CPR-TPC dedicated physical data channel with compressed mode gap (without any SF reduction) TPC symbols are sent in the first slot of the gap. [Fig. 58]
- CPR-SF/2 dedicated physical data channel with compressed mode gap and half spreading factor (SF/2) [Fig. 59]
- CPR-SF/2-TPC dedicated physical data channel with compressed mode gap and half spreading factor (SF/2). TPC symbols are sent in the first slot of the gap [Fig. 60].

Code Domain Measurements on 3GPP FDD Signals

Channel Table SR 120 kbps  
Chan Code 4  
 CF 1 GHz CPICH Slot 0 Chan Slot 0

Chan Type	Symb Rate [ksps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-70.40	-13.49	---
PSCH	-.-	---	active	---	---	-74.67	-17.77	---
SSCH	-.-	---	active	---	---	-73.07	-16.16	---
PCCPCH	15.0	1	active	---	---	-70.40	-13.49	---
SCCPCH	15.0	3	active	OFF	0	-60.41	-3.50	0
PICH	15.0	16	active	---	---	-75.35	-18.45	30720
CPRSD	480.0	4	active	ON	16	-70.41	-13.50	2304
CPRSD	240.0	6	active	ON	16	-70.41	-13.50	2048
CPRSD	120.0	8	active	ON	8	-70.37	-13.47	1792
CPRSD	60.0	12	active	ON	8	-70.39	-13.48	1536

Fig. 57 Channel table display of an standard compressed mode channel

Channel Table SR 120 kbps  
Chan Code 4  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Chan Type	Symb Rate [ksps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-70.43	-12.68	---
PSCH	-.-	---	active	---	---	-74.69	-16.93	---
SSCH	-.-	---	active	---	---	-73.05	-15.29	---
PCCPCH	15.0	1	active	---	---	-70.41	-12.66	---
SCCPCH	15.0	3	active	OFF	0	-60.40	-2.65	0
PICH	15.0	16	active	---	---	-75.39	-17.63	30720
CPRSD-TPC	480.0	4	active	ON	16	-70.88	-13.12	2304
CPRSD-TPC	240.0	6	active	ON	16	-71.21	-13.45	2048
CPRSD-TPC	120.0	8	active	ON	8	-71.80	-14.04	1792
CPRSD-TPC	60.0	12	active	ON	8	-72.28	-14.52	1536

Fig. 58 Channel table display of an standard compressed mode channel including TPC symbols in the first slot of the gap

Channel Table SR 240 kbps  
Chan Code 4  
 CF 1 GHz CPICH Slot 0 Chan Slot 0

Chan Type	Symb Rate [ksps]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-70.50	0.00	---
PSCH	-.-	---	active	---	---	-74.96	-4.46	---
SSCH	-.-	---	active	---	---	-73.39	-2.89	---
PCCPCH	15.0	1	pilotF	---	---	-70.48	0.02	---
SCCPCH	15.0	3	active	OFF	0	-60.48	10.02	0
PICH	15.0	16	active	---	---	-75.47	-4.97	30720
CPR-SF/2	960.0	2	active	ON	16	-70.45	0.04	2304
CPR-SF/2	480.0	3	active	ON	16	-70.48	0.01	2048
CPR-SF/2	240.0	4	active	ON	16	-70.50	-0.01	1792
CPR-SF/2	120.0	6	active	ON	16	-70.44	0.06	1536

Fig. 59 Channel table display of a compressed mode channel using the half spreading factor (SF/2) outside the compressed gap.

Code Domain Measurements on 3GPP FDD Signals

Channel Table SR 240 ksp/s  
Chan Code 4

CF 1 GHz CPICH Slot 3 Chan Slot 3

Chan Type	Symb Rate [ksp/s]	Chan#	Status	TFCI	PilotL [Bits]	Pwr Abs [dBm]	Pwr Rel [dB]	T Offs [Chips]
CPICH	15.0	0	active	---	---	-70.43	-12.63	---
PSCH	-.	---	active	---	---	-74.98	-17.18	---
SSCH	-.	---	active	---	---	-73.38	-15.59	---
PCCPCH	15.0	1	pilotF	---	---	-70.42	-12.63	---
SCCPCH	15.0	3	active	OFF	0	-60.47	-2.67	0
PICH	15.0	16	active	---	---	-75.47	-17.68	30720
CPR-SF/2-TPC	960.0	2	active	ON	16	-70.85	-13.05	2304
CPR-SF/2-TPC	480.0	3	active	ON	16	-71.27	-13.48	2048
CPR-SF/2-TPC	240.0	4	active	ON	16	-71.84	-14.05	1792
CPR-SF/2-TPC	120.0	6	active	ON	16	-72.30	-14.51	1536

Fig. 60 Channel table display of a compressed mode channel using the half spreading factor (SF/2) outside the compressed gap. TPC symbols are sent in the first slot of the gap.

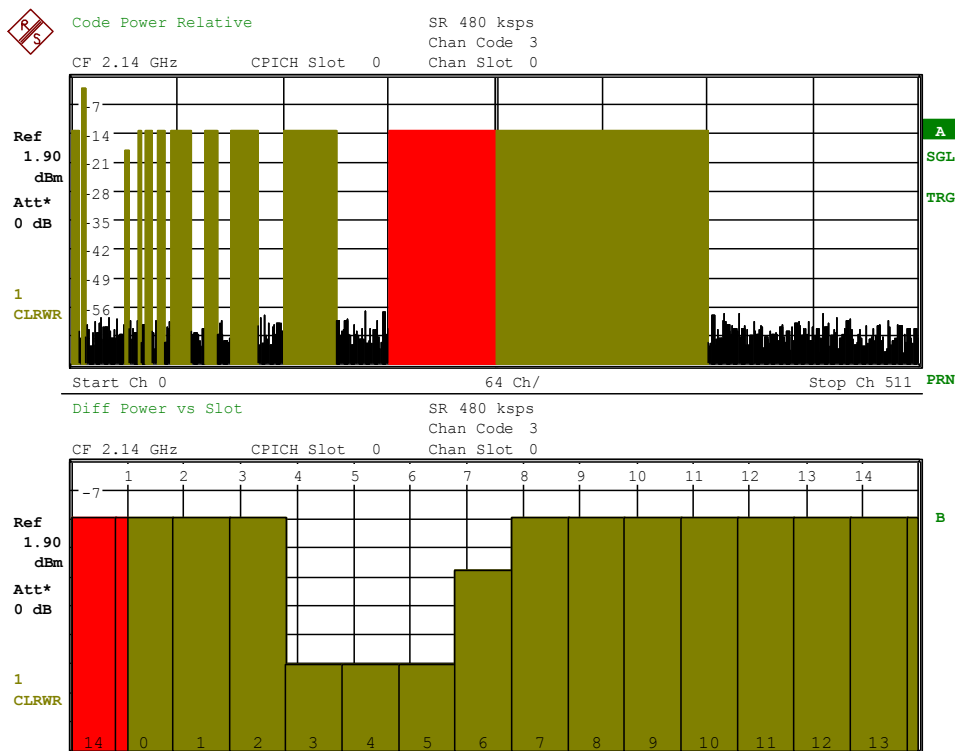


Fig. 61 Code domain power and power versus slot of a compressed channel

Display of slot format type A and type B

In compressed mode two different slot formats are defined. Slot format A describes a channel without changing the spreading factor outside the compressed gap. Slot format B describes a channel with a decreased spreading factor outside the compressed gap. The different slot format definitions vary in the number of TPC, TFCI and pilots symbols as well in the number and position of the data symbols. An exact definition of the slot format can be found in the 3GPP technical specification number 25.211 at chapter "5.3.2 Dedicated downlink physical channels".

Code Domain Measurements on 3GPP FDD Signals

The examples below shows a slot format type A (Fig. 62) signal and a slot format type B (Fig. 63). signal.

Bitstream SR 120 ksps  
Chan Code 4  
 CF 1 GHz CPICH Slot 0 Chan Slot 0

Format	CPRSD	13A:	28xData1				4xTPC		16xTFCI				104xData2				8xPilot	
0	00	01	01	11	10	11	01	10	01	10	10	00	01	11	00	00		
32	10	10	10	10	10	10	10	11	01	11	10	00	01	11	11	11		
64	11	00	00	01	11	10	11	11	10	00	10	11	10	01	10	01		
96	00	00	01	00	10	10	01	11	01	10	10	00	11	11	00	11		
128	11	10	01	10	11	00	01	01	01	00	10	00	11	11	11	10		
160																		
192																		
224																		
256																		
288																		
320																		
352																		

Fig. 62 Bit-stream display of an compressed mode channel using slot format A.

Bitstream SR 240 ksps  
Chan Code 4  
 CF 1 GHz CPICH Slot 0 Chan Slot 0

Format	CPRSD	13B:	56xData1				8xTPC		16xTFCI				224xData2				16xPilot	
0	00	01	01	11	10	11	01	10	01	10	10	00	01	11	01	11		
32	10	00	01	11	11	11	11	00	00	01	11	10	00	00	00	00		
64	10	10	10	10	10	10	10	11	11	11	10	00	10	11	10	01		
96	10	01	00	00	01	00	10	10	01	11	01	10	10	00	11	11		
128	00	11	11	10	01	10	11	00	01	01	01	00	10	00	11	10		
160	00	11	01	10	10	10	11	10	00	10	01	10	00	10	00	10		
192	00	00	00	01	00	00	10	00	11	00	00	10	01	11	00	10		
224	10	10	11	00	00	11	01	11	10	10	01	10	11	10	01	00		
256	01	01	00	00	10	10	11	01	00	11	11	11	01	10	01	00		
288	10	01	01	10	11	11	11	00	11	11	11	11	11	11	10	10		
320																		
352																		

Fig. 63 Bit-stream display of an compressed mode channel using slot format B.

Display of TPC symbols in the first slot of a compressed gap

In compressed mode the TPC symbols can be sent within the first slot of the compressed gap. Within this version, the bit-stream, symbol EVM and symbol constellation display considers the TPC symbols. In bit-stream, all suppressed symbols of the slot are marked by "-". The TPC bits are displayed with its sent value.

The examples below shows the bit-stream display of the first slot in the compressed gap. All symbols accept of the TPC are suppressed in this slot. The channels is sent in slot format A (Fig. 64)and a slot format (Fig. 65) signal.



Code Domain Measurements on 3GPP FDD Signals

Bitstream SR 120 ksps  
Chan Code 4  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	CPRSD	13A:	28xData1	4xTPC	16xTFCI	104xData2	8xPilot
0	--	--	--	--	--	--	00 00
32	--	--	--	--	--	--	--
64	--	--	--	--	--	--	--
96	--	--	--	--	--	--	--
128	--	--	--	--	--	--	--
160							
192							
224							
256							
288							
320							
352							

Fig. 64 First slot of a compressed gap including TPC symbols. (slot format A)

Bitstream SR 240 ksps  
Chan Code 4  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	CPRSD	13B:	56xData1	8xTPC	16xTFCI	224xData2	16xPilot
0	--	--	--	--	--	--	--
32	--	--	--	--	--	--	--
64	--	--	--	--	--	00 00	00 00
96	--	--	--	--	--	--	--
128	--	--	--	--	--	--	--
160	--	--	--	--	--	--	--
192	--	--	--	--	--	--	--
224	--	--	--	--	--	--	--
256	--	--	--	--	--	--	--
288	--	--	--	--	--	--	--
320							
352							

Fig. 65 First slot of a compressed gap including TPC symbols. The spreading factor is reduced (slot format B)

**SYNC TYPE CPICH/SCH**

The SYNC TYPE CPICH/SCH softkey allows the user to choose between synchronization with or without CPICH. If CPICH is selected, FS-K72/K74/K74+ assumes that the CPICH control channel is present in the signal and attempts to synchronize to this channel. If the signal does not contain CPICH (test model 4 without CPICH), synchronization fails.

If SCH is selected, FS-K72/K74/K74+ synchronizes to the signal without assuming the presence of a CPICH. This setting is required for measurements on test model 4 without CPICH. While this setting can also be used with other channel configurations, it should be noted that the probability of synchronization failure increases with the number of data channels.

The default setting of the softkey is CPICH.

Remote: SENSE1:CDP:STYP CPIC | SCH

**ANT DIV ON/OFF**

The *ANT DIV ON/OFF* softkey activates or deactivates the antenna diversity mode for CDP analysis. If the softkey is set to ON, analysis is carried out with diversity antenna 1 as a default setting (see *ANT NO. 1/2* softkey). The default setting of the softkey is OFF.

Remote: SENS1:CDP:ANT OFF|1|2

**ANT NO. 1/2**

The *ANT NO. 1/2* softkey switches between diversity antennas 1 and 2. Depending on the softkey setting, FS-K72/K74/K74+ synchronizes to the CPICH of antenna 1 or antenna 2.

The softkey is available only if the antenna diversity mode is active (*ANT DIV ON/OFF* softkey set to ON).

The default setting of the softkey is 1.

Remote: SENS1:CDP:ANT OFF|1|2

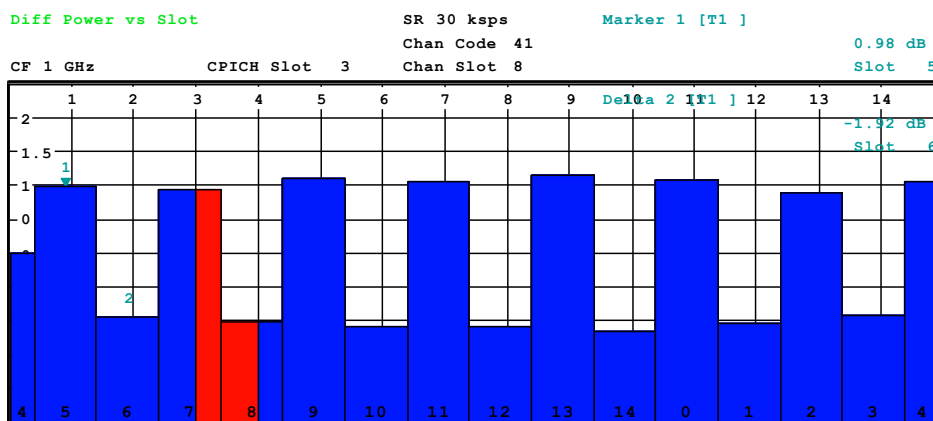
**POWER DIFF ON/OFF**

The *POW DIFF ON/OFF* softkey selects the indication of the slot power difference between the actual slot and the previous slot. To get the results it is necessary to activate the power versus slot measurement in the result display.

The default setting of the softkey is OFF

OFF: The slot power of each slot is displayed (POWER VS SLOT display).

ON: The slot power difference to the previous slot is displayed for each slot (POWER VS SLOT display).



**Fig. 66** Slot power difference of a alternating slot power sequence, with a power step of 1 dB between each step.

Remote: SENS1:CDP:PDIF ON|OFF

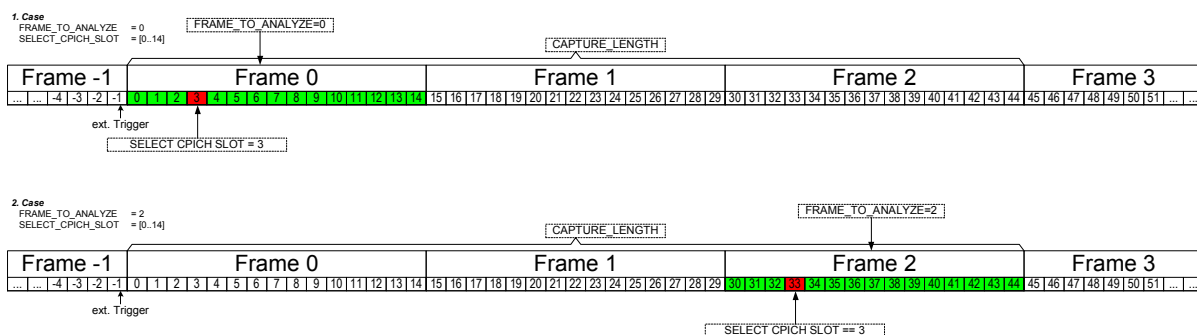
**MULTI FRM CAPTURE**

CAPTURE LENGTH
FRAME TO ANALYZE

The MULTI FRM CAPTURE softkey opens a submenu for specifying the parameters for multi-frame measurement. This measurement supports the data acquisition and evaluation of more than one 3GPP WCDMA frame. Depending on the analyzer type that is used, several frames can be captured and evaluated. The figure below 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 displayed in the result summary. For the TTF time of frame n, the following equation is used:

$$TTF_n = TTF_0 + n \cdot 10 \text{ ms}$$

For FSQ only: If the capture length is set to a minimum of 3 frames, the external trigger can be applied at any position in the frame preceding the first frame to be captured. In this case, the TTF of frame 0 can also reach larger values lower than 10ms. The maximum number of captured frames depends on the memory size and the trigger mode.



**Fig. 67 Data scheme of the captured and analyzed frames**

Table 9 Maximum number of captured frames

Analyzer	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	3 frames	2 frames
R&S FSQ	100 frames	100 frames	100 frames	100 frames
R&S FSMR	3 frames	2 frames	3 frames	2 frames

### CAPTURE LENGTH

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

Remote: 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: [Frames]

Default: 1

### FRAME TO ANALYZE

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

Remote: SENS:CDP:FRAM:VAL 2

Range: <numeric value> [0 ... CAPTURE\_LENGTH - 1]

Unit: [frames]

Default: 0

### MULT CARR ON/OFF

The *MULT CARR ON/OFF* softkey effects the following measurements:

- POWER
- CODE DOMAIN POWER
- SIGNAL STATISTICS

ACLR, OCCUPIED BANDWIDTH and SPECTRUM EMISSION MASK measurements refer to a single carrier. MULT CARR ACLR can handle both single and multi carrier signals.

If the MULT CARR softkey is switched to ON the adjust reference level procedure ensures that the settings of RF attenuation and reference level are optimally adjusted for measuring a multi carrier signal. Even if one of the channels next to the analyzed one has higher power than the analyzed one the device is set to a non RF or IF overload condition.

If the MULT CARR softkey is in its default state OFF, the adjust reference level procedure works as if a single carrier signal is present, which is a faster routine.

Remote: CONF:WCDP:BTS:MCAR:STAT ON | OFF

**AUTO SCALE ON/OFF**

The AUTO SCALE ON/OFF softkey is available if the MULT CARR softkey is switched ON. The autoscaling function automatically changes the level settings if the center frequency is changed to another carrier. The level settings are derived from the latest adjust reference level procedure. In default state AUTO SCALE is turned ON, but it can be turned OFF if the functionality is not needed.

Remote: CONF:WCDP:BTS:ASC:STAT ON | OFF

**CONST PARAM B**

The CONST PARAM B softkey enables an entry window for setting the constellation parameter B.

According to 3GPP specification the mapping of 16QAM and 64QAM symbols to an assigned bit-stream depends on the constellation parameter B. This parameter can be adjusted to decide which bit mapping should be used for bit-stream evaluation.



