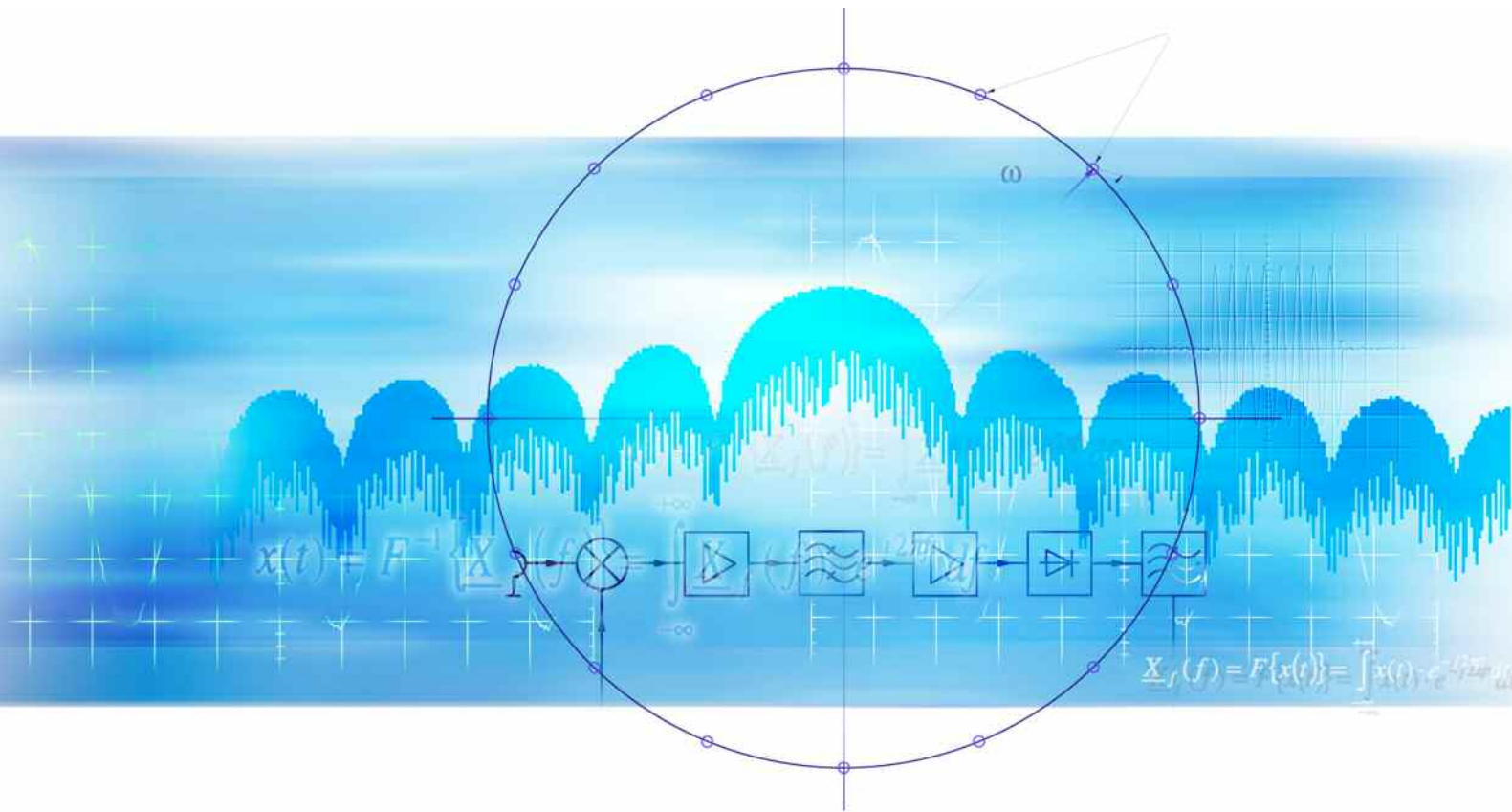


Software Manual



1xEV-DO Base Station Test

Applikations Firmware

R&S[®] FS-K84

1157.2851.02



This Software Manual describes the Applikations Firmware R&S® FS-K84 for the following models:

R&S® FMU

R&S® FSG

R&S® FSMR

R&S® FSP

R&S® FSQ

R&S® FSU

R&S® FSUP

Dear Customer,

throughout this manual, R&S FS–K84 is generally used as an abbreviation for the software option R&S® FS-K84. Similarly the spectrum and signal analyzers mentioned above are abbreviated the same way.