Default: 0  
Range: 0...3

Remote: SENS1:CDP:CPB 0..3

The figures below give the bit-stream of the same symbol sequence, but a varied constellation parameter B.

Bitstream

SR 240 kbps  
Chan Code 5  
CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	HSPDSCH:	640xData1	0xTPC	0xTFCI	0xData2	0xPilot
0	0000	0001	0010	0011	0100	0101 0110 0111
32	1000	1001	1010	1011	1100	1101 1110 1111
64	0000	0001	0010	0011	0100	0101 0110 0111
96	1000	1001	1010	1011	1100	1101 1110 1111
128	0000	0001	0010	0011	0100	0101 0110 0111
160	1000	1001	1010	1011	1100	1101 1110 1111
192	0000	0001	0010	0011	0100	0101 0110 0111
224	1000	1001	1010	1011	1100	1101 1110 1111
256	0000	0001	0010	0011	0100	0101 0110 0111
288	1000	1001	1010	1011	1100	1101 1110 1111
320	0000	0001	0010	0011	0100	0101 0110 0111
352	1000	1001	1010	1011	1100	1101 1110 1111

Fig. 68 Bit-stream of an counter sequence measured with constellation parameter B equal to 0.

Code Domain Measurements on 3GPP FDD Signals

Bitstream SR 240 kbps  
Chan Code 5  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	HSPDSCH:	640xData1	0xTPC	0xTFCI	0xData2	0xPilot		
0	0000	0100	1000	1100	0001	0101	1001	1101
32	0010	0110	1010	1110	0011	0111	1011	1111
64	0000	0100	1000	1100	0001	0101	1001	1101
96	0010	0110	1010	1110	0011	0111	1011	1111
128	0000	0100	1000	1100	0001	0101	1001	1101
160	0010	0110	1010	1110	0011	0111	1011	1111
192	0000	0100	1000	1100	0001	0101	1001	1101
224	0010	0110	1010	1110	0011	0111	1011	1111
256	0000	0100	1000	1100	0001	0101	1001	1101
288	0010	0110	1010	1110	0011	0111	1011	1111
320	0000	0100	1000	1100	0001	0101	1001	1101
352	0010	0110	1010	1110	0011	0111	1011	1111

Fig. 69 Bit-stream of a counter sequence measured with constellation parameter B equal to 1.

Bitstream SR 240 kbps  
Chan Code 12  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	HSPDSCH:	640xData1	0xTPC	0xTFCI	0xData2	0xPilot		
0	0011	0010	0001	0000	0111	0110	0101	0100
32	1011	1010	1001	1000	1111	1110	1101	1100
64	0011	0010	0001	0000	0111	0110	0101	0100
96	1011	1010	1001	1000	1111	1110	1101	1100
128	0011	0010	0001	0000	0111	0110	0101	0100
160	1011	1010	1001	1000	1111	1110	1101	1100
192	0011	0010	0001	0000	0111	0110	0101	0100
224	1011	1010	1001	1000	1111	1110	1101	1100
256	0011	0010	0001	0000	0111	0110	0101	0100
288	1011	1010	1001	1000	1111	1110	1101	1100
320	0011	0010	0001	0000	0111	0110	0101	0100
352	1011	1010	1001	1000	1111	1110	1101	1100

Fig. 70 Bit-stream of a counter sequence measured with constellation parameter B equal to 2.

Bitstream SR 240 kbps  
Chan Code 5  
 CF 1 GHz CPICH Slot 3 Chan Slot 3

Format	HSPDSCH:	640xData1	0xTPC	0xTFCI	0xData2	0xPilot		
0	1100	1000	0100	0000	1101	1001	0101	0001
32	1110	1010	0110	0010	1111	1011	0111	0011
64	1100	1000	0100	0000	1101	1001	0101	0001
96	1110	1010	0110	0010	1111	1011	0111	0011
128	1100	1000	0100	0000	1101	1001	0101	0001
160	1110	1010	0110	0010	1111	1011	0111	0011
192	1100	1000	0100	0000	1101	1001	0101	0001
224	1110	1010	0110	0010	1111	1011	0111	0011
256	1100	1000	0100	0000	1101	1001	0101	0001
288	1110	1010	0110	0010	1111	1011	0111	0011
320	1100	1000	0100	0000	1101	1001	0101	0001
352	1110	1010	0110	0010	1111	1011	0111	0011

Fig. 71 Bit-stream of a counter sequence measured with constellation parameter B equal to 3.

**HS-DPA/UPA ON/OFF**

The *HS-DPA/UPA ON/OFF* softkey selects if the HSUPA or HSDPA channels are searched or not.

- ON: The high speed channels can be detected (default settings).  
 A detection of the modulation type (QPSK /16QAM) is done instead of a detection of pilot symbols.

OFF: The high speed channel can not be detected.  
A detection of pilot symbols is done instead a detection of the modulation type (QPSK /16QAM).

Remote: SENS:CDP:HSDP ON|OFF

#### RRC FILTER ON / OFF

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.

Remote: SENS:CDP:FILT ON|OFF

#### INVERT Q ON / OFF

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

Remote: SENS:CDP:QINV OFF|ON

#### SIDEBAND NORM / INV

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

NORM The normal position allows the measurement of RF signals from the base station.

INV The inverted position is useful for measurements on IF modules or components in the case of spectral inversion.

The default setting is *NORM*.

Remote: SENS:CDP:SBAN NORM|INV

#### **Explanation:**

Pressing the *SIDE BAND [INV]* softkey or activating the *INVERT Q* softkey inverts the baseband spectrum. When the two softkeys are active, the spectrum is inverted twice and in the same position as the transmit signal.

(normal → inverted → normal)

Therefore, if the two softkeys are active, synchronization to the signal is still possible but the EVM is reduced. This is due to inverted frequency response correction.

#### **Measuring signals in inverted position:**

If a signal in inverted position is to be measured, only one of the softkeys *SIDE BAND [INV]* and *INVERT Q* should be pressed. The following combination is useful because, in this case, the EVM is not reduced by inverted frequency response correction.

*SIDE BAND [NORM]*

*INVERT Q [ON]*

## Code Domain Measurements on 3GPP FDD Signals

```
Remote: SENS:CDP:SBAN NORM
        SENS:CDP:QINV ON
```

**NORMALIZE ON / OFF**

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

```
Remote: SENS:CDP:NORM OFF
```

**CPICH USER DEF**

The *CPICH USER DEF* softkey allows the selection of different CPICH code numbers and patterns used for synchronization. If a CPICH with a code number different from 0 or a different CPICH pattern shall be used for signal analysis, this switch has to be turned on. Turning off leads again to standard-compliant behavior without losing the settings of the next two input parameters. This softkey is only available with R&S FS-K74+ option.

```
Remote: SENS:CDP:UCP:STAT ON|OFF
```

**CPICH CODE#**

The *CPICH CODE#* softkey provides a window for input of a user defined CPICH code number. The value can be chosen in the range of 0..255. This softkey is only available with R&S FS-K74+ option.

```
Remote: SENS:CDP:UCP:CODE 0..255
```

**CPICH PATT ANTENNA | PATTERN 1 | PATTERN 2**

The standard defines two different CPICH patterns for Antenna 1 and Antenna 2, referred to by "Pattern 1" and "Pattern 2", respectively, in the following. Using the *SETTINGS* hotkey the antenna selection is done with the "ANT. NO" softkey, influencing the assumptions on SCH-channels, CPICH pattern, pilot symbols, etc.. By multiple pressing the softkey *CPICH PATT*, it is possible to choose the CPICH pattern either depending on the antenna selection ("ANTENNA"), or independently from the antenna selection, i.e. fixed to "PATTERN 1" or "PATTERN 2". The default setting is "ANTENNA" (same behavior as in the case of no user defined CPICH). This softkey is only available with R&S FS-K74+ option.

```
Remote: SENS:CDP:UCP:PATT OFF|1|2
```

**MIMO ON / OFF**

The *MIMO ON / OFF* softkey switches the single antenna MIMO mode on or off. Channels that have modulation type MIMO-QPSK or MIMO-16QAM will only be recognized as active channels at MIMO ON. MIMO OFF represents those channels in blue color, stating they are not recognized. This softkey is only available with R&S FS-K74+ option.

```
Remote: SENS:CDP:MIMO ON | OFF
```



### 6.10.4 Frequency Settings – *FREQ* key

CENTER
CF-STEPSIZE
FREQUENCY OFFSET
MANUAL

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

#### CENTER

The *CENTER* softkey opens the window for manually entering the center frequency.

The permissible range of values for the center frequency is:

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

$f_{\text{center}}$  center frequency

$\text{minspan}$  smallest selectable span > 0 Hz (10 Hz)

$f_{\text{max}}$  max. frequency

Remote: `FREQ:CENT 100MHz`

#### CF-STEPSIZE

With the softkey *CF STEPSIZE* a submenu with the softkey *MANUAL* is available. The default value of 10 Hz can be adjusted

#### FREQUENCY OFFSET

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

Remote: `FREQ:OFFS 10 MHz`

#### MANUAL

The center frequency can be adjusted either by typing in the carrier frequency or by using the key up and key down keys or the knob wheel. The stepsize can be set, e.g. to a carrier spacing in multi carrier measurements.

Remote: `SENS:FREQ:CENT:STEP 15 Hz`

### 6.10.5 Span Settings – *SPAN* key

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

### 6.10.6 Level Settings – *AMPT* key

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).

```
Remote: DISP:WIND:TRAC:Y:RLEV -60dBm
```

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

```
Remote: :SENSe2: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.

```
Remote: DISP:WIND:TRAC:Y:RLEV:OFFS -10dB
```

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

```
Remote: DISP:WIND2:TRAC1:Y:SCAL:PDIV
```

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

```
Remote: DISP:WIND1:TRAC1:Y:SCAL:RPOS
```

The *RF ATTEN MANUAL* softkey allows the attenuation to be entered irrespective of the reference level.

The attenuation can be set in 10 dB steps between 0 and 70 dB (in 5 dB steps between 0 and 75 dB if option R&S FSU-B25, *Electronic Attenuator*, is fitted). Other entries will be rounded to the next lower integer value.

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

```
Remote: 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.

```
Remote: INP:ATT:AUTO ON
```

### 6.10.7 Marker Settings – MKR key

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, and they can be defined as a 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 *MARKERS 2 to 4* have been switched on, they are delta markers that are referenced to *MARKER 1*. These markers can be converted into markers with absolute value displays by means of the *MARKER NORM DELTA* softkey. When *MARKER 1* is the active marker, pressing the *MARKER NORM DELTA* softkey switches on an additional delta marker.

Pressing the *MARKER 1 to MARKER 4* softkey switches off the selected marker.

```
Remote:  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 the active marker. With the zoom function, more details of the measurement signal can be seen. The softkey *MARKER ZOOM* can be selected only if at least one of the markers is activated. If an instrument setting is changed after *MARKER ZOOM* is selected, the function is cancelled.

```
Remote:  CALC:MARK:FUNC:ZOOM
```

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

```
Remote:  CALC:MARK:AOFF
```

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



```
Marker 1 [T1 ]
                -6.02 dBm
Slot 4 SR 30.00 ksp/s Ch 62
```

**Fig. 72 Parameters of marker info field**

In addition to the channel power, which is displayed relative to the value specified with *POWER REF TOT/CPICH*, the parameters are:

Slot 4: Slot number of the channel (unassigned codes have a timing offset of 0 chips referenced to the beginning of the frame)  
 SR 30 ksp/s: Symbol rate of the channel (for unassigned codes 7.5 ksp/s)  
 Ch 62: Number of the spreading code of the channel

### 6.10.8 Changing Instrument Settings – *MKR* → key

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

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

```
Remote:  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 the *MKR*-> menu is called, *MARKER 1* is automatically switched on and the peak search is performed.

```
Remote:  CALC:MARK:MAX, CALC:MARK:MIN
         CALC:DELT:MAX, 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).

```
Remote:  CALC:MARK:MAX:NEXT, CALC:MARK:MIN:NEXT
         CALC:DELT:MAX:NEXT, CALC:DELT:MIN:NEXT
```

The *NEXT MODE LEFT/RIGHT* softkey defines the direction in which the next higher maximum or minimum is searched for. For *NEXT MODE LEFT/RIGHT*, the search is done to the left/right of the active marker.

```
Remote:  CALC:MARK:MAX:LEFT, CALC:MARK:MAX:RIGH
         CALC:DELT:MAX:LEFT, CALC:DELT:MAX:RIGH
         CALC:MARK:MIN:LEFT, CALC:MARK:MIN:RIGH
         CALC:DELT:MIN:LEFT, CALC:DELT:MIN:RIGH
```

The *PEAK MODE MIN/MAX* softkey defines if the next minimum or maximum peak should be searched for. The parameter influences the behaviour of the *PEAK* and *NEXT PEAK* softkeys.

```
Remote  --
```

The *MARKER -> CPICH* softkey sets the marker to the common pilot channel (code number 0 for spreading factor 256; corresponds to displayed code numbers 0 and 1 of the x axis).

```
Remote:  CALC<1 | 2>:MARK<1>:FUNC:CPIC
         CALC<1 | 2>:MARK<1>:Y?
```

The *MARKER -> PCCPCH* softkey sets the marker to the primary common control physical channel (code number 1 for spreading factor 256; corresponds to displayed code numbers 2 and 3 of the x axis).

```
Remote:  CALC<1 | 2>:MARK<1>:FUNC:PCCP
         CALC<1 | 2>:MARK<1>:Y?
```

### 6.10.9 Marker Functions – MKR *FCTN* key

The *MKR FCTN* key is disabled for all measurements in the code domain power. For all other FS-K72/K74/K74+ measurements, the menu softkeys are described in the manual for the base unit.

### 6.10.10 Bandwidth Setting – *BW* key

The *BW* key is disabled for all measurements in the code domain power. For all other R&S FS-K72/K74/K74+ measurements, the menu-specific softkeys are described in the manual for the base unit.

### 6.10.11 Measurement Control – *SWEEP* key

The menu of the *SWEEP* key contains options for switching between single measurement and continuous measurement and for controlling 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 for the base unit.

### 6.10.12 Measurement Selection – Taste *MEAS*

The menu of the *MEAS* key contains all the FS-K72/K74/K74+ measurements that can be selected at a keystroke. The menu and its submenus are described in chapter 6.

### 6.10.13 Trigger Settings – *TRIG* key

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 base unit. The associated softkeys are described in the manual for the base 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.

```
Remote: TRIG:SEQ:LEV:EXT 1.4V
        Read trigger level
        TRIG1:SEQ:LEV:EXT?
        Activate external Trigger Mode
        TRIG1:SEQ:SOUR EXT
        Inactivate external Trigger Mode
        TRIG1:SEQ:SOUR IMM
```

### 6.10.14 Trace Settings – *TRACE* key

The *TRACE* key opens the following submenu:

CLEAR/WRITE
MAX HOLD
MIN HOLD
AVERAGE
VIEW
SWEEP COUNT
SCREEN A / SCREEN B

#### **CLEAR/WRITE**

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 R&S Analyzer clears the selected trace memory and restarts the measurement.

Remote:        `DISP:WIND:TRAC:MODE WRIT`

#### **MAX HOLD**

The *MAX HOLD* softkey activates the max peak detector.

The R&S 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 during 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.

Remote:    `DISP:WIND:TRAC:MODE MAXH`

#### **MIN HOLD**

The *MIN HOLD* softkey activates the min peak detector.

The R&S 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 during 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.

Remote:    `DISP:WIND:TRAC:MODE MINH`

## AVERAGE

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 R&S Analyzer, the sample detector is used.

Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared..

```
Remote: DISP:WIND:TRAC:MODE AVER
```

## VIEW

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.

```
Remote: DISP:WIND:TRAC:MODE VIEW
```

## SWEEP COUNT

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.

```
Remote: 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 that are described above are applied only to the measurement results, which are displayed in the selected screen. A 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 they are 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. Especially the resolution and accuracy of the trigger to frame value can be increased by using the trace average mode.

```

Result Summary
SR 15 ksp/s
Chan Code 0
Chan Slot 0
CF 2.9 GHz      CPICH Slot 0

```

GLOBAL RESULTS FOR FRAME 0:		Carrier Freq Error	402.64 mHz	
Total Power	AVG -24.42 dBm	Trg to Frame	AVG 344.179089 µs	
Chip Rate Err	AVG -0.84 ppm	Avg Pow Ina Chan	AVG -58.44 dB	
IQ Offset / Imb		AVG 0.06 / 0.07 %	PkCDE(960ksp/s)	AVG -49.72 dB
Composite EVM	AVG 3.66 %	Avg RCDE (64QAM)	AVG -29.30 dB	
Rho	AVG 0.99866	No of Active Chan	44	
CHANNEL RESULTS		RCDE	AVG -42.75 dB	
Symbol Rate	15.00 ksp/s	Timing Offset	AVG 0 Chips	
Channel Code	0	Channel Slot No	0	
No of Pilot Bits	0			
Chan Pwr Rel	AVG 0.00 dB	Chan Pwr Abs	AVG -34.61 dBm	
Symbol EVM	AVG 0.81 % rms	Symbol EVM	AVG 1.21 % Pk	

SWP 8 of 20

Fig. 73 Result summary with applied average mode

### 6.10.15 Display Lines – *LINES* key

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 base unit; the associated softkeys are described in the manual for the base unit.

### 6.10.16 Settings of Measurement Screen – *DISP* key

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

### 6.10.17 Storing and Loading of Unit Data – *FILE* key

The *FILE* menu is identical to that of the base unit. All softkeys are described in the manual for the base unit. All keys of the R&S Analyzer front panel that are not specifically mentioned are identical to those of the base unit. The key functions and the softkeys are described in the manual for the base unit.



### 6.10.18 Preset of device – *PRESET* key

The *PRESET* key presets the device. The behavior is the same as of the basic unit and is described in the manual for the basic unit.

### 6.10.19 Calibration of device – *CAL* key

The menu *CAL* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

### 6.10.20 Setup of device – *SETUP* key

The menu *SETUP* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit. The usage of transducer factors is possible in the Code-Domain as well as in the RF measurements.

Using the FS-K9 “Measurements with Power Sensor” is also possible within that application. Therefore the FS-K9 must be installed and the option key must be entered, then in the sidemenu the softkey *POWERMETER* is available. For further details of the FS-K9 please refer to the FS-K9 software manual.

### 6.10.21 Printing – *HCOPY* key

The menu *HCOPY* is the same as that of the basic unit. All softkeys are described in the manual for the basic unit.

All keys on the front panel of the unit that are not specifically mentioned are identical to those of the basic unit. The functions of the keys 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 alphabetic list at the end of this chapter provides an overview of the commands. The commands, which are also valid for the base unit in the signal analyzer mode as well as the system settings, are described in the operating manual for the analyzer.

### 7.1 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.

---

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

This command selects the measured data to be displayed.

##### Parameter

```
<string> := 'XPOWer:CDP' |
            'XPOWer:CDPower:ABSolute' |
            'XPOWer:CDPower:RATio' |
            'XPOWer:CDEP'
            'XTIMe:CDPower:FVSLot' |
            'XTIMe:CDPower:MACCuracy' |
            'XTIMe:CDPower:PVSymbol' |
            'XTIMe:CDPower:PVSLOT' |
            'XTIMe:CDPower:PVSLOT:ABSolute' |
            'XTIMe:CDPower:PVSLOT:RATio' |
            'XTIMe:CDPower:COMP:CONStellation'
            'XTIMe:CDPower:BSTReam' |
            'XTIMe:CDPower:CHIP:EVM' |
            'XTIMe:CDPower:CHIP:MAGNitude' |
            'XTIMe:CDPower:CHIP:PHASe' |
            'XTIMe:CDPower:ERR:SUMMery' |
            'XTIMe:CDPower:ERR:CTABLE' |
            'XTIMe:CDPower:ERR:PCDomain' |
            'XTIMe:CDPower:SYMB:CONStellation' |
            'XTIMe:CDPower:SYMB:EVM'
            'XTIMe:CDPower:SYMBol:EVM:MAGNitude' |
            'XTIMe:CDPower:SYMBol:EVM:PHASe' |
```

##### Example

```
CALC2:FEED `XTIM:CDP:MACC` "
```

##### Characteristics

\*RST value: 'XTIM:OFF'  
SCPI: device-specific



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

The string parameters are defined as follows:

'XPOW:CDP'	Result display of code domain power as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:ABS'	Result display of code domain power ratio as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:RAT'	Result display of code domain power ratio as bar graph [absolute scaling] (CALCulate<1>)
'XPOW:CDP:ERR'	Result display of code domain error power as bar graph (CALCulate<1>)
'XTIM:CDP:CHIP:EVM'	Result display error vector magnitude (EVM) versus Chip
'XTIM:CDP:CHIP:MAGN'	Result display magnitude error versus chip
'XTIM:CDP:CHIP:PHAS'	Result display phase error versus chip
'XTIM:CDP:ERR:SUMM'	Result display in tabular form (CALCulate2)(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:MACC'	Result display of composite EVM (error vector magnitude referenced to the overall signal) (CALCulate2)
'XTIM:CDP:PVS'	Result display of power versus symbol (CALCulate2)
'XTIM:CDP:COMP:CONS'	Result display of composite constellation (CALCulate2)
'XTIM:CDP:FVSL'	Result display of frequency versus slot (CALCulate2)
'XTIM:CDP:PVSL'	Result display of power versus slot (CALCulate2)
'XTIM:CDP:PVSL:ABS'	Result display of power versus slot [absolute scaling] (CALCulate2)
'XTIM:CDP:PVSL:RAT'	Result display of power versus slot [absolute scaling] (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)

## 7.2 CALCulate:LIMit - Subsystem

### 7.2.1 CALCulate:LIMit:ACPower Subsystem

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

---

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

This command activates the limit check for the adjacent channel when adjacent- 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
'Switches on the check of absolute limit values for the adjacent channels.
```

#### 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:REL: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[: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: 0DB  
SCPI: device-specific

**CALCulate<1|2>:LIMit1:ACPpower: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:ACPpower:STATe ON`.

The result can be queried with `CALCulate:LIMit:ACPpower:ACHannel:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no 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:ACPpower: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>:ABSolute  
200DBM...200DBM, -200...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 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:ALT:ABS: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:ACPpower:ALternate<1...11>[:RELative] 0...100DB, 0...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:ACPpower: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: 0 DB  
SCPI: device-specific

**CALCulate<1|2>:LIMit1:ACPpower: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:ACPpower:STATe ON`. The numeric suffix after `ALternate` denotes alternate channel. The result can be queried with `CALCulate:LIMit:ACPpower:ALternate<1...11>:RESult?`. It should be noted that a complete measurement must be performed between switching on the limit check and the result query, since otherwise no valid results are obtained.

**Example**

```
CALC:LIM:ACP:ALT: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:ACPpower: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:ALT:RES?
```

'Queries the limit check result in the second alternate adjacent channels.'

**Characteristics**

\*RST value: --

SCPI: device-specific

**CALCulate<1|2>:LIMit1:ACPpower[: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:LIMit1:ACPpower:ACHannel:STATe` or `CALCulate:LIMit1:ACPpower: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

**7.2.2 CALCulate:LIMit:ESPECTrum Subsystem**

The `CALCulate:LIMit:ESPECTrum` subsystem defines limit checking for spectral measurements with options `WCDMA 3G FDD BTS` (option R&S FS-K72/K74/K74+).

**CALCulate:LIMit:ESPECTrum:MODE AUTO | MANual | USER**

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

**Parameter**

AUTO	The limit line is set as a function of the measured channel power.
MANUAL	One of the four predefined limit lines is set. The selection is made with the command <code>CALC:LIM:ESP:VAL</code> .
USER	Query only; user-defined limit lines are active (refer to description of limit lines in the manual for the base unit).

**Example**

```
CALC:LIM:ESP:MODE AUTO
```

**Characteristics**

\*RST value: AUTO  
 SCPI: device-specific

**CALCulate<1|2>:LIMit<1...8>:ESPectrum:RESTore**

This command restores the standard limit lines for the spectrum emission mask measurement. All modifications made to the standard limit lines are lost and the default setting valid upon delivery is restored.

**Example**

```
CALC:LIM:ESP:REST
'Sets the spectrum emission mask limit lines back to the
default setting
```

**Characteristics**

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

**CALCulate:LIMit:ESPectrum:TRANsition <numeric\_value>**

This command specifies the offset frequency at which the resolution bandwidth is changed between 30k and 1MHz. For multicarrier spectrum emission mask measurement this value can be extended. It is recommended to define user specific limit lines in this case..

**Example**

```
"CALC:LIM:ESP:TRAN 2MHz"
```

**Characteristics**

\*RST value: 4.0 MHz  
 SCPI: device-specific

**CALCulate:LIMit:ESpectrum:VALue <numeric\_value>**

This command activates manual selection of the limit line. This means that one of the four possible limit lines is selected by specifying the expected power range as a value:

Specified value in dBm	Selected limit line	Value returned on query
Value $\geq$ 43	„P $\geq$ 43“	43
39 $\leq$ Value < 43	„39 $\leq$ P < 43“	39
31 $\leq$ Value < 39	„31 $\leq$ P < 39“	31
Value < 31	„P < 31“	0

**Example**

```
CALC:LIM:ESP:VAL 39
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

## 7.3 CALCulate:MARKer – Subsystem

**CALCulate<1|2>:MARKer<1>:FUNCtion:CPICh**

This command sets the marker to channel 0.

This command is an <Event> and, therefore, has neither an \*RST value: nor a query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with:

CALCulate<1> for CDP absolute and relative

CALCulate2 for composite EVM, peak code domain error, power versus slot, bit stream, symbol constellation and EVM

**Example**

```
CALC:MARK:FUNC:CPIC"
```

**Characteristics**

\*RST value: -  
SCPI: device-specific

**CALCulate<1|2>:MARKer<1>:FUNCtion:PCCPch**

This command sets the marker to channel 1.

This command is an <Event> and, therefore, has neither an \*RST value: nor a query. Only the numeric suffix 1 is permissible in MARKer.

The numeric suffix in CALCulate that is required or permissible depends on the selected display mode for which the marker is to be valid and has to coincide with:

CALCulate<1> for CDP absolute and relative

CALCulate2 for composite EVM, peak code domain error, power versus

slot, bit stream, symbol constellation and EVM

### Example

```
CALC:MARK:FUNC:PCCP"
```

### Characteristics

\*RST value: -  
SCPI: device-specific

## CALCulate<1|2>:MARKer<1...4>:FUNCTION:POWER:MODE WRITE | MAXHold

This command selects the Clear Write or Maxhold for Channel Power values.

### Example

```
CALC:MARK:FUNC:POW:MODE MAXH
'Maxhold for Channel Power values
```

### Characteristics

\*RST value: WRITE  
SCPI: device-specific

## CALCulate<1|2>:MARKer<1...4>:FUNCTION:POWER:RESult? ACPower | CPOWER | MCACpower | OBANdwidth | OBWidth

This command queries the result of the power measurement performed in the selected window. If necessary, the measurement is switched on prior to the query. The channel spacings and channel bandwidths are configured in the `SENSe:POWer:ACHannel` subsystem.

To obtain a valid result, a complete sweep with synchronization to the end of the sweep must be performed before a query is output. Synchronization is possible only in the single-sweep mode.

### Parameter

ACPower: Adjacent-channel power measurement  
Results are output in the following sequence, separated by commas:

3. Power of transmission channel
4. Power of lower adjacent channel
5. Power of upper adjacent channel
6. Power of lower alternate channel 1
7. Power of upper alternate channel 1
8. Power of lower alternate channel 2
9. Power of upper alternate channel 2

The number of measured values returned depends on the number of adjacent/alternate channels selected with

```
SENSe:POWer:ACHannel:ACPairs.
```

With logarithmic scaling (RANGE LOG), the power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If

```
SENSe:POWer:ACHannel:MODE REL
```

is selected, the

adjacent/alternate-channel power is output in dB.

**CPOWer** Channel power measurement  
With logarithmic scaling (RANGE LOG), the channel power is output in the currently selected level unit; with linear scaling (RANGE LIN dB or LIN %), the channel power is output in W.

**MCACpower:** Channel/adjacent-channel power measurement with several carrier signals  
Results are output in the following sequence, separated by commas:

1. Power of carrier signal 1
2. Power of carrier signal 2
3. Power of carrier signal 3
4. Power of carrier signal 4
5. Power of carrier signal 5
6. Power of carrier signal 6
7. Power of carrier signal 7
8. Power of carrier signal 8
9. Power of carrier signal 9
10. Power of carrier signal 10
11. Power of carrier signal 11
12. Power of carrier signal 12
13. Total power of all carrier signals
14. Power of lower adjacent channel
15. Power of upper adjacent channel
16. Power of lower alternate channel 1
17. Power of upper alternate channel 1
18. Power of lower alternate channel 2
19. Power of upper alternate channel 2

The number of measured values returned depends on the number of carrier signals and adjacent/alternate channels selected with `SENSE:POWer:ACHannel:TXChannel:COUNT` and `SENSE:POWer:ACHannel:ACPairs`.

If only one carrier signal is measured, the total value of all carrier signals will not be output.

With logarithmic scaling (RANGE LOG), the power is output in dBm; with linear scaling (RANGE LIN dB or LIN %), the power is output in W. If `SENSE:POWer:ACHannel:MODE REL` is selected, the adjacent/alternate-channel power is output in dB.

**OBANdwidth |** Measurement of occupied bandwidth  
**OBWidth** The occupied bandwidth in Hz is returned.

### Example

```
CALC:MARK:FUNC:WCDP:RES? ACP
```

### Characteristics

\*RST value: -  
SCPI: device-specific

---

**CALCulate<1|2>:MARKer<1...4>: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: -

SCPI: device-specific

---

**CALCulate<1>:MARKer<1>:FUNction:TAERror:RESult? TAERror**

This command queries the result of the Time Alignment Error measurement, if the corresponding base station test was selected with the command `"CONF:WCDP:BTS:MEAS TAER"`.

To obtain a valid result, a complete sweep with synchronization to the end of the sweep must be performed. Additionally, the synchronization state must be checked reading the SYNC register with `" :STAT:QUES:SYNC:COND?"`

**Example**

```
CALC:MARK:FUNC:TAER:RES? TAER
```

**Characteristics**

\*RST value: -

SCPI: device-specific

---

**CALCulate<1|2>:MARKer<1>:FUNCtion:WCDPower[:BTS]:RESult? PTOTal | FERRor | TFRame | TOFFset | MACCuracy | PCDerror | EVMRms | EVMPeak | CERRor | CSLot | SRATe | CHANnel | CDPabsolute | CDPRelative | IQOFFset | IQIMbalance | MTYPe | RHO | PSYMBOL | ACHannels | MPIC | RCDerror | ARCDerror**

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	TOFFset	timing offset
MACCuracy	composite EVM	PCDerror	peak code domain error
EVMRms	error vector magnitude RMS	EVMPeak	error vector magnitude peak
CERRor	chip rate error	CSLot	channel slot number
SRATe	symbol rate	CHANnel	channel number
CDPabsolute	channel power absolute	CDPRelative	channel power relative
IQOFFset	I/Q offset	IQIMbalance	I/Q imbalance
MTYPe	modulation type	PSYMBOL	Number of pilot bits
RHO	rho value for every slot	ACHannels	Number of active channels
MPIC	Mean Power of Inactive Chan.	RCDerror	Relative Code Domain Error
ARCDerror	Average RCDE for 64QAM		

### Example

```
CALC:MARK:FUNC:WCDP:RES? PTOT
```

### Characteristics

\*RST value: -  
SCPI: device-specific

## 7.4 CALCulate:PEAKsearch – Subsystem

### CALCulate<1|2>:PEAKsearch

The limit mask - reduced by an overall margin - is checked against the trace. The fail positions are marked. Every value is added to a peak list, which can be opened and saved in ASCII format or read out via an IEC/IEEE command.

### Example

```
CALC:PEAK
```

### Characteristics

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

**Query of results**

```
CALC<1|2>:PEAK?
```

**Result:**

```
<-->
```

**CALCulate<1|2>:PEAKsearch:AUTO <Boolean>**

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.

ON: Enables automatic peak search

OFF: Disables automatic peak search

**Example**

```
CALC1:PEAK:AUTO ON
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**CALCulate<1|2>:PEAKsearch:MARGin -200 ... 200 dB**

This command defines an overall margin which is subtracted from the limit line to make the peak search more stronger. If the values of the trace are above the limit line minus margin value it will be marked in the peak list.

**Example**

```
CALC:PEAK:MARG 6
```

**Characteristics**

\*RST value: 6

SCPI: device-specific

**Query of results**

```
CALC1:PEAK:MARG?
```

**Result**

```
<value>
```

**CALCulate<1|2>:PEAKsearch:SUBRange 1 ... 50**

The command defines how many peaks are searched for within one range. The ranges are:

- below -4 MHz from the carrier,
- above +4 MHz from carrier, and
- the area from -4 MHz to +4 MHz around the carrier.



**Example**

```
CALC:PEAK:SUBR 25
```

**Characteristics**

\*RST value: 25  
SCPI: device-specific

**Query of results**

```
CALC1:PEAK:SUBR?
```

**Result**

```
<value>
```

## 7.5 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.

---

**CALCulate:STATistics:APD[:STATe] ON | OFF**

This command switches on or off the measurement of the amplitude distribution function (APD).

**Example**

```
CALC:STAT:APD ON
```

**Characteristics**

\*RST value: OFF  
SCPI: device-specific

---

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

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

**Example**

```
CALC:STAT:CCDF ON
```

**Characteristics**

\*RST value: OFF  
SCPI: device-specific

---

**CALCulate:STATistics:NSAMples 100 ... 32768**

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

**Example**

```
CALC:STAT:NSAM 5000
```

**Characteristics**

\*RST value: 10000  
 SCPI: device-specific

**CALCulate:STATistics:SCALE:AUTO ONCE**

This command optimizes the level setting of the instrument depending on the measured peak power, in order to obtain maximum instrument sensitivity. To obtain maximum resolution, the level range is set as a function of the measured spacing between peak power and the minimum power for the APD measurement and of the spacing between peak power and mean power for the CCDF measurement. In addition, the probability scale for the number of test points is adapted.



Subsequent commands have to be synchronized with \*WAI, \*OPC or \*OPC? to the end of the autorange process which would otherwise be aborted.

**Example**

```
CALC:STAT:SCAL:AUTO ONCE;*WAI
'Adapts the level setting for statistical measurements.
```

**Characteristics**

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

**CALCulate:STATistics:SCALE:X:RLEVeI -130dBm ... 30dBm**

This command defines the reference value for the x-axis of the diagram.. At a reference value offset <>0, the range of the reference value will be changed by the offset. The unit depends on the setting of CALC:UNIT.

**Example**

```
CALC:STAT:SCAL:X:RLEV -60dBm
```

**Characteristics**

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

**CALCulate:STATistics:SCALE:X:RANGe 10dB ... 200dB**

This command defines the range of x-axis of the diagram.

**Example**

```
CALC:STAT:SCAL:X:RANG 20dB
```

**Characteristics**

\*RST value: 100dB  
 SCPI: device-specific

---

#### **CALCulate:STATistics:SCALE:Y:UPPer 1E-5 ...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:SCALE:Y:UPP 0.01
```

##### **Characteristics**

\*RST value: 1.0  
 SCPI: device-specific

---

#### **CALCulate:STATistics:SCALE:Y:LOWer 1E-6 ...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:SCALE:Y:LOW 0.001
```

##### **Characteristics**

\*RST value: 1E-6  
 SCPI: device-specific

---

#### **CALCulate:STATistics:PRESet[:DUMMy]**

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

---

#### **CALCulate:STATistics:PRESet:RLEVel**

This command adjusts the reference level to get an optimized sensitivity. Only the reference level is changed all other setting parameters are kept.

**Example**

```
CALC:STAT:PRES:RLEV
```

**Characteristics**

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

**CALCulate:STATistics:RESult<1...3>? MEAN | PEAK | CFACTor | ALL**

This command reads out the results of statistics measurement. The trace is selected via the numeric <1...3>.

MEAN mean (rms) measured power in dBm in the period of observation

PEAK measured peak power in dBm in the period of observation

CFACTor determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL results of all three measurements, separated by comma:

<mean power>,<peak power>,<crest factor>

**Example**

```
CALC:STAT:RES2? ALL
```

```
'l.i.e. mean power: 5.56 dBm, peak power 19.25 dBm, CREST
factor 13.69 dB
```

**Characteristics**

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

## 7.6 CONFigure:WCDPower Subsystem

This subsystem comprises the commands for configuring the code domain power measurements. Only the numeric suffix 1 is permissible in CONFigure.

**CONFigure:WCDPower[:BTS]:ASCale:STATe ON | OFF**

Is available if multi carrier is switched ON. The autoscaling function automatically changes the level settings if the center frequency is changed to another carrier.

ON Changes the level settings, if the center frequency is changed to another carrier.

OFF Does not change the level settings, if the center frequency is changed to another carrier.

**Example**

```
CONF:WCDP:BTS:ASC:STAT ON
```

**Characteristics**

\*RST value: ON  
 SCPI: device-specific

**Query of results:**

```
CONF:WCDP:BTS:ASC:STAT?
```

**Result:**

```
<1|0>
```

---

**CONFigure:WCDPower[:BTS]:CTABLE:CATalog?**

This command reads out the names of all channel tables stored on the hard disk.

Syntax of output format:

```
<Sum of file lengths of all subsequent files>,<free memory on hard disk>,  
<1st file name>,<1st file length><2nd file name>,<2nd file length>,...,<nth file  
name>,<nth file length>
```

**Example**

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

**Characteristics**

\*RST value: --

SCPI: device-specific

---

**CONFigure:WCDPower[:BTS]: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 :CTAB:NAME and the values of the table have to be defined with  
command CONF:WCDP:CTAB:DATA.
```

**Example**

```
CONF:WCDP:CTAB:COMM 'Comment for table 1'
```

**Characteristics**

\*RST value: --

SCPI: device-specific

**CONFigure:WCDPower[:BTS]:CTABLE:COMPare ON | OFF**

This command switches between normal predefined mode and predefined channel table compare mode.