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

CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA –USA).

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 Certificate of Quality
 Support Center Address
 List of R&S Representatives

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Grouped Safety Messages









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







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

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

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

Symbols and safety labels

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

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

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

Tags and their meaning

DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	NOTICE indicates a property damage message.

In the product documentation, the word ATTENTION is used synonymously.

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

Basic safety instructions

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

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

Grouped Safety Messages

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

Informaciones elementales de seguridad

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







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

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

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

Símbolos y definiciones de seguridad

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

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

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

Palabras de señal y su significado

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

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

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

Informaciones de seguridad elementales

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

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

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

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

Certified Quality System

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

DQS REG. NO 001954 QM UM

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Sehr geehrter Kunde,

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



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Contents of the Software Manual for Application Firmware R&S FS-K84

This software manual contains information on operation of the R&S FSU and R&S FSP spectrum analyzers and the R&S FSQ signal analyzer configured with Application Firmware R&S FS-K84. It includes a description of the menus and the remote-control commands for the 1xEV-DO base station test application firmware.

All other aspects of analyzer operation can be taken from the operating manual of the analyzer.

The software description of the application firmware consists of the data sheet and the following chapters:

The data sheet	informs on the typical specifications and the firmware characteristics
Chapter 1	describes how you enable the application firmware.
Chapter 2	describes typical examples of measurements by means of tests.
Chapter 3	describes the test setup for base station tests.
Chapter 4	describes the predefined channel tunnels
Chapter 5	gives a schematic view of the control menus.
Chapter 6	contains a detailed description of all functions for base station tests as a reference for manual operation. The chapter also lists the corresponding IEC/IEEE bus command for each chapter.
Chapter 7	describes all the remote-control commands that have been defined for the application firmware. A table containing the IEC/IEEE bus commands assigned to the softkeys are given at the end of the chapter.
Chapter 8	describes the performance test
Chapter 9	contains tables that illustrate the relationship between the MAC index and the Walsh code for the MAC and PREAMBLE channel types
Chapter 10	provides definitions and abbreviations relating to the 1xEV-DO standard that are also used in this software description
Chapter 11	contains the index of this software manual.

1xEV-DO Base Station Test Application Firmware

R&S FS-K84

When configured with Application Firmware R&S FS-K84, the analyzer performs code domain power measurements on forward link signals (base station) on the basis of the 3GPP2 Standard (Third Generation Partnership Project 2) 3GPP2 Standard (Third Generation Partnership Project 2) High Rate Packet Data. This Standard, which was defined for packet-oriented data communications, is generally referred to as 1xEV-DO (First Evolution Data Only). This name is also used in Application Firmware R&S FS-K84.

In this Standard, the expressions "access network" (AN) and "access terminal" (AT) are used for the base station and the mobile terminal, respectively. To retain the similarity with the CDMA2000 BTS application firmware, the expression "base station" is also used in connection with the 1xEV-DO FS-K84 application firmware.

The 1xEV-DO BTS application firmware is based on the "**CDMA2000 High Rate Packet Data Air Interface Specification**" of version C.S0024 v.3.0 dated December 2001 and the "**Recommended Minimum Performance Standards for CDMA2000 High Rate Packet Data Access Network**" of version C.S0032-0 v.1.0 dated December 2001.

These standard documents are published as TIA 856 (IS-856) and TIA 864 (IS-864), respectively. The application firmware supports code domain measurements on 1xEV-DO signals. This code domain power analyzer provides the following analyses, among others: Code Domain Power, Channel Occupancy Table, EVM, Frequency Error and RHO Factor. All four channel types (PILOT, MAC, PREAMBLE and DATA) are supported and the modulation types in the DATA channel type are detected automatically. The signals needing to be measured may contain different modulation types or preamble lengths in each slot, thus making it possible to perform measurements on base stations while operation is in progress.

In addition to the code domain measurements described in the 1xEV-DO Standard, the application features measurements in the spectral range such as channel power, adjacent channel power, occupied bandwidth and spectrum emission mask with predefined settings.