In the compare mode a predefined channel table model can be compared against the measurement in respect of power, pilot length and timing offset of the active channels.

Comparison is a sub mode from predefined channel table measurement. It only influences the measurement if the softkey *CODE CHAN PREDEFINED* is active. If the compare mode is selected the power values, pilot lengths and timing offsets are measured and are compared against the values from the predefined channel table. The softkey *TIMING OFS PREDMEAS* becomes unavailable. These results are visualized in the corresponding columns of the measurement evaluation CHANNEL TABLE. The table can be switched on with the hotkey *RESULT, NEXT* and the softkey *CHANNEL TABL*. The columns are then titled PIL L, PWR and T OFS.

PIL L is the subtraction of PilotLengthMeasured – PilotLengthPredefined.

PWR is the subtraction of PowerRelMeasured – PowerRelPredefined.

The column POWER of the predefined channel table can be edited and via IEC/IEEE bus the value power of the definition of the channel table will be used to set the estimated power.

T OFS is the subtraction of TimingOffsetMeasured – TimingOffsetPredefined.

For non active channels dashes are shown.

**Example**

```
CONF:WCDP:CTAB:COMP ON
```

**Characteristics**

RST value: OFF

SCPI: device-specific

**CONFigure:WCDPower[:BTS]: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:CTAB:NAME`.

The name of the channel table may contain a maximum of 8 characters. This command is an "event" which is why it is not assigned an \*RST value: and has no query.

**Parameter**

<file\_name> := name of the new channel table

**Example**

```
CONF:WCDP:CTAB:COPY 'CTAB_2'
```

**Characteristics**

\*RST value: --

SCPI: device-specific

**CONFigure:WCDPower[:BTS]:CTABLE:DATA <code class>,<code number>,<use TFCI>,<timing offset > , <pilot length>,<pich>,<status>,<CDP relative [dB]>**

This command defines the values of the selected channel table.

Each line of the table consists of 8 values:

Code class:	2 to 9
Code number:	0 to 511
Use TFCI:	0: not used, 1: used
Timing offset:	0 to 38400, for code class 9, the step width is 512; otherwise, 256
Pilot length:	code class 9: 4 code class 8: 2, 4, 8 code class 7: 4, 8 code class 5/6: 8 code class 2/3/4 16
Channel Type:	0: DPCH Dedicated <b>Physical Channel</b> of a standard WCDMA Frame 1: PICH <b>Paging Indication Channel</b> 2: SCCPCH <b>Secondary Common Control Physical Channel</b> 3: HS_SCCH HSDPA: <b>High Speed Shared Control Channel</b> 4: HS_PDSCH HSDPA: <b>High Speed Physical Downlink Shared Channel</b> 5: CHAN any other QPSK modulated channel without pilot symbols 10: CPRSD Dedicated Physical Channel (DPCH) in <b>compressed</b> mode 11: CPR-TPC DPCH in <b>compressed</b> mode <b>TPC</b> symbols are sent in the first slot of the gap. 12: CPR-SF/2 DPCH in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ). 13: CPR-SF/2-TPC DPCH in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ). <b>TPC</b> symbols are sent in the first slot of the gap. 14: E-HICH: Enhanced HARQ Hybrid Acknowledgement Indicator Channel E-RGCH: Enhanced Relative Grant Channel 15: EAGCH E-AGCH: Enhanced Absolute Grant Channel
Status:	0: not active, 1: active
CDP relative:	for setting commands any value, for query CDP relative value

Channels PICH, CPICH and PCCPCH may only be defined once. If channel CPICH or PCCPCH is missing in the command, it is automatically added at the end of the table. Prior to this command, the name of the channel table has to be defined with the command `CONF:WCDP:CTAB:NAME`.

#### Example

```
CONF:WCDP:CTAB:DATA 8,0,0,0,0,0,1,0.00,
8,1,0,0,0,0,1,0.00,7,1,0,256,8,0,1,0.00
'D2 channels are defined: CPICH, PCCPCH and a channel in code
class 7
```

#### Characteristics

\*RST value: -  
SCPI: device-specific

### CONFigure:WCDPower[:BTS]:CTABLE:DELEte

This command deletes the selected channel table. The channel table to be deleted is selected with the command `CONF:WCDP:CTAB:NAME`.

#### Example

```
CONF:WCDP:CTAB:DEL
```

#### Characteristics

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

This command is an "event" which is why it is not assigned an \*RST value: and has no query.

### CONFigure:WCDPower[:BTS]: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'
```

#### Characteristics

\*RST value: ""  
SCPI: device-specific

### CONFigure<1>:WCDPower[:BTS]: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:CTAB1 ON
CONF:WCDP:CTAB:SEL 'CTAB_1'
```

#### Characteristics



\*RST value: "RECENT"  
 SCPI: device-specific

---

### CONFigure<1>:WCDPower[:BTS]:CTABLE[:State] ON | OFF

This command switches the channel table on or off. When switch-on takes place, the measured channel table is stored under the name RECENT and is switched on. After the RECENT channel table is switched on, another channel table can be selected with the command `CONF:WCDP:CTABLE:SElect`.



The RECENT channel table must always be switched on first with the command `CONF:WCDP:CTAB:STAT` and then the required channel table can be selected with the command `CONF:WCDP:CTAB:SEL`.

---

#### Example

```
CONF:WCDP:CTAB ON
```

#### Characteristics

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

---

### -CONFigure:WCDPower[:BTS]:CTABLE:TOFFset PREDefine|MEASurement

This command specifies whether the timing offset and pilot length are measured or if the values are taken from the predefined table.

PRED The timing offset and pilot length values from the predefined table are used.

MEAS The timing offset and the pilot length are measured by the application. The channel configuration is specified via the predefined channel table.

#### Example

```
CONF:WCDP:CTAB:TOFF MEAS
'Measure timing offset and pilot length in predefined mode
Measure timing offset and pilot length in predefined mode
```

#### Characteristics

\*RST value: OFF  
 SCPI: device-specific

---

### CONFigure:WCDPower[:BTS]:MCARier:STATe ON | OFF

If multi carrier is switched ON, the adjust reference level procedure ensures that the settings of RF attenuation and reference level are optimally adjusted for measuring a multi carrier signal.

ON Adjust reference level considering multi carrier conditions.

OFF Adjust reference level considering single carrier conditions

**Example**

```
CONF:WCDP:BTS:MCAR:STAT ON
```

**Characteristics**

\*RST value: OFF  
 SCPI: device-specific

**Query of results**

```
CONF:WCDP:BTS:MCAR:STAT ?
```

**Result**

```
<1|0>
```

---

**CONFigure<1>:WCDPower[:BTS]:MEASurement POWER | ACLR | ESpectrum | OBANdwith | OBWidth | WCDPower | CCDF | RFCombi | TAERror**

This command selects the 3GPP FDD base station tests. The settings of the predefined measurements are described for the associated softkey in chapter 6.

**Parameter**

POWER	Channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
ACLR	Adjacent-channel power measurement (standard 3GPP WCDMA Forward) with predefined settings
MCAClr	This command selects the 3GPP FDD base station test for measurement of <b>multi carrier adjacent channel leakage power ratio (MCACLR)</b>
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 <code>INSTRument:SElect WCDPower</code> .
WCDPower	Code domain power measurement. This selection has the same effect as command <code>INSTRument:SElect WCDPower</code> .
CCDF	Measurement of complementary cumulative distribution function
RFCombi	RF combination measurement of adjacent channel leakage error (ACLR), spectrum emission mask (SEM) and occupied bandwidth (OBW).
TAERror	Time Alignment Error measurement between the two antenna branches of a BTS supporting Tx diversity or MIMO

**Example**

```
CONF:WCDP:MEAS POW
```

**Characteristics:**

\*RST value: POWER  
 SCPI: device-specific

## 7.7 DISPlay - Subsystem

The DISPlay subsystem controls the selection and presentation of textual and graphic information as well as of measurement data on the display. The measurement windows are selected by WINDow1 (screen A) or WINDow2 (screen B).

---

### DISPlay[:WINDow<1|2>]: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

```
DISPlay[:WINDow<1|2>]:SIZE?
```

#### Result

```
<LARGE | SMALL>
```

## 7.8 FORMat - Subsystem

The FORMat subsystem defines the format for data transfer from and to the analyzer.

---

### FORMat:DEXPort:DSEPARATOR POINT | COMMA

This command is used to select between default separators '.' (decimal point) and ',' (comma).

POINT peak list is separated by point '.'

COMMA peak list is separated by comma ','

#### Example

```
FORM:DEXP:DSEP POIN
```

#### Characteristics

\*RST value: POINT

SCPI: device-specific

#### Query of results:

```
FORM:DEXPort:DSEP?
```

#### Result

```
< POINT | COMMA >
```

## 7.9 INITiate - Subsystem

The INITiate subsystem is used to control the init-measurement function in the selected measurement window. The measurement windows are assigned to INITiate1 (screen A) and INITiate2 (screen B).

---

### INITiate<1|2>:CONTInuous ON | OFF

This command determines whether the trigger system is continuously initiated (continuous) or performs single measurements (single).

In the spectrum analysis mode, this setting refers to the sweep sequence (switching between continuous/single sweep).

#### Example

```
INIT2:CONT OFF
'Switches the sequence in screen B to single sweep.

INIT2:CONT ON
'Switches the sequence to continuous sweep..
```

#### Characteristics

\*RST value: ON  
SCPI: conforming

---

### INITiate<1|2>[:IMMEDIATE]

The command initiates a new sweep in the indicated measurement window. In receiver mode with *SINGLE* selected, the ESPI performs a single scan and stops at the end frequency. With *CONTINUOUS* selected, the scan is performed continuously until it is deliberately stopped.

In analyzer mode, with Sweep Count > 0 or Average Count > 0, this means a restart of the indicated number of measurements. With trace functions MAXHold, MINHold and AVERage, the previous results are reset on restarting the measurement.

#### Example

```
"INIT:CONT OFF
'Switches to single-sweep mode.
DISP:WIND:TRAC:MODE AVER
'Switches on trace averaging.
SWE:COUN 20
'Setting the sweep counter to 20 sweeps
INIT;*WAI
'Starts the measurement and waits for the end of the 20 sweeps.
```

#### Characteristics

\*RST value: -  
SCPI: conforming

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

## 7.10 INSTRUMENT Subsystem

The INSTRUMENT subsystem defines the operating mode of the unit.

---

**INSTRUMENT[:SElect] SANalyzer | REceiver | ADEMod | MSGM | BWCDpower | WCDPower | BWCDpower | MWCDpower | BTOoth | BC2K | MC2K | BDO | MDO | BTDScdma | MTDScdma | MREceiver**

This command switches between the operating modes by means of text parameters. Selection BWCDpower or WCDPower presets the instrument as described in Chapter 2, Section "Basic Settings in Code Domain Measurement Mode".

### Example

```
INST BWCD
```

### Characteristics

\*RST value: SANalyzer  
SCPI: conforming

## 7.11 MMEMORY – Subsystem

The MMEMORY subsystem (Mass Memory) contains all commands to direct the memory parts of the unit.

**MMEMORY:STORe1:FINal 'A:\final.dat'**

This command exports the peak list in ASCII format to a file. The complete output format is similar to the trace export. The peak values within the file are comma separated in the format:

```
. <1> <freq1>, <level1>, <delta level 1>, <1> <freq2>,
<level2>, <delta level 2>, ... <1> <freq n>, <level n>,
<delta level n>
```

### Example

```
MMEM:STOR:FIN 'A:\final.dat'
```

### Characteristics

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

### Query of results

```
---
```

### Result File:

```
<1>          []      - trace number is always 1
<freq>      [Hz]    - frequency of the peak
<level>     [dBm]   - absolute level of the peak
<delta level> [dB]  - distance to the limit line
```

## 7.12 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.

---

### `[SENSe<1|2>]:CDPower:ANTenna OFF | 1 | 2`

This command activates or deactivates the antenna diversity mode and selects the antenna to be used.

OFF The antenna diversity mode is switched off.

1 | 2 The antenna diversity mode is switched on, and the signal from antenna 1 or antenna 2 is used for CDP analysis.

#### Example

```
CDP:ANT 1
```

#### Characteristics

\*RST value: OFF

SCPI: device-specific

---

### `[SENSe:]CDPower:CPB 0..3`

This command selects the constellation parameter B. According to 3GPP specification the mapping of 16QAM symbols to an assigned bit pattern depends on the constellation parameter B.

#### Example

```
CDP:CPB 1
```

#### Characteristics

RST value: OFF

SCPI: device-specific

---

### `[SENSe:]CDPower:CODE 0 ... 511`

This command sets the code number. The code number refers to code class 9 (spreading factor 512).

#### Example

```
CDP:CODE 30
```

#### Characteristics

\*RST value: 0

SCPI: device-specific

---

### `[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
```

#### Characteristics

\*RST value: ON  
SCPI: device-specific

### [SENSe<1|2>:]CDPower:FRAME[:VALue] <numeric value>

This command enables an entry window for selecting the frame number to be analyzed.

#### Range

<numeric value> [0 ... CAPTURE\_LENGTH - 1]

#### Unit

[Frames]

#### Example

```
CDP:FRAME 2
```

#### Characteristics

\*RST value: 0  
SCPI: device-specific

### [SENSe<1|2>:]CDPower:HSDPamode ON|OFF

This command selects if the HS-DPCCH channel is searched or not.

ON: The high speed channels can be detected. A detection of the modulation type (QPSK /16QAM) is done instead of a detection of pilot symbols.

OFF: The high speed channel can not be detected. A detection of pilot symbols is done instead a detection of the modulation type (QPSK /16QAM).

#### Example

```
CDP:HSDP OFF
```

#### Characteristics

\*RST value: ON  
SCPI: device-specific

### [SENSe:]CDPower:ICTReshold -100 dB ... 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: -60dB  
 SCPI: device-specific

**[SENSe<1|2>:]CDPower:IQLength <numeric value>**

This command specifies the number of frames that are captured by one sweep.

**Range**

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

**Unit**

[Frames]

**Example**

```
CDP:IQL 3
```

**Characteristics**

\*RST value: 1  
 SCPI: device-specific

**[SENSe:]CDPower:LCODe:DVALue <numeric>**

This command defines the scrambling code in decimal format.

**Example**

```
CDP:LCOD:DVAL 3
```

**Characteristics**

\*RST value: 0  
 SCPI: device-specific

**[SENSe:]CDPower:LCODe[:VALue] #H0 ... #H5fff**

This command defines the scrambling code in hexadecimal format.

**Example**

```
CDP:LCOD #H2
```

**Characteristics**

\*RST value: -  
 SCPI: device-specific



**[SENSe:]CDPower:LCODe:SEARch[:IMMediate]?**

This command activates the automatic detection of the scrambling code. Predcondition is that the correct center frequency and level is set. The scrambling code search can automatically determine the primary scrambling code number. The secondary scrambling code number is expected as 0. Alternative scrambling codes can not be detected. Therefore the range for detection is 0x0000 – 0x1FF0h, where the last digit is always 0. The return value is PASSED if the code was found. The value can be read out by CDP:LCOD?. If the return value is FAILED no scrambling code detection is possible. The scrambling code value remains unchanged.

**Example**

```
CDP:LCOD:SEAR?
```

**Characteristics**

\*RST value: -  
SCPI: device-specific

**[SENSe:]CDPower:LCODe:SEARch:LIST?**

This command returns comma separated result table of the scrambling code search for each found scrambling code:  
<decimal scrambling code value>, <hexadecimal scrambling code value>, <power in dBm>, ...



To generate a new list the scrambling code search need to be forced by using the “[SENSe:]CDPower:LCODe:SEARch[:IMMediate]?” command.

**Example**

```
CDP:LCOD:SEAR?  
CDP:LCOD:SEAR:LIST?
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value:**

```
16,0x10,-18.04,32,0x20,-22.87,48,0x30,-27.62,64,0x40,-29.46
```

code (dec)	code(hex)	CPICH power (dBm)
16,	0x10,	-18.04
32,	0x20,	-22.87
48,	0x30,	-27.62
64,	0x40,	-29.46

---

**[SENSe:]CDPower:MIMO ON | OFF**

This command switches the single antenna MIMO mode on or off. Channels that have modulation type MIMO-QPSK or MIMO-16QAM will only be recongnized as active channels at MIMO ON.

**Example**

```
SENS:CDP:MIMO ON
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

---

**[SENSe:]CDPower:NORMalize ON | OFF**

This command switches elimination of I/Q offset on or off.

**Example**

```
SENS:CDP:NORM OFF
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

---

**[SENSe<1|2>:]CDPower:PCONtrol PILOt | SLOt**

This command determines the power control measurement position. The slot power can be averaged from the beginning of the slot to the end of the slot (param. SLOt) or from the beginning of the pilot symbols of the previous slot to the beginning of the pilot symbols of the actual slot. (param. PILOt). Furthermore, an enhanced channel search is used to consider the properties of compressed mode channels.

**Example**

```
SENS:CDP:PCON SLOt
```

'switch to power averaging from slot start to the end of the slot

An enhanced channel search to consider the properties of compressed mode channels is used.

```
SENS:CDP:PCON PILOt
```

'switch to power averaging from the pilot symbols of the previous slot number to the start of the pilots of the displayed slot number.

The channel search does only consider standart channels.

**Characteristics**

\*RST value: PILOt

SCPI: device-specific

**[SENSe<1|2>:]CDPower:PDIFf ON|OFF**

This command activates or deactivates the slot power difference calculation of the POWER VERSUS SLOT display. The slot power difference between the actual and the previous slot is displayed, if the power versus slot display is enabled.

ON The slot power difference to the previous slot is displayed (POWER VS SLOT display).

OFF The slot power of each slot is displayed (POWER VS SLOT display).

**Example**

```
CDP:PDIF ON
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**[SENSe:]CDPower:PREFference TOTAL | CPIC**

This command switches between the use of total power or CPICH power as the reference for the relative CDP measurement values.

**Example**

```
CDP:PREF CPIC
```

**Characteristics**

\*RST value: TOTAL

SCPI: device-specific

**[SENSe:]CDPower:QINVert ON | OFF**

This command inverts the Q component of the signal.

**Example**

```
CDP:QINV ON
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**[SENSe:]CDPower:SBANd NORMAL | INVers**

This command is for interchanging the left and the right sidebands.

**Example**

```
CDP:SBAN INV
```

**Characteristics**

\*RST value: NORM

SCPI: device-specific

---

**[SENSe:]CDPower:SFACtor 4 | 8 | 16 | 32 | 64 | 128 | 256 | 512**

This command defines the spreading factor. The spreading factor is only significant for display mode PEAK CODE DOMAIN ERROR.

**Example**

```
CDP:SFAC 16
```

**Characteristics**

\*RST value: 512  
SCPI: device-specific

---

**[SENSe:]CDPower:SLOT 0 ...14**

This command sets the slot number of the common pilot channels (CPICH).

**Example**

```
CDP:SLOT 3
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

---

**[SENSe<1|2>:]CDPower:STYPe CPICH | SCHannel**

This command selects the type of synchronization.

CPICH Synchronization to CPICH (default setting). For this type of synchronization, the CPICH must be present in the transmit signal.

SCH Synchronization without CPICH. This type of synchronization is required for test model 4 without CPICH.

**Example**

```
CDP:STYP SCH
```

**Characteristics**

\*RST value: CPICH  
SCPI: device-specific

---

**[SENSe:]CDPower:UCPich:CODE 0 to 255**

This command sets the code number of the user defined CPICH used for signal analysis.

**Example**

```
SENS:CDP:UCP:CODE 10
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**[SENSe:]CDPower:UCPich:PATtern OFF | 1 | 2**

This command defines which pattern for the user defined CPICH is used for signal analysis. OFF leads to a pattern selection according to the antenna selection, 1 leads to the fixed usage of "Pattern 1" and 2 leads to the fixed usage of "Pattern 2" according to standard.

**Example**

```
SENS:CDP:UCP:PATT 1
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**[SENSe:]CDPower:UCPich[:STATe] ON | OFF**

This command defines if the user defined CPICH settings are valid and shall be used for signal analysis.

**Example**

```
SENS:CDP:UCP ON
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

## 7.13 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.

**[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**

```
SENS:POW:ACH:ACP 3
```

**Characteristics**

Range: 0 | 1 | 2 | 3

Unit: []

\*RST value: 1

SCPI: device-specific

**Query of results**

```
SENS:POWer:ACH:ACP?
```

**Result**

```
<0|1|2|3>
```

---

```
[SENSe<1|2>:]POWer:ACHannel:BANDwidth|BWIDth[: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 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|BWIDth:ACHannel <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:ACH 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|BWIDth: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:ALT 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.
```

**Example**

```
"POW:ACH:MODE REL"
```

**Characteristics**

\*RST value: ABSolute (absolute adjacent channel measurement)

RELative (relative adjacent channel measurement.)

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;*WAI
```

**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.



**Parameter**

MINimum Transmission channel with the lowest power  
 MAXimum Transmission channel with the highest power  
 LHIGhest Lowermost transmission channel for the lower adjacent channels,  
 uppermost transmission channel for the upper adjacent channels

**Example**

```
POW:ACH:REF:TXCH:AUTO MAX
```

**Characteristics**

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 3
```

**Characteristics**

Range: <1 ... number of TX channels>  
 Unit: []  
 \*RST value: 1  
 SCPI: device-specific

**[SENSe<1|2>:]POWer:ACHannel:SPACing:CHANnel 100 Hz ... 1000 MHz**

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:CHAN 5MHz
```

**Characteristics**

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

**SENSe<1|2>:]POWer:ACHannel:SPACing[:ACHannel] <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:ACH 5MHz
'sets the spacing between TX carrier 2 and 3 to 4.8 MHz.
```

### Characteristics

Range: 100Hz ... 1GHz

Unit: [Hz]

\*RST value: 5 MHz

SCPI: device-specific

### Query of results

```
SENSe:POW:ACH:SPAC:CHAN?
```

### Result

```
<100Hz ... 1GHz>
```



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: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
```

### Characteristics

Range: 100Hz ... 1GHz

Unit: [Hz]

\*RST value: 10 MHz (ALT1)

15 MHz (ALT2)

SCPI: device-specific

**Query of results**

```
SENS:POW:ACH:SPAC:ALT<1...11>?
```

**Result**

```
<100Hz ... 1GHz>
```

**[SENSe<1|2>:]POWer:ACHannel:TXChannel:COUNT <value>**

This command selects the number of carrier signals. The command is available only for multicarrier channel and adjacent-channel leakage power measurements (CALC:MARK:FUNC:POW:SEL MCAC).

**Example**

```
"POW:ACH:TXCH:COUN 3"
```

**Characteristics**

Range: 1...12

Unit: []

\*RST value: 4

SCPI: device-specific

**Query of results**

```
SENS:POW:ACH:TXCH:COUN?
```

**Result**

```
<1...12>
```

**[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

**[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>
```

## 7.14 SENSe:SWEep – Subsystem

This subsystem directs the parameters for the sweep. The measurement window is selected with SENSe1 (SCREEN A) and SENSe2 (SCREEN B).

**[SENSe<1|2>:]SWEep:TIME <value>**

This command defines the sweep time. If `SWEep:TIME` is directly programmed, automatic coupling to resolution bandwidth and video bandwidth is switched off.

**Example**

```
SWE:TIM 10s
```

**Characteristics**

Range: 0.005 ... 16000

Unit: [s]

\*RST value: 0.16

SCPI: device-specific

**Query of results**

```
SENS:SWE:TIME?
```

**Result**

```
<0.005 ... 16000>
```

## 7.15 SENSe:TAERror – Subsystem

This sub system allows to configure the time alignment error measurement.

---

### SENSe:TAERror:CARRier:COUNT?

This command requests the number of base stations configured by the user. The maximum number of base stations to be configured depends on the type of device:

R&S FSP and R&S FSU allow to configure one base station

R&S FSG and R&S FSQ without B72 allow to define up to 5 base stations

The R&S FSQ with B72 allows the definition of up to 23 base stations depending on the type of B72.

**Example**

```
SENS:TAER:CARR:COUNT?
```

**Characteristics**

\*RST value: 1

SCPI: device-specific

**Return value**

Number of BTS

---

### SENSe:TAERror:CARRier<1...23>:INSert

This command adds a new base station for the time alignment error measurement. The base station will be added at the position specified by the carrier number.

**Example**

```
SENS:TAER:CARR2:INS
```

'Adds a new BTS at the beginning of the list.'

**Characteristics**

\*RST value: 0

SCPI: device-specific

**Return value**

---

---

**SENSe:TAERror:CARRier<1...23>:DELete**

This command deletes the base station specified by the carrier number.

**Example**

```
SENS:TAER:CARR2:DEL
'Deletes the first base station in the list that follows the
reference carrier.
SENS:TAER:CARR2:DEL ALL
'Deletes all base stations in the list except the reference
carrier.
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value**

---

---

**SENSe:TAERror:CARRier<1...23>:OFFSet**

This command sets for the base station specified by the carrier number the frequency offset compared to the reference carrier. If the carrier number specified in the command is higher than the highest currently available number, a new carrier will be set at the end of the list.

**Example**

```
SENS:TAER:CARR2:OFFS 5000000
'Sets for the first BTS of the list the frequency offset to 5
MHz.
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Result query**

```
SENS:TAER:CARR2:OFFS?
```

**Result**

Frequency offset to reference

---

**SENSe:TAERror:CARRier<1...23>:SCODE**

This command sets for the base station specified by the carrier number the scrambling code. The scrambling code of the base stations has to be known for performing the time alignment error measurement. No scrambling code search will be performed.

**Example**

```
SENS:TAER:CARR2:SCOD 16
'Sets for the first base station in the list the scrambling
code to 16.
```

**Characteristics**

```
*RST value: 0
SCPI:      device-specific
```

**Result query**

```
SENS:TAER:CARR2:SCOD?
```

**Result**

```
Scrambling code of the BTS
```

---

**SENSe:TAERror:CARRier<1...23>:ANTenna<1|2>:CPICH**

This command sets for the base station specified by the carrier number the CPICH code number on antenna 2. The command can also be used to show the CPICH code numbers used for both antennas.

**Example**

```
SENS:TAER:CARR2:ANT:CPIC 2
'Sets for the first base station in the list the CPICH code
number on antenna 2 to 2.
```

**Characteristics**

```
*RST value: 0
SCPI:      device-specific
```

**Result query**

```
SENS:TAER:CARR2: ANT:CPIC?
```

**Result**

```
CPICH code number of antenna 2 of the BTS
```

---

**SENSe:TAERror:CARRier<1...23>:ANTenna<1|2>:CPICH**

This command sets for the base station specified by the carrier number the CPICH pattern on antenna 2. Antenna 1 of each BTS uses CPICH code number 0 and CPICH pattern 1. For antenna 2, CPICH pattern 2 can be specified in case the CPICH code number is 0. For all CPICH code numbers different to 0 the pattern pattern1 and pattern 2 are usable. If the pattern is set to "None" the antenna will be treated as inactive – its time alignment error will not be calculated and its status will not influence the global status.

The command can also be used to show the CPICH patterns used for both antennas.

**Example**

```
SENS:TAER:CARR2:ANT:PATT 1
'Sets for the first base station in the list the CPICH
pattern on antenna 2 to 1.
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Result query**

```
SENS:TAER:CARR2:ANT:PATT?
```

**Result**

```
CPICH pattern of antenna 2 of the BTS
```

---

**SENSe:TAERror:SAVE**

This command saves a time alignment error table.

**Example**

```
SENS:TAER:SAVE 'string'
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value**

---

---

**SENSe:TAERror:DELeTe**

By use of this command a table is deleted.

**Example**

```
SENS:TAER:DEL 'string'
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value**

---



---

**SENSe:TAERror:CATalog?**

By use of this command the tables saved will be shown.

**Example**

```
SENS:TAER:CAT?
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value**

'string'

---

**SENSe:TAERror:PRESet?**

With this command a list save in advance is loaded and run for time alignment error measurement.

**Example**

```
SENS:TAER:PRES?
```

**Characteristics**

\*RST value: 0  
SCPI: device-specific

**Return value**

---

## 7.16 STATus-QUEStionable:SYNC Register

This register contains information on the error situation in the code domain power analysis of the FS-K72/K74/K74+ option. It can be queried with the following commands.

---

**STATus:QUEStionable:SYNC:CONDition ?**

This command reads the information on the error situation in the code domain power analysis of the R&S FS-K72 option.

**Example**

```
STATUS:QUES:SYNC:COND?
```

**Characteristics**

\*RST value: OFF  
SCPI: device-specific

**Query of results**

see Table 10

**STATus:QUEStionable:SYNC[:EVENT] ?**

This command reads the information on the error situation in the code domain power analysis of the R&S FS-K72 option. The value can only be read once.

**Example**

```
STATUS:QUES:SYNC:EVEN?
```

**Characteristics**

\*RST value: OFF

SCPI: device-specific

**Return value**

see Table 10

**Table 10** Definition of the error bits of the SYNC register

Bit No.	Definition
0	Not used in FS-K72/K74/K74+
1	<p><b>K72/K74 Frame Sync failed</b>            This bit is set when synchronization is not possible within the application.            Possible reasons:                Incorrectly set frequency                Incorrectly set level                Incorrectly set scrambling code                Incorrectly set values for Q-INVERT or SIDE BAND INVERT                Invalid signal at input</p> <p>In Time Alignment Error measurement mode, this bit is set, if antenna 1 synchronization is not possible.</p>
2	In Time Alignment Error measurement mode, this bit is set, if antenna 2 synchronization is not possible.
3 to 4	Not used in the R&S FS-K72 application.
5	<p><b>K72/K74 Incorrect Pilot Symbol</b>            This bit is set when one or more of the received pilot symbols are not equal to the specified pilot symbols of the 3GPP standard.            Possible reasons:                Incorrectly sent pilot symbols in the received frame.                Low signal to noise ratio (SNR) of the WCDMA signal.                One or more code channels has a significantly lower power level compared to the total power. The incorrect pilots are detected in these channels because of low channel SNR.                One or more channels are sent with high power ramping. In slots with low relative power to total power, the pilot symbols might be detected incorrectly (check the signal quality by using the symbol constellation display).</p>
6 to 14	Not used in the FS-K72/K74/K74+ application.
15	This bit is always 0.

## 7.17 TRACe-Subsystem

TRACe[:DATA]? ATRACE2 | FINAL1 | TRACE1 | TRACE2 | PWCDp | CTABLE | CWCDp | ABITstream | TPVSlot | LIST

Transfers trace data from the controller to the instrument; the query reads trace data from the instrument. TRACE1, TRACE2, CTABLE, PWCDp, CWCDp (K747/K74+), TPVSlot or ABITstream can be queried depending on the display mode.

ATRACE2 returns a list of slot number / absolute frequency error vs slot for all slots. In contrast to the scope presentation and the TRACE2 parameter return value, absolute values are returned.

Output: List of slot number and absolute frequency error values of all slots

Format: SlotNumber 0, FreqError<sub>0</sub>, ..., SlotNumber 14, FreqError<sub>14</sub>

Unit: [Hz]

Quantity: 15

FINAL1 returns the peak list. For each peak the following entries are given:  
<freq1>, <level1>, <delta level 1>, <freq2>, <level2>, <delta level 2>, ... <freq n>, <level n>, <delta level n>

TRACE1| returns the trace data. Depending on the display, the trace data format varies (for details see Display of the Trace Data)

PWCDp can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length is transmitted in addition to the values as transmitted for trace 1. The pilot length is specified in symbols. Six values are transmitted for each channel:  
< class>, <channel number>, <absolute level>, <relative level>, <timing offset> or <I/Q-mapping>, <pilot length>, ...

CTABLE can be set if CODE PWR ABSOLUTE / RELATIVE, CHANNEL TABLE is selected for trace 1. The pilot length and the channel state (active, inactive) are transmitted in addition to the values transmitted for trace 1. The pilot length is specified in symbols. Seven values are transmitted for each channel:  
< class>, <channel number>, <absolute level>, <relative level>, <timing offset>, <pilot length>, <active|inactive> ...

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 10 values are transmitted. The range of channel types 13.

<code class>, <channel number>, <absolute level>, <relative level>, <timing offset>, <pilot length>, <active flag>, <channel type>, <modulation type>, <reserved> ...

The channels are output in ascending order sorted by code number, i.e. in the same sequence they are displayed on screen.

No.	Parameter	Range	Unit	Explanation
1)	<code class>	{2 ... 9}	[1]	Code class of the channel.
2)	<channel number>	{0 ... 511}	[1]	Code number of the channel.
3)	<absolute level>	{-∞ ... ∞}	[dBm]	Absolute level of the code channel at the selected channel slot. (The channel slot can be marked by the SELECTED CPICH slot.)
1	< relative level >	{-∞ ... ∞}	[dB]	Relative level of the code channel at the selected channel slot referenced to CPICH or total power. (The channel slot can be marked by the SELECTED CPICH slot.)
5)	<timing offset>	{0 ... 38400}	[chips]	Timing offset of the code channel to the frame start. The value is measured in chips. The step width is 256 chips in the case of code class 2 to 8, and 512 chips in the case of code class 9.
6)	<pilot length>	{0,2,4,8,16}	[symbols]	Pilot length of the code channel. According to the 3GPP standard, the pilot length range depends on the code class.
7)	<active flag>	{0,1}	[1]	Flag to indicate whether a channel is active 0 - channel not active 1 - channel active
8)	<channel type>	{0 ... 13}	[1]	Channel type indication
		0 - DPCH		<b>D</b> edicated <b>P</b> hysical <b>C</b> hannel of a standard frame
		1 - PICH		<b>P</b> aging <b>I</b> ndication <b>C</b> hannel
		2 - CPICH		<b>C</b> ommon <b>P</b> ilot <b>C</b> hannel
		3 - PSCH		<b>P</b> rimary <b>S</b> ynchronization <b>C</b> hannel
		4 - SSCH		<b>S</b> econdary <b>S</b> ynchronization <b>C</b> hannel
		5 - PCCPCH		<b>P</b> rimary <b>C</b> ommon <b>C</b> ontrol <b>P</b> hysical <b>C</b> hannel
		6 - SCCPCH		<b>S</b> econdary <b>C</b> ommon <b>C</b> ontrol <b>P</b> hysical <b>C</b> hannel
		7 - HS_SCCH		HSDPA: <b>H</b> igh <b>S</b> peed <b>S</b> hared <b>C</b> ontrol <b>C</b> hannel
		8 - HS_PDSCCH		HSDPA: <b>H</b> igh <b>S</b> peed <b>P</b> hysical <b>D</b> ownlink <b>S</b> hared <b>C</b> hannel
		9 - CHAN		Channel without any pilot symbols (QPSK modulated)
		10 - CPRSD		Dedicated Physical Channel in <b>compressed</b> mode
		11 - CPR-TPC		Dedicated Physical Channel in <b>compressed</b> mode <b>TPC</b> symbols are sent in the first slot of the gap.
		12 - CPR-SF/2		Dedicated Physical Channel in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ).
		13 - CPR-SF/2-TPC		Dedicated Physical Channel in <b>compressed</b> mode using half spreading factor ( <b>SF/2</b> ). <b>TPC</b> symbols are sent in the first slot of the gap
		14 - EHICH		HSUPA: <b>E</b> nhanced <b>H</b> ARQ <b>H</b> ybrid <b>A</b> cknowledgement

		ERGCH	Indicator Channel HSUPA: Enhanced Relative Grant Channel
		15 - EAGCH	Enhanced Absolute Grant Channel
		16 - SCPICH	Secondary Common Pilot Channel
9)	<modulation type>	{2,4,15}	[1] Modulation type of the code channel at the selected channel slot. (The channel slot can be marked by adjusting SELECT CPICH slot.)
		2 - QPSK	Modulation type: QPSK
		4 - 16QAM	Modulation type:: 16QAM
		5 - 64QAM	Modulation type: 64QAM
		15 - NONE	There is no power in the selected channel slot [slot is switched OFF]. (According to 3GPP, the power of an HSDPA channel can be switched every 2 ms, i.e. 3 slots.)
10)	<reserved>	{0}	[1] Reserved for future functionality.

**ABITstream** can be set only if CALC2:FEED "XTIM:CDP:BSTReam" is selected (in the lower bit stream window). This command returns the bit streams of all 15 slots one after the other. The output format may be REAL, UINT or ASCII. The number of bits of a 16QAM-modulated channel is twice that of a QPSK-modulated channel, the number of bits of a 64QAM-modulated channel is three times that of a QPSK-modulated channel. The output format is equal to that of the ":TRAC1: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) or four (16QAM) consecutive bits. The number of symbols is not constant and may vary depending on the selected channel and its symbol modulation type. The bit stream may contain invalid (symbols without power).