The 1xEV-DO Standard has been developed from the CDMA2000 Standard, which in its turn was an extension of cdmaOne (IS 95). All these standards are based on the same RF parameters, this being the reason why the RF measurements of CDMA2000 and 1xEV-DO are identical. In the code domain, however, CDMA2000 and 1xEV-DO are not compatible, since the chips for 1xEV-DO are assigned chronologically one after the other to the different channel types, and in the DATA channel type 8-PSK and 16-QAM modulation methods are used in addition to QPSK. With CDMA2000, there are only BPSK and QPSK modulation methods. Furthermore, a slot is always assigned to precisely one node with 1xEV-DO, whereas with CDMA2000 several nodes communicate with the base station simultaneously. For further details refer to the chapter entitled "Code Domain Measurements on 1xEV-DO Signals", starting on page 67.

1 Installing and Enabling the Application Firmware

Installation

If Application Firmware R&S FS-K84 has not been installed on the device, a firmware update will have to be performed. This will have been done already if the application software was installed at the factory.

Before the application firmware can be installed, a corresponding basic firmware of the basic device has to be installed on the analyzer. Refer to the release notes of the current Application Firmware R&S FS-K84 for the latest versions.

If the basic firmware has to be updated, start the firmware update from the current floppy disks of the basic firmware by successively pressing *SETUP* → *NEXT* → *FIRMWARE UPDATE*.

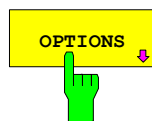
If the correct basic firmware is installed, the firmware update for the firmware application is started from the floppy disks of the Firmware Application R&S FS-K84 using the same key sequence – *SETUP* → *NEXT* → *FIRMWARE UPDATE*.

Following installation, the application firmware has to be enabled as described below.

Enabling

Application Firmware R&S FS-K84 is enabled on the *SETUP* → *GENERAL SETUP* menu by entering a keyword. The keyword is supplied with the application firmware. When the application software is installed before the device leaves the factory, the application firmware will already have been enabled.

GENERAL SETUP menu:



The *OPTIONS* softkey opens a submenu in which the keywords can be entered for the application firmware. The available applications are displayed in a table, which is opened when you enter the submenu.



The *INSTALL OPTION* softkey activates input of the keyword for an application firmware.

One or several keywords can be entered in the input field. If the keyword is valid, the message *OPTION KEY OK* is displayed and the application firmware is entered in the *FIRMWARE OPTIONS* table.

If a keyword is invalid, the message *OPTION KEY INVALID* is displayed.

If the version of the application firmware and the version of the basic firmware are not compatible, an appropriate message is issued. In this instance, follow the instructions contained in the above chapter, "Installation".

2 Getting Started

The following chapter explains basic 1xEV-DO base station tests using a test setup with the Signal Generator R&S SMIQ as the device under test. It describes how operating and measuring errors can be avoided by means of correct default settings.

The measurement screen is presented in Chapter 6 for the different measurements.

Attention is drawn to important settings exemplifying how to avoid measurement errors during measurements. The correct setting is followed by the effect of an incorrect setting. The following measurements are performed:

- Measurement 1: Measuring the signal spectrum
- Measurement 2: Measuring the spectrum emission mask
- Measurement 3: Measuring the relative code domain power and the frequency error
 - Setting: Center frequency
- Measurement 4: Triggered measurement of relative code domain power
 - Setting: Trigger offset
 - Setting: PN offset of base station
- Measurement 5: Measurement of composite EVM
- Measurement 6: Measurement of peak code domain error
- Measurement 7: Measurement of RHO factor

The 1xEV-DO raw data are created with the R&S WinIQSIM software and loaded into the arbitrary waveform generator of the SMIQ.

The measurements are performed with the following instruments and aids:

- Spectrum Analyzers R&S FSU, R&S FSP or Signal Analyzer R&S FSQ with Application Firmware R&S FS-K84 (base station test for 1xEV-DO).
- Vector Signal Generator SMIQ with hardware options data generator B11 / modulation coder B20 and arbitrary waveform generator B60 together with firmware version 5.70 or higher with enabled option K17 1xEV-DO and SMIQ-Z5 PARADATA BNC ADAPTER for external trigger signal.
- PC that is either connected by means of a serial cable to the SMIQ, or has an IEC/IEEE bus card and connected by means of an IEC/IEEE bus cable to the SMIQ. R&S WinIQSIM Software 3.91 or higher is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at <http://www.rohde-schwarz.com>.
- 1 coaxial cable, 50 Ω , approximately 1 m, N connector