If the analyzer is equipped with R&S FS-K72 only, the values and numbers of the bits are as follows:

Unit:  $\square$   
 Range: {0,1,6,9}  
 Bits per symbol:  $N_{\text{BitPerSymb}} = 2$   
 Number of symbols:  $N_{\text{Symb}} = 150 \cdot 2^{(8-\text{Code Class})}$   
 Number of bits:  $N_{\text{Bit}} = N_{\text{Symb}} \cdot N_{\text{BitPerSymb}}$   
 Format: Bit00, Bit01, Bit10, Bit11, Bit20, Bit21, ..., Bit <sub>$N_{\text{Symb}}$</sub>   
<sub>0, Bit <sub>$N_{\text{Symb}}$</sub>  1</sub>

Explanation: 0 - Low state of a transmitted bit  
 1 - High state of a transmitted bit

6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD)

9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)

If the analyzer is equipped additionally with R&S FS-K74/FS-K74+, the values and numbers of the bits are as follows:

Unit:  $\square$   
 Range: {0,1,6,7,8,9}  
 Bits pro Symbol:  $N_{\text{BitPerSymb}} = \{2,4,6\}$   
 Max. bits per symbol:

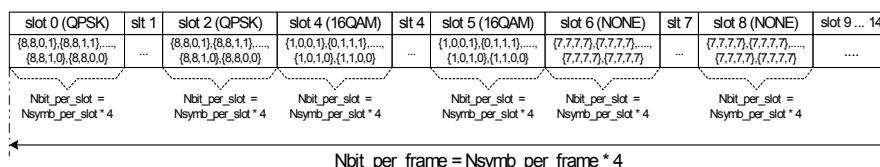
$$N_{BitPerSymb\_MAX} = MAX \left\{ N_{BitPerSymb} (slot) \right\}_{slot=1}^{15}$$

Symbols per slot: NSymb\_Slot = 10\*2(8-Code Class)  
 Symbols per frame: NSymb\_Frame = 15\* NSymb\_Slot = 150\*2(8-Code Class)  
 BitQuantity: NBit = NSymb\_Frame \*  
 NBitPerSymb\_MAX  
 Format (QPSK): Bit<sub>00</sub>, Bit<sub>01</sub>, Bit<sub>10</sub>, Bit<sub>11</sub>, Bit<sub>20</sub>, Bit<sub>21</sub>, ... ,  
 Bit<sub>NSymb\_Frame 0</sub>, Bit<sub>NSymb\_Frame 1</sub>  
 Format (16QAM): Bit<sub>00</sub>, Bit<sub>01</sub>, Bit<sub>02</sub>, Bit<sub>03</sub>, Bit<sub>10</sub>, Bit<sub>11</sub>, Bit<sub>12</sub>, Bit<sub>13</sub>, ... ,  
 Bit<sub>NSymb\_Frame 0</sub>, Bit<sub>NSymb\_Frame 1</sub>, Bit<sub>NSymb\_Frame 2</sub>,  
 Bit<sub>NSymb\_Frame 3</sub>  
 Format (64QAM): Bit<sub>00</sub>, Bit<sub>01</sub>, Bit<sub>02</sub>, Bit<sub>03</sub>, Bit<sub>04</sub>, Bit<sub>05</sub>, Bit<sub>10</sub>, Bit<sub>11</sub>,  
 Bit<sub>12</sub>, Bit<sub>13</sub>,  
 (FS-K74+ only) Bit<sub>14</sub>, Bit<sub>15</sub>, ... ,  
 Bit<sub>NSymb\_Frame 0</sub>, Bit<sub>NSymb\_Frame 1</sub>, Bit<sub>NSymb\_Frame 2</sub>,  
 Bit<sub>NSymb\_Frame 3</sub>, Bit<sub>NSymb\_Frame 4</sub>, Bit<sub>NSymb\_Frame 5</sub>

Explanation:  
 0 - Low state of a transmitted bit  
 1 - High state of a transmitted bit  
 6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD)  
 7 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD)  
 8 - Fill value for unused bits of a lower order modulation symbol in a frame containing higher order modulation.  
 9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)

The values 7 and 8 are only used in case of a varying modulation type of an HS-PDSCH channel. In this case the number of bits per symbol (N<sub>BitPerSymb</sub>) varies too. However, the length of the transmitted bit vector (N<sub>Bit</sub>) depends only of the maximum number of bits per symbol in that frame. That means, if the modulation type changes throughout the frame this will not influence the number of biots being transmitted.

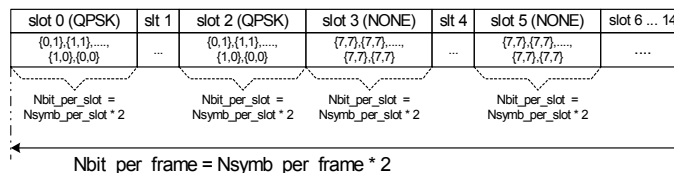
**Example 1:** Some slots of the frame are 64QAM modulated, other are 16QAM and QPSK modulated and some are switched OFF (NONE). If one or more slots of the frame are 64QAM modulated, six bits per symbol are transmitted and if the highest modulation order is 16QAM, four bits per symbol are transmitted. In any slot of the frame with lower order modulation, the first two or four of the four or six bits are marked by the number 8 and the last bits represent the transmitted symbol. If no power is transmitted in a slot, four or six entries per symbol of value 7 are transmitted.



IEEE response: 8,8,1,0,.....,8,8,0,1,1,1,0,1,.....,0,1,1,0,7,7,7,7,...7,7,7,7

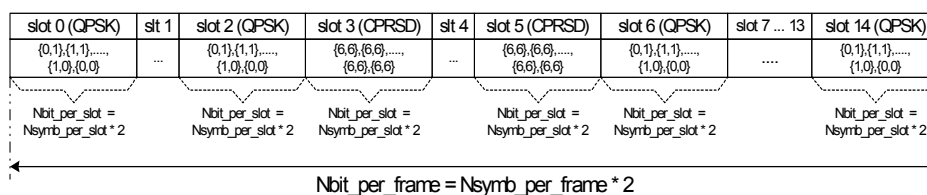
**Example 2:** Some slots of the frame are QPSK modulated and some are switched OFF.

If one or more slots of the frame are QPSK modulated and no slot is 16QAM modulated, 2 bits per symbol are transmitted. If no power is transmitted in a slot, 2 entries per symbol of value 7 are transmitted.



IEEE response: 1,1,0,1,....,0,1,1,0,7,7,7,7,...7,7,7,7

**Example 3:** Some slots of a DPCH are suppressed because of compressed mode transmission. The bits of the suppressed slots are marked by the digit '6'. In this case always 2 bits per symbol are transmitted.



IEEE response: 1,1,0,1,....,0,1,1,0,6,6,6,6,...6,6,6,6,1,1,0,1,....,0,1,1,0

**TPVSlot** can be set if POWER VS SLOT is selected. Sixteen (16) pairs of slots (slot number of CPICH) and level values (for 16 slots) are always transferred. The query is possible no matter which evaluation is selected in the code domain analyzer.

<slot number>, <level value in dBm>, <slot number>, <level value in dBm>, ....

**LIST 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**

```

INST WCDP
'start K72
CALC:FEED 'XTIM:CDP:FVSL'
'select FREQUENCY ERROR VS SLOT display
INIT:CONT OF
'select single sweep mode
INIT
'performs a single sweep
TRACe:DATA? ATRACE2
'reads the trace data of FREQUENCY 'ERROR VS SLOT display
TRAC1:DATA? FINAL1
'Query of results

```

**Result**

```

<freq> [Hz]
'frequency of the peak
<level> [dBm]
'absolute level of the peak
<delta level>[dB]
'distance to the limit line
TRAC TRACE1,+A$
'A$: data list in current format
TRAC? TRACE1"
TRAC:DATA? LIST

```

**Characteristics**

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

**Display of the Trace Data**

The trace data format (TRACE1 | TRACE2) for the different displays is as follows:

**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 9 corresponds to the highest spreading factor (512, symbol rate 7.5 ksps), class 2 to the lowest admissible spreading factor (4, symbol rate 960 ksps).

Five values are transmitted for each channel.

<class>,<channel number>,<absolute level>,<relative level>,<timing offset>, .....

**CODE PWR ABSOLUTE / RELATIVE:**

The channels are output in ascending order sorted by code number, i.e. in the same sequence they are displayed on screen.

**CHANNEL TABLE:**

The channels are sorted by code class, i.e. the unassigned channels are transmitted last.

The units are: Absolute level dBm

Relative level dB referenced to CPICH or total power

Timing offset chips

The example shows the results of a query for three channels with the following configuration:



1st channel: spreading factor 512, channel number 7, timing offset 0

2nd channel: spreading factor 4, channel number 1, timing offset 256 chips

3rd channel: spreading factor 128, channel number 255, timing offset 2560 chips

This yields the following result:

9,7,-40,-20,0,2,1,-40,-20,256,7,255,-40,-20,2560

The channel order is the same as in the CDP diagram, i.e. it depends on their position in the code domain of spreading factor 512.

#### CODE DOMAIN ERROR POWER (TRACE1)

Output: Five values are transmitted for each code class 9 channel. The channels are sorted by code number

Format: <code class><sub>1</sub>, <code number><sub>1</sub>, <CDEP><sub>1</sub>, <channel flag><sub>1</sub>,  
<code class><sub>2</sub>, <code number><sub>2</sub>, <CDEP><sub>2</sub>, <channel flag><sub>2</sub>,  
.....,  
<code class><sub>512</sub>, <code number><sub>512</sub>, <CDEP><sub>512</sub>, <channel  
flag><sub>512</sub>

Unit: < [1] >, < [1] >, < [dB] >, < [1] >

Range: < 8 >, < 0...511 >, < -∞ ... ∞ >, < 0 ; 1 >

Quantity: 512

Explanation:

code class: [1] Highest code class of an downlink signal. It is always set to 9 (CC9).

code number: [1] Code number of the evaluated CC9 channel.

CDEP: [dB] Code domain error power value of the CC9 channel

channel flag: [1] Denotes whether the CC9 channel belongs to an assigned code channel:

Range:	0b00	0d0	- CC9 is inactive
	0b01	0d1	- CC9 channel belongs to an active code channel
	0b11	0d3	- CC9 channel belongs to an active code channel with sent pilot symbols incorrect.

#### POWER VS SLOT (TRACE2)

Sixteen (16) pairs of slots (slot number of CPICH) and level values (for 16 slots) are always transferred.

<slot number>, <level value in dB>, <slot number>, <level value in dB>, ....

#### 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>,  
<timing offset>, <I/Q offset>, <I/Q imbalance>

The units are:

EVM peak channel/mean channel, composite EVM, I/Q offset/imbalance: %

Peak CDE, total power and power abs. channel: dB

Power rel. Channel: dB referenced to CPICH or total power

Carr freq error: Hz

Chip rate error: ppm

Timing offset: chips

Trg to frame: μs

**COMPOSITE EVM und PEAK CODE DOMAIN ERR (TRACE2)**

Fifteen (15) pairs of slot (slot number of CPICH) end values are always transferred.

COMPOSITE EVM: <slot number>, <value in %>, ....

PEAK CODE DOMAIN ERR: <slot number>, <level value in dB>, ....

**COMPOSITE CONSTELLATION**

The real and the imaginary components of the chip constellation at the selected slot are transferred. The values are normalized to the square root of the average power at the selected slot:

Output: List of I/Q values of all chips per slot  
 Format:  $Re_1, Im_1, Re_2, Im_2, \dots, Re_{2560}, Im_{2560}$   
 Unit: [1]  
 Quantity: 2560

**POWER VERSUS SYMBOL**

The power of each symbol at the selected slot is transferred. The values indicate the difference to the reference power in dB. The number of the symbols depends on the spreading factor of the selected channel.

Output: List of symbol power relative to the reference power  
 Format: Val1, Val2, ..., ValNOF  
 Unit: [dB]

Quantity:  $NOF_{Symbols} = 10 \cdot 2^{(8-Code\ Class)}$

**SYMBOL CONSTELLATION (TRACE2)**

The real and the imaginary components are transferred as a pair:  
 <re 0>, <im 0>, <re 1>, <im 1>, ..... <re n>, <im n>

The number of level values depends on the spreading factor:

Spreading factor 512	5 values
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 value

**SYMBOL EVM (TRACE2)**

The number of level values depends on the spreading factor:

Spreading factor 512	5 values
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 value

**BITSTREAM (TRACE2)**

The bit stream of one slot is transferred. One value is transferred per bit (range 0, 1). Each symbol contains two consecutive bits in the case of a QPSK modulated slot and 4 consecutive bits in the case of a 16QAM modulated slot. The number of symbols is not constant and may vary for each sweep. Specific symbols in the bit stream may be invalid depending on the channel type and the bit rate (symbols without power). The assigned invalid bits are marked by on of the digits "6", "7" or "9".

If the analyzer is equipped with R&S FS-K72 only, the values and numbers of the bits are as follows:

Unit:	[]
Range:	{0,1,6,9}
Bits per symbol:	$N_{\text{BitPerSymb}} = 2$
Number of symbols:	$N_{\text{Symb}} = 10 * 2^{(8-\text{Code Class})}$
Number of bits:	$N_{\text{Bit}} = N_{\text{Symb}} * N_{\text{BitPerSymb}}$
Format (QPSK):	$\text{Bit}_{00}, \text{Bit}_{01}, \text{Bit}_{10}, \text{Bit}_{11}, \text{Bit}_{20}, \text{Bit}_{21}, \dots, \text{Bit}_{N_{\text{Symb}}0}, \text{Bit}_{N_{\text{Symb}}1}$
Explanation:	<ul style="list-style-type: none"> <li>0 - Low state of a transmitted bit</li> <li>1 - High state of a transmitted bit</li> <li>6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD)</li> <li>9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)</li> </ul>

If the analyzer is equipped additionally with R&S FS-K74/FS-K74+, the values and numbers of the bits are as follows:

Unit:	[]
Range:	{0,1,6,7,9}
Bits per symbol:	$N_{\text{BitPerSymb}} = \{2,4,6\}$
Symbols per slot:	$N_{\text{Symb_Slot}} = 10 * 2^{(8-\text{Code Class})}$
Number of bits:	$N_{\text{Bit}} = N_{\text{Symb_Slot}} \cdot N_{\text{BitPerSymb}}$
Format (QPSK):	$\text{Bit}_{00}, \text{Bit}_{01}, \text{Bit}_{10}, \text{Bit}_{11}, \text{Bit}_{20}, \text{Bit}_{21}, \dots, \text{Bit}_{N_{\text{Symb\_Frame}}0}, \text{Bit}_{N_{\text{Symb\_Frame}}1}$
Format (16QAM):	$\text{Bit}_{00}, \text{Bit}_{01}, \text{Bit}_{02}, \text{Bit}_{03}, \text{Bit}_{10}, \text{Bit}_{11}, \text{Bit}_{12}, \text{Bit}_{13}, \dots, \text{Bit}_{N_{\text{Symb\_Frame}}0}, \text{Bit}_{N_{\text{Symb\_Frame}}1}, \text{Bit}_{N_{\text{Symb\_Frame}}2}, \text{Bit}_{N_{\text{Symb\_Frame}}3}$
Format (64QAM): (FS-K74+ only)	$\text{Bit}_{00}, \text{Bit}_{01}, \text{Bit}_{02}, \text{Bit}_{03}, \text{Bit}_{04}, \text{Bit}_{05}, \text{Bit}_{10}, \text{Bit}_{11}, \text{Bit}_{12}, \text{Bit}_{13}, \text{Bit}_{14}, \text{Bit}_{15}, \dots, \text{Bit}_{N_{\text{Symb\_Frame}}0}, \text{Bit}_{N_{\text{Symb\_Frame}}1}, \text{Bit}_{N_{\text{Symb\_Frame}}2}, \text{Bit}_{N_{\text{Symb\_Frame}}3}, \text{Bit}_{N_{\text{Symb\_Frame}}4}, \text{Bit}_{N_{\text{Symb\_Frame}}5}$
Explanation:	<ul style="list-style-type: none"> <li>0 - Low state of a transmitted bit</li> <li>1 - High state of a transmitted bit</li> <li>6 - Bit of a symbol of a suppressed slot of a DPCH in Compressed Mode (DPCH-CPRSD) (DPCH-CPRSD)</li> <li>7 - Bit of a switched-off symbol of an HS-PDSCH channel</li> <li>9 - Bit of a suppressed symbol of a DPCH (e.g. TFCI off)</li> </ul>

**FREQ ERROR VS SLOT (TRACE2)**

Fifteen (15) pairs of slot (slot number of CPICH) end values are always transferred.

<slot number>, <value in Hz>, ....

**PHASE DISCONT (TRACE2)**

Fifteen (15) pairs of slot (slot number of CPICH) end values are always transferred.

<slot number>, <value in deg>, ....

**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: VectError0, 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: MagError0, 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: PhaseError0, PhaseError 1, ....., PhaseError 2559  
 Unit: [°]  
 Quantity: 2560

**COMPOSITE CONSTELLATION (TRACE2)**

The real and the imaginary components of the received chip constellation at the selected slot are transferred. The values are normalized to the square root of the average power at the selected slot:

Output: List of I/Q values of all chips per slot  
 Format: Re1, Im1, Re2, Im2, ....., Re2560, Im2560  
 Unit: [1]  
 Quantity: 2560

Table of Softkeys with Assignment of IEC/IEEE Commands

### 7.18 Table of Softkeys with Assignment of IEC/IEEE Commands

3G FDD BS	:INSTRument:SElect BWCDpower WCDPower
POWER	:CONFigure<1>:WCDPower:MEASurement POWER Query of results: :CALCulate<1>:MARKer<1>:FUNctIon:POWer:RESult? CPOWER
ADJUST REF LVL	:SENSe1 2>:POWer:ACHannel:PRESet:RLEVel
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:ACPpower ON   OFF Query of results: :CALCulate<1>:LIMit1:ACPpower? Result: <0   1>  Query of results: :CALCulate<1>:LIMit1:ACPpower:ACHannel:RESult? Result: <PASSED <sub>Left SB</sub>   FAILED <sub>Left SB</sub> , PASSED <sub>Right SB</sub>   FAILED <sub>Right SB</sub> >  Query of results: :CALCulate<1>:LIMit1:ACPpower:ALternate<1..2>:RESult? Result: <PASSED <sub>Left SB</sub>   FAILED <sub>Left SB</sub> , PASSED <sub>Right SB</sub>   FAILED <sub>Right SB</sub> >

Table of Softkeys with Assignment of IEC/IEEE Commands

EDIT ACLR  
LIMIT

```
:CALCulate<1>:LIMit1:ACPowEr:ACHannel:[RELative] <Val_1left,Val_1right>
Query of results: :CALCulate<1>:LIMit1:ACPowEr:ACHannel:[RELative] ?
Result: <Val_1left,Val_1right> [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_1left,Val_1right>
Query of results: :CALCulate<1>:LIMit1:ACPowEr:ACHannel:[RELative] ?
Result: <Val_1left,Val_1right> [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_1left,Val_1right>
Query of results: :CALCulate<1>:LIMit1:ACPowEr:ACHannel:ABSolute ?
Result: <Val_1left,Val_1right> [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_1left,Val_1right>
Query of results: :CALCulate<1>:LIMit1:ACPowEr:ACHannel:ABSolute ?
Result: <Val_1left,Val_1right> [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:RANGe:PHZ ON|OFF
Query of results: :CALCulate1:MARKer1:FUNCTion:POWer:RANGe:PHZ ?
Result: <0 | 1>
```

POWER  
MODE

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

Table of Softkeys with Assignment of IEC/IEEE Commands

MULTI CARR ACLR	CONFigure<1>:WCDPower[:BTS]:MEASurement MCAClr
CP / ACP CONFIG	---
NO. OF ADJ CHAN	: [SENSe<1 2>:]POWer:ACHannel:ACPairs <value> Query of results: : [SENSe<1 2>:]POWer:ACHannel:ACPairs? Range: <0 1 2 3>
NO. OF TX CHAN	: [SENSe<1 2>:]POWer:ACHannel:TXCHannel:COUNT <value> Query of results: : [SENSe<1 2>:]POWer:ACHannel:TXCHannel:COUNT? Range: <1 ... 12>
CHANNEL BANDWIDTH	: [SENSe<1 2>:]POWer:ACHannel:BANDwidth[:CHANnel] <value> : [SENSe<1 2>:]POWer:ACHannel:BANDwidth:ACHannel <value> : [SENSe<1 2>:]POWer:ACHannel:BANDwidth:ALternate<1...11> <value> Range: <100Hz ... 1GHz>
CHANNEL SPACING	: [SENSe<1 2>:]POWer:ACHannel:SPACing:CHANnel <value> : [SENSe<1 2>:]POWer:ACHannel:SPACing[: ACHannel] <value> : [SENSe<1 2>:]POWer:ACHannel:SPACing:ALternate<1...11> <value> Bereich: <100Hz ... 1GHz>
ACP REF SETTINGS	: [SENSe<1 2>:]POWer:ACHannel:REFeRence:TXCHannel:MANual <value> : [SENSe<1 2>:]POWer:ACHannel:REFeRence:TXCHannel:AUTO MINimum MAXimum LHIGhest
CP / ACP ABS REL	: [SENSe<1 2>:] Power:ACHannel:MODE ABSolute RELative
CHAN PWR / HZ	:CALCulate<1 2>:MARKer1:FUNction:POWer:RANGe:PHZ ON OFF
ADJUST SETTINGS	: [SENSe<1 2>:]POWer:ACHannel:PRESet MCACpower
ACP LIMIT CHECK	CALCulate<1 2>:LIMit1:ACPoweR[:STATe] ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:RESult? CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:RESult?
EDIT ACP LIMIT	CALCulate<1 2>:LIMit1:ACPoweR[:STATe] ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ACHannel[:RELative] <value>,<value> CALCulate<1 2>:LIMit1:ACPoweR:ACHannel[:RELative]:STATe ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:ABSolute <value>,<value> CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:ABSolute:STATe ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>[:RELative] <value>,<value> CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>[:RELative]:STATe ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:ABSolute <value>,<value> CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:ABSolute:STATe ON   OFF
SWEEP TIME	: [SENSe<1 2>:]SWEep:TIME <value>
NOISE CORR ON OFF	: [SENSe<1 2>:]POWer:NCORrection ON OFF
FAST ACP ON OFF	: [SENSe<1 2>:] Power:HSPeed ON OFF
DIAGRAM FULL SIZE	:DISPlay[:WINDow<1 2>]:SIZE LARGE   SMALL

## Table of Softkeys with Assignment of IEC/IEEE Commands

ADJUST REF LVL	: [SENSe<1 2>:]POWER:ACHannel:PRESet:RLEVel
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 MANUAL	:CALCulate<1>:LIMit<1>:ESpectrum:MODE MANual :CALCulate<1>:LIMit<1>:ESpectrum:VALue <numeric_value>
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
	<b>Note:</b> - If the y values are entered by means of the :CALCulate:LIMit<1>:LOWer[:DATA] command, the limit check result is 'failed' if the limit line is underrange. - If a user-defined limit line is activated, it has priority over limit lines selected with AUTO and MANUAL.
RESTORE STD LINES	:CALCulate:LIMit:ESpectrum:RESTore
LIST EVALUATION	:CALCulate1:PEAKsearch:AUTO ON   OFF
ADJUST REF LVL	: [SENSe<1 2>:]POWER:ACHannel:PRESet:RLEVel
30kHz/1MHz TRANSITION	:CALCulate<1 2>:LIMit<1...8>:ESpectrum:TRANSition <numeric value>
PEAK SEARCH	:CALCULATE<1 2>:PEAKsearch
PEAKS PER RANGE	:CALCULATE<1 2>:PEAKsearch:SUBRange <value> Query of results: :CALCULATE<1 2>:PEAKsearch:SUBRange? Result: <value> Range: 1 ... 50
MARGIN	:CALCULATE<1 2>:PEAKsearch:MARGin <value> Query of results: :CALCULATE<1 2>:PEAKsearch:MARGin? Result: <value> Range: -200dB ... 200 dB
VIEW PEAK LIST	:TRACe1[:DATA]? FINall Result: <freq1>, <level1>, <delta level 1>, <freq2>, <level2>, <delta level 2>, <freq n>, <level n>, <delta level n> ...
SORT BY FREQUENCY	---



Table of Softkeys with Assignment of IEC/IEEE Commands

SORT BY DELTA LIM	---
ASCII FILE EXPORT	:MMEMory:STORel:FINal 'A:\final.dat'
DECIM SEP . /	:FORMat:DEXPort:DSEPARATOR POINT   COMMA
OCCUPIED BANDWIDTH	:CONFigure<1>:WCDPower:MEASurement OBANdwidth Query of results: :CALCulate<1>:MARKer<1>:FUNction:POWer:RESult? OBANdwidth
% POWER BANDWIDTH	:SENSe<1>:POWer:BANDwidth <value> PCT Query of results: :SENSe<1>:POWer:BANDwidth? Result: <value> [%]
ADJUST REF LVL	:SENSe1:POWer:ACHannel:PRESet:RLEVel
ADJUST SETTINGS	:SENSe1:POWer:ACHannel:PRESet OBWidth
CODE DOM POWER	:INSTrument<1>[:SElect] WCDPower Or :CONFigure:WCDPower:MEASurement WCDPower Query of results: :TRACe:DATA? TRACE1   TRACE2   ABITstream   PWCDp   CTABLE   CWCDp   TPVSlot or :CALCulate<1>:MARKer<1>:FUNction:WCDPower:RESult? PTOTAL   FERRor   TFRame   TOFFset   MACCuracy   PCDError   EVMRms   EVMPeak   CERRor   CSLot   SRATE   CHANnel   CDPabsolute   CDPRelative   IQOFFset   IQIMbalance   MTYPE   RHO   PSYMBOL   ACHannels   MPIC RCDerror or Marker function Marker submenu)
STATISTICS	:CONFigure:WCDPower:MEASurement CCDF Or :CALCulate:STATistics[:BTS]:CCDF[:STATe] ON Query of results: CALCulate:MARKer:X?
APD	:CALCulate1:STATistics:APD:STATE ON Query of results: :CALCulate1:STATistics:APD:STATE? Result: <0 1>
CCDF	:CALCulate1:STATistics:CCDF:STATE ON Query of results: :CALCulate1:STATistics:CCDF:STATE? Result: <0 1>
PERCENT MARKER	:CALCulate<1>:MARKer1:Y:PERCent <value> PCT Query of results: :CALCulate<1>:MARKer1:Y:PERCent? Result: <0..100> [%]
NO OF SAMPLES	:CALCulate<1>:STATistics:NSAMples <value> Query of results: :CALCulate<1>:STATistics:NSAMples? Result: <value>

Table of Softkeys with Assignment of IEC/IEEE Commands

SCALING	:CALCulate<1>:STATistics:NSAMples <value> Query of results: :CALCulate<1>:STATistics:NSAMples? Result: <value>
X-AXIS REF LEVEL	:CALCulate<1>:STATistics:SCALE:X:RLEVel <value> dBm Query of results: :CALCulate<1>:STATistics:SCALE:X:RLEVel? Result: <value> [dBm]
X-AXIS RANGE	:CALCulate<1>:STATistics:SCALE:X:Range <value> dBm Query of results: :CALCulate<1>:STATistics:SCALE:X:Range? Result: <value> [dBm]
Y-UNIT % ABS	:CALCulate:STATistics:SCALE:Y:UNIT PCT   ABS :CALCulate:STATistics:CCDF:X? P0_1   P1   P10
Y-AXIS MAX VALUE	:CALCulate<1>:STATistics:SCALE:Y:UPPer <value> Query of results: :CALCulate<1>:STATistics:SCALE:Y:UPPer? Result: <value> Range: [1E-8...1]
Y-AXIS MIN VALUE	:CALCulate<1>:STATistics:SCALE:Y:LOWer <value> Query of results: :CALCulate<1>:STATistics:SCALE:Y:LOWer? 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
RF COMBI	:CONFigure:WCDPower:[BTS:]MEASurement RFCombi
% POWER BANDWIDTH	:SENSe<1>:POWer:BANDwidth <value> PCT Query of results: :SENSe<1>:POWer:BANDwidth? Result: <value> [%]
CP / ACP CONFIG	---
NO. OF ADJ CHAN	: [SENSe<1 2>:]POWer:ACHannel:ACPairs <value> Query of results: : [SENSe<1 2>:]POWer:ACHannel:ACPairs? Bereich: <0 1 2 3>

Table of Softkeys with Assignment of IEC/IEEE Commands

<b>NO. OF TX CHAN</b>	: [SENSe<1 2>:]POWer:ACHannel:TXCHannel:COUNT <value> Query of results: : [SENSe<1 2>:]POWer:ACHannel:TXCHannel:COUNT? Bereich: <1 ... 12>
<b>CHANNEL BANDWIDTH</b>	: [SENSe<1 2>:]POWer:ACHannel:BANDwidth[:CHANnel] <value> : [SENSe<1 2>:]POWer:ACHannel:BANDwidth:ACHannel <value> : [SENSe<1 2>:]POWer:ACHannel:BANDwidth:ALternate<1...11> <value> Bereich: <100Hz ... 1GHz>
<b>CHANNEL SPACING</b>	: [SENSe<1 2>:]POWer:ACHannel:SPACing:CHANnel <value> : [SENSe<1 2>:]POWer:ACHannel:SPACing[: ACHannel] <value> : [SENSe<1 2>:]POWer:ACHannel:SPACing:ALternate<1...11> <value> Range: <100Hz ... 1GHz>
<b>ACP REF SETTINGS</b>	: [SENSe<1 2>:]POWer:ACHannel:REFeRence:TXCHannel:MANual <value> : [SENSe<1 2>:]POWer:ACHannel:REFeRence:TXCHannel:AUTO MINimum MAXimum LHIGhest
<b>CP / ACP ABS REL</b>	: [SENSe<1 2>:] POWer:ACHannel:MODE ABSolute RELative
<b>CHAN PWR / HZ</b>	:CALCulate<1 2>:MARKer1:FUNCTion:POWer:RANGe:PHZ ON OFF
<b>ADJUST SETTINGS</b>	: [SENSe<1 2>:]POWer:ACHannel:PRESet MCACpower
<b>ACP LIMIT CHECK</b>	:CALCulate<1 2>:LIMit1:ACPoweR[:STATe] ON   OFF :CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:RESult? :CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:RESult?
<b>EDIT ACP LIMIT</b>	:CALCulate<1 2>:LIMit1:ACPoweR[:STATe] ON   OFF :CALCulate<1 2>:LIMit1:ACPoweR:ACHannel[:RELative] <value>,<value> :CALCulate<1 2>:LIMit1:ACPoweR:ACHannel[:RELative]:STATe ON   OFF :CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:ABSolute <value>,<value> :CALCulate<1 2>:LIMit1:ACPoweR:ACHannel:ABSolute:STATe ON   OFF CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>[:RELative] <value>,<value> :CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>[:RELative]:STATe ON   OFF :CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:ABSolute <value>,<value> :CALCulate<1 2>:LIMit1:ACPoweR:ALternate<1...11>:ABSolute:STATe ON   OFF
<b>SWEEP TIME</b>	: [SENSe<1 2>:]SWEep:TIME <value>
<b>NOISE CORRECTION</b>	: [SENSe<1 2>:]POWer:NCORrection ON   OFF
<b>ADJUST REF LVL</b>	: [SENSe<1 2>:]POWer:ACHannel:PRESet:RLEVel
<b>LIMIT LINE AUTO</b>	:CALCulate<1>:LIMit<1>:ESpectrum:MODE AUTO
<b>LIMIT LINE MANUAL</b>	:CALCulate<1>:LIMit<1>:ESpectrum:MODE MANual :CALCulate<1>:LIMit<1>:ESpectrum:VALue <numeric_value>

## Table of Softkeys with Assignment of IEC/IEEE Commands

LIMIT LINE USER	<pre>:CALCulate:LIMit&lt;1&gt;:NAME &lt;string&gt; :CALCulate:LIMit&lt;1&gt;:UNIT DBM :CALCulate:LIMit&lt;1&gt;:CONTRol[:DATA] &lt;num_value&gt;, &lt;num_value&gt;, ... :CALCulate:LIMit&lt;1&gt;:CONTRol:DOMain FREQuency :CALCulate:LIMit&lt;1&gt;:CONTRol:TRACe 1 :CALCulate:LIMit&lt;1&gt;:CONTRol:OFFset &lt;num_value&gt; :CALCulate:LIMit&lt;1&gt;:CONTRol:MODE RELative  :CALCulate:LIMit&lt;1&gt;:UPPer[:DATA] &lt;num_value&gt;, &lt;num_value&gt;.. :CALCulate:LIMit&lt;1&gt;:UPPer:STATe ON   OFF :CALCulate:LIMit&lt;1&gt;:UPPer:OFFset &lt;num_value&gt; :CALCulate:LIMit&lt;1&gt;:UPPer:MARGin &lt;num_value&gt; :CALCulate:LIMit&lt;1&gt;:UPPer:MODE ABSolute :CALCulate:LIMit&lt;1&gt;:UPPer:SPACing LINear</pre>
<b>Note</b>	
<ul style="list-style-type: none"> <li>- If the y values are entered by means of the :CALCulate:LIMit&lt;1&gt;:LOWer[:DATA] command, the limit check result is 'failed' if the limit line is underrange.</li> <li>- If a user-defined limit line is activated, it has priority over limit lines selected with AUTO and MANUAL..</li> </ul>	
RESTORE STD LINES	:CALCulate:LIMit:ESpectrum:RESTore
PEAK SEARCH	:CALCULATE<1 2>:PEAKsearch
PEAKS PER RANGE	<pre>:CALCULATE&lt;1 2&gt;:PEAKsearch:SUBRange &lt;value&gt; Query of results: :CALCULATE&lt;1 2&gt;:PEAKsearch:SUBRange? Result: &lt;value&gt; Bereich: 1 ... 50</pre>
MARGIN	<pre>:CALCULATE&lt;1 2&gt;:PEAKsearch:MARGIN &lt;value&gt; Query of results: :CALCULATE&lt;1 2&gt;:PEAKsearch:MARGIN? Result: &lt;value&gt; Bereich: -200dB ... 200 dB</pre>
VIEW PEAK LIST	<pre>:TRACe1[:DATA]? FINal1 Result: &lt;freq1&gt;, &lt;level1&gt;, &lt;delta level 1&gt;, &lt;freq2&gt;, &lt;level2&gt;, &lt;delta level 2&gt;, ... &lt;freq n&gt;, &lt;level n&gt;, &lt;delta level n&gt;</pre>
SORT BY FREQUENCY	---
SORT BY DELTA LIM	---
ASCII FILE EXPORT	:MMEMory:STORE1:FINal 'A:\final.dat'
DECIM SEP .	:FORMat:DEXPort:DSEparator POINT   COMMa
ADJUST REF LVL	: [SENSe<1 2>:]POWER:ACHannel:PRESet:RLEVEL
TIME ALIGN ERROR	:CONFIGure:WCDPower:[BTS:]MEASurement TAERror
SCRAMBLING CODE	<pre>: [SENSe:]CDPower:LCODE[:VALue] #H0 ... #H5fff&lt;hex&gt; (scrambling code hex) : [SENSe&lt;1 2&gt;:]CDPower:LCODE:DVALue &lt;numeric_value&gt; (scrambling code dec)</pre>
SCRAMBCODE AUTO SRCH	: [SENSe:]CDPower:LCODE:SEARch: [:IMMediate]?

Table of Softkeys with Assignment of IEC/IEEE Commands

SCRAMBCODE LIST	: [SENSe:]CDPower:LCODE:SEARCh:LIST?
FORMAT HEX DEC	[SENSe<1 2>:]CDPower:LCODE[:VALue] <hex> (scrambling code hex) [SENSe<1 2>:]CDPower:LCODE:DVALue <numeric_value> (scrambling code dec)
CPICH USER DEF	: [SENSe:]CDPower:UCPich[:STATe] ON   OFF
CPICH CODE#	: [SENSe:]CDPower:UCPich:CODE 0..255
CPICH PATT ANTENNA	: [SENSe:]CDPower:UCPich:PATTern OFF   1   2
INVERT Q ON OFF	: [SENSe:]CDPower:QINVert ON   OFF
SIDE BAND NORM INV	: [SENSe:]CDPower:SBANd NORMal   INVerse
ADJUST REF LVL	: [SENS:]POW:ACH:PRES:RLEV
CHAN CONF	--
CODE CHAN AUTOSEARCH	: CONFigure:WCDPower[:BTS]:CTABLE[:STATe] OFF
CODE CHAN PREDEFINED	: CONFigure:WCDPower[:BTS]:CTABLE[:STATe] ON : CONFigure:WCDPower[:BTS]:CTABLE:SElect <channel table name>
CHAN TABLE COMPARE	CONFigure:WCDPower[:BTS]:CTABLE:COMPare ON   OFF
EDIT CHAN CONF TABL	
HEADER VALUES	: CONFigure:WCDPower[:BTS]:CTABLE:NAME 'channel table name' : CONFigure:WCDPower[:BTS]:CTABLE:COMMeNt 'Comment for new table'
ADD SPECIAL	--
INSERT LINE	--
DELETE LINE	--
MEAS CHAN CONF TABLE	--
SAVE TABLE	--
SORT TABLE	--
NEW CHAN CONF TABL	see EDIT CHAN CONF TABLE

Table of Softkeys with Assignment of IEC/IEEE Commands

DEL CHAN CONF TABLE	:CONFigure:WCDPower[:BTS]:CTABLE:NAME 'channel table name' :CONFigure:WCDPower[:BTS]:CTABLE:DELeTe
COPY CHAN CONF TABLE	:CONFigure:WCDPower[:BTS]:CTABLE:NAME 'channel table name' :CONFigure:WCDPower[:BTS]:CTABLE:COpy 'new channel table name'
TIMING OFS PRED MEAS	:CONFigure:WCDPower[:BTS]:CTABLE:TOFFset PREDefine MEASurement
SETTINGS	--
SCRAMBLING CODE	:[SENSe:]CDPower:LCODE[:VALue] #H0 ... #H5fff<hex> (scrambling code hex) :[SENSe<1 2>:]CDPower:LCODE:DVALue <numeric_value> (scrambling code dec)
SCRAMCODE AUTO SRCH	:[SENSe:]CDPower:LCODE:SEARch[:IMMediate]?
SCRAMCODE LIST	:[SENSe:]CDPower:LCODE:SEARch:LIST?
FORMAT HEX DEC	[SENSe<1 2>:]CDPower:LCODE[:VALue] <hex> (scrambling code hex) [SENSe<1 2>:]CDPower:LCODE:DVALue <numeric_value> (scrambling code dec)
INACT CHAN THRESH	:[SENSe:]CDPower:ICTReshold -50 dB ... +10 dB
CODE PWR ABS REL	Abs. scaling: :CALCulate<1>:FEED 'XPOWER:CDP' :CALCulate<1>:FEED 'XPOWER:CDP:ABSolute' Rel. scaling: :CALCulate<1>:FEED 'XPOWER:CDP:RATio'
POWER REF TOT CPICH	:[SENSe:]CDPower:PREFeRence TOTal   CPICH
COMP MODE ON OFF	:[SENSe<1>:]CDPower:PCONTrol SLOT PIlot Query of results: [[:SENSe<1>:]CDPower:PCONTrol? Result: <1 0>
SYNC TYPE CPICH SCH	:[SENSe:]CDPower:STYPe CPICHh   SCHannel
ANT DIV ON OFF	:[SENSe:]CDPower:ANTenna OFF   1   2
ANT NO. 1 2	:[SENSe:]CDPower:ANTenna OFF   1   2
POWER DIFF ON OFF	:[SENSe<1 2>:]CDPower:PDIFf ON OFF Query of results: [[:SENSe<1 2>:]CDPower:PDIFf? Result: <1 0>
MULTI FRM CAPTURE	---
CAPTURE LENGTH	:[SENSe:]CDPower:IQLength <numeric_value>
FRAME TO ANALYZE	:[SENSe:]CDPower:FRAME[:VALue] <numeric_value>
SELECT CHANNEL	:[SENSe:]CDPower:CODE 0...511

Table of Softkeys with Assignment of IEC/IEEE Commands

<b>SELECT CPICH SLOT</b>	: [SENSe:]CDPower:SLOT 0 ... 14
<b>ADJUST REF LVL</b>	: [SENS:]POW:ACH:PRES:RLEV
<b>MULT CARR ON OFF</b>	: CONFigure:WCDPower[:BTS]:MCARier:STATe ON   OFF
<b>AUTO SCALE ON OFF</b>	: CONFigure:WCDPower[:BTS]:AScale:STATe ON   OFF
<b>CONST PARAM B</b>	: SENSe1:CDPower:CPB 0..3
<b>HS-DPA/UPA ON OFF</b>	: [SENSe:]CDPower:HSDPamode ON OFF
<b>RRC FILTER ON OFF</b>	: [SENSe:]CDPower:FILTer ON OFF
<b>INVERT Q ON OFF</b>	: [SENSe:]CDPower:QINVert ON   OFF
<b>SIDE BAND NORM INV</b>	: [SENSe:]CDPower:SBANd NORMAl   INVerse
<b>NORMALIZE ON OFF</b>	: [SENSe:]CDPower:NORMAlize ON   OFF
<b>CPICH USER DEF</b>	: [SENSe:]CDPower:UCPich[:STATe] ON   OFF
<b>CPICH CODE#</b>	: [SENSe:]CDPower:UCPich:CODE 0..255
<b>CPICH PATT ANTENNA</b>	: [SENSe:]CDPower:UCPich:PATTern OFF   1   2
<b>MIMO ON OFF</b>	: [SENSe:]CDPower:MIMO ON   OFF
<b>RESULTS</b>	--
<b>CODE DOM POWER</b>	: CALCulate<1>:FEED `XPOW:CDP` : CALCulate<1>:FEED `XPOW:CDP:ABS` : CALCulate<1>:FEED `XPOW:CDP:RAT`
<b>COMPOSITE EVM (RMS)</b>	: CALCulate2:FEED `XTIM:CDP:MACCuracy` Query of results: :TRACe1:DATA? TRACe2 Unit: [%] Range: [0% ... 100%]
<b>COMPOSITE SIGNAL</b>	
<b>PEAK CODE DOMAIN ERR</b>	: CALCulate2:FEED `XTIM:CDP:ERR:PCDomain` Query of results: :TRACe1:DATA? TRACe2

Table of Softkeys with Assignment of IEC/IEEE Commands

EVM VS CHIP	:CALCulate1:FEED 'XTIME:CDPower:CHIP:EVM' Query of results: :TRACe1:DATA? TRACe2
MAG ERR VS CHIP	:CALCulate1:FEED 'XTIME:CDPower:CHIP:MAGNitude' Query of results: :TRACe1:DATA? TRACe2 Unit: [%] Range: [-100% ... 100%]
PHASE ERR VS CHIP	:CALCulate1:FEED :CALCulate1:FEED 'XTIME:CDPower:CHIP:PHASE' Query of results: :TRACe1:DATA? TRACe2 Unit: [%] Range: [-180° ... 180°]
COMPOSITE CONST	:CALCulate<1>:FEED 'XTIM:CDP:COMP:CONStellation' Query of results: :TRACe<1>:DATA? TRACe2 Output: Liste der I/Q-Werte aller Chips pro Slot Format: Re <sub>1</sub> ,Im <sub>1</sub> ,Re <sub>2</sub> ,Im <sub>2</sub> ,...,Re <sub>2560</sub> ,Im <sub>2560</sub> Unit: [1] Quantity: 2560
POWER VS SLOT	:CALCulate2:FEED 'XTIM:CDP:PVSLOT'
RESULT SUMMARY	:CALCulate2:FEED 'XTIM:CDP:ERR:SUMMARY' Query of results: :CALCulate:MARKer:FUNCTION:WCDPower[:BTS]:RESult? PTOTal   FERRor   TFRame   TOFFset   MACCuracy   PCDError   EVMRms   EVMPeak   CERRor   CSLOT   SRATe   CHANnel   CDPabsolute   CDPRelative   IQOffset   IQIMbalance   MTYPe   RHO   MPIC   RCDerror
SELECT CHANNEL	:[SENSe:]CDPower:CODE 0...511
SELECT	
CAPTURE LENGTH	:[SENSe:]CDPower:IQLength <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: [] Default: 1
FRAME TO ANALYZE	:[SENSe:]CDPower:FRAME[:VALue] <numeric value> Range: <numeric value> [0 ... CAPTURE_LENGTH - 1] Unit: [] Default: 0
SELECT CHANNEL	:[SENSe:]CDPower:CODE 0...511
SELECT CPICH SLOT	:[SENSe:]CDPower:SLOT 0 ... 14
ADJUST REF LVL	:[SENS:]POW:ACH:PRES:RLEV



Table of Softkeys with Assignment of IEC/IEEE Commands

CODE DOM ERROR	<p>:CALCulate&lt;1&gt;:FEED 'XPOWER:CDEP'</p> <p>Query of results : :TRACe&lt;1&gt;:DATA? TRACe1</p> <p>Output: CDEP list of each CC9 channel</p> <p>Format: &lt;code class&gt;<sub>1</sub>, &lt;code number&gt;<sub>1</sub>, &lt;CDEP&gt;<sub>1</sub>, &lt;channel flag&gt;<sub>1</sub>, &lt;code class&gt;<sub>2</sub>, &lt;code number&gt;<sub>2</sub>, &lt;CDEP&gt;<sub>2</sub>, &lt;channel flag&gt;<sub>2</sub>,    &lt;code class&gt;<sub>512</sub>, &lt;code number&gt;<sub>512</sub>, &lt;CDEP&gt;<sub>512</sub>, &lt;channel flag&gt;<sub>512</sub></p> <p>Unit: &lt; [1] &gt;, &lt; [1] &gt;, &lt; [dB] &gt;, &lt; [1] &gt;</p> <p>Range: &lt; 9 &gt;, &lt; 0...511 &gt;, &lt; -∞ ... ∞ &gt;, &lt; 0 ; 1 ; 3 &gt;</p> <p>Quantity: 512</p>
CHANNEL TABLE	:CALCulate<1>:FEED 'XTIM:CDP:ERR:CTABLE'
POWER VS SYMBOL	<p>:CALCulate&lt;1&gt;:FEED 'XTIM:CDP:PVSyMbol'</p> <p>Query of results: TRACe&lt;1&gt;:DATA? TRACe2</p> <p>Format: Val<sub>1</sub>   Val<sub>2</sub>     Val<sub>NOF</sub></p> <p>Unit: [dB]</p> <p>Quantity: <math>NOF_{Symbols} = 10 \cdot 2^{(8-Code\ Class)}</math></p>
SYMBOL CONST	:CALCulate2:FEED 'XTIM:CDP:SYMB:CONStellation'
SYMBOL EVM	---
SYMBOL EVM	:CALCulate2:FEED 'XTIM:CDP:SYMB:EVM'
SYMB MAG ERROR	:CALC2:FEED XTIM:CDP:SYMB:EVM:'MAGNitude'
SYMB PHASE ERROR	:CALC2:FEED XTIM:CDP:SYMB:EVM:'PHASe'
BITSTREAM	:CALCulate2:FEED'XTIM:CDP:BSTReam'
FREQ ERR VS SLOT	:CALC2:FEED 'XTIM:CDP:FVSLot'
PHASE DISCOUNT	:CALC2:FEED 'XTIM:CDP:PSVSLot'

## 8 Performance Test

- Switch off the R&S Analyzer 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 R&S Analyzer and R&S SMIQ. Only then is compliance with specifications ensured.
- Unless specified otherwise, all settings are made after a PRESET.
- Conventions for settings on the R&S 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 below in this document are not guaranteed values. Only the data sheet specifications are binding.

### 8.1 Required Measuring Equipment and Accessories

Table 11 Required measuring equipment and accessories

Item	Instrument type	Recommended characteristics	Recommended equipment	R&S Order No.
1	Signal generator	Vector signal generator for generating cdmaOne signals	R&S SMIQ with options: R&S SMIQB42 R&S SMIQB20 R&S SMIQB11	1125.5555.xx 1104.7936.02 1125.5190.02 1085.4502.04

### 8.2 Test Procedure

The performance test refers exclusively to results of the code domain power. It is not necessary to check the POWER-, ACLR- and SPECTRUM results since they are covered by the performance test of the base unit.

Default settings on the R&S SMIQ:

```

[PRESET]
[LEVEL :           0 dBm]
[FREQ:             2.1175 GHz]
DIGITAL STD
  WCDMA 3GPP
    TEST MODELS ...
      TEST1_32
        SELECT BS/MS
          BS 1 ON
            STATE: ON
              Trigger output: RADIO FRAME
  
```

Check set channels against the following table:

CHNO	TYPE	SYM.R	CH.CD	POW	DATA	TOFFS	PILOT	TPC	MC	STATE
0	P-CPICH	15	0	-10.0					OFF	ON
2	P-SCH	15		-13.0					OFF	ON
3	S-SCH	15		-13.0					OFF	ON
4	P-CCPCH	15	1	-10.0	PN9					ON
6	PICH	15	16	-15.0	PATT	120				ON
11	DPCH	30	2	-13.0	PN9	86	8		PATTOFF	ON
12	DPCH	30	11	-13.0	PN9	134	8		PATTOFF	ON
13	DPCH	30	17	-14.0	PN9	52	8		PATTOFF	ON
14	DPCH	30	23	-15.0	PN9	45	8		PATTOFF	ON
15	DPCH	30	31	-17.0	PN9	143	8		PATTOFF	ON
16	DPCH	30	38	-14.0	PN9	112	8		PATTOFF	ON
17	DPCH	30	47	-16.0	PN9	59	8		PATTOFF	ON
18	DPCH	30	55	-18.0	PN9	23	8		PATTOFF	ON
19	DPCH	30	62	-16.0	PN9	1	8		PATTOFF	ON
20	DPCH	30	69	-19.0	PN9	88	8		PATTOFF	ON
21	DPCH	30	78	-17.0	PN9	30	8		PATTOFF	ON
22	DPCH	30	85	-15.0	PN9	18	8		PATTOFF	ON
23	DPCH	30	94	-17.0	PN9	30	8		PATTOFF	ON
24	DPCH	30	102	-22.0	PN9	61	8		PATTOFF	ON
25	DPCH	30	113	-20.0	PN9	128	8		PATTOFF	ON
26	DPCH	30	119	-24.0	PN9	143	8		PATTOFF	ON
27	DPCH	30	7	-20.0	PN9	83	8		PATTOFF	ON
28	DPCH	30	13	-18.0	PN9	25	8		PATTOFF	ON
29	DPCH	30	20	-14.0	PN9	103	8		PATTOFF	ON
30	DPCH	30	27	-14.0	PN9	97	8		PATTOFF	ON
31	DPCH	30	35	-15.0	PN9	56	8		PATTOFF	ON
32	DPCH	30	41	-19.0	PN9	104	8		PATTOFF	ON
33	DPCH	30	51	-18.0	PN9	51	8		PATTOFF	ON
34	DPCH	30	58	-17.0	PN9	26	8		PATTOFF	ON
35	DPCH	30	64	-22.0	PN9	137	8		PATTOFF	ON
36	DPCH	30	74	-19.0	PN9	65	8		PATTOFF	ON
37	DPCH	30	82	-19.0	PN9	37	8		PATTOFF	ON
38	DPCH	30	88	-16.0	PN9	125	8		PATTOFF	ON
39	DPCH	30	97	-18.0	PN9	149	8		PATTOFF	ON
40	DPCH	30	108	-15.0	PN9	123	8		PATTOFF	ON
41	DPCH	30	117	-17.0	PN9	83	8		PATTOFF	ON
42	DPCH	30	125	-12.0	PN9	5	8		PATTOFF	ON

all other channels STATE OFF

Default settings on the R&S Analyzer:

<b>[PRESET]</b>	
<b>[CENTER:</b>	2.1175 GHz]
<b>[REF:</b>	10 dBm]
<b>[3G FDD BS]</b>	
<b>[TRIG</b>	EXTERN]
<b>[SETTINGS</b>	SCRAMBLING CODE 0]
<b>[DISPLAY</b>	CHANNEL TABLE]

Test setup and other settings: ► Connect external trigger input of the R&S Analyzer to the R&S SMIQ.

- ▶ Connect external reference output of the R&S Analyzer to the R&S SMIQ.


R&S SMIQ UTILITIES

REF OSC

SOURCE: EXT

R&S Analyzer [SETUP: REFERENCE INT]

The display of the R&S Analyzer should show the following:



Channel Table

Channel Table

SR 30 ksps  
Chan Code 69  
SR 30 ksps  
Chan Code 69  
Chan Slot 7

CF 2.1175 GHz CPICH Slot 0 Chan Slot 7

Channel Table										
	Type	Symb Rate	Chan#	Status	TFCI	PilotL	Pwr Abs	Pwr Rel	T Offs	
Ref 10.0 dBm	CPICH	15.0 ksps	0	active	---	---	-10.19	-0.00	---	A
	PSCH	-. ksps	---	active	---	---	-16.29	-6.10	---	
	SSCH	-. ksps	---	active	---	---	-15.85	-5.67	---	
Att 35 dB	PCCPCH	15.0 ksps	1	active	---	---	-10.18	0.01	---	TRG
	-----	-. ksps	---	inactv	---	---	-.--	-.--	---	
1 CLRWR	PICH	15.0 ksps	16	active	---	---	-18.20	-8.02	30720	
	DPCH	30.0 ksps	69	active	ON	8	-19.16	-8.97	22528	
	DPCH	30.0 ksps	74	active	ON	8	-19.20	-9.01	16640	
	DPCH	30.0 ksps	78	active	ON	8	-17.19	-7.00	7680	
	DPCH	30.0 ksps	82	active	ON	8	-19.19	-9.00	9472	

PRN

---

Result Summary

SR 30 ksps  
Chan Code 69  
Chan Slot 7

CF 2.1175 GHz CPICH Slot 0 Chan Slot 7

Result Summary			
GLOBAL RESULTS			
Ref 10.0 dBm	Total Power	-0.26 dBm	Carrier Freq Error -83.91 mHz
	Chip Rate Error	0.01 ppm	Trigger to Frame 0.00 s
	IQ Offset	0.19 %	IQ Imbalance 0.06 %
Att 35 dB	Composite EVM	1.41 % rms	Pk CDE (15.0 ksps) -57.83 dB rms
	CPICH Slot No	0	No of Active Chan 35
CHANNEL RESULTS			
1 CLRWR	Symbol Rate	30.00 ksps	Timing Offset 22528 Chips
	Channel Code	69	Channel Slot No 7
	No of Pilot Symb	8	
	Channel Power Rel	-8.97 dB	Channel Power Abs -19.16 dBm
	Symbol EVM	1.10 % rms	Symbol EVM 1.78 % Pk

EXT

B

# Glossary

## T

**Term:** Definition

CPICH	<p>Common pilot channel (spreading code number 0 at spreading factor 128).</p> <p>The channel constantly contains the symbol (1,1) throughout the total length of the 3GPP FDD frame. For the measurements, the CPICH (Primary CPICH) is used for synchronization. For this reason, the CPICH must be contained in the signal to be measured.</p>
Composite EVM	<p>In accordance with the 3GPP specifications, the squared error between the real and imaginary components of the test signal and an ideal reference signal is determined (EVM referenced to the total signal) in a composite EVM measurement.</p>
DPCH	<p>Dedicated physical channel, data channel. The data channels, which can be sent at different transmission rates, are automatically recognized during the measurement.</p>
Inactive Channel Threshold	<p>Minimum power that a single channel must have as compared to the total signal in order to be recognized as an active channel.</p>
PCCPCH	<p>Primary common control physical channel (spreading code number 1 at spreading factor 128).</p> <p>The channel is used for synchronizing the measurements. For this reason, it must be contained in the signal to be measured.</p>
Peak Code Domain Error	<p>In accordance with the 3GPP specifications, the error between the test signal and the ideal reference signal is projected onto the classes of the different spreading factors in the case of a peak code domain measurement.</p>
PICH	<p>Paging indication channel.</p> <p>This special channel is defined in the test models to 3GPP for measurements on base station signals. Since it does not contain any pilot symbols, it cannot automatically be recognized during measurement. Therefore, this channel must be deactivated for CDP measurements.</p>
SCH	<p>Synchronization channel, divided into P-SCH (primary synchronization channel) and S-SCH (secondary synchronization channel).</p>

The two channels are required for synchronizing the measurement. Therefore, they must always be contained in the signal to be measured.

#### Timing-Offset

Offset between the start of the first slot of a channel and the start of the analyzed 3GPP FDD frame (in multiples of 256 chips).

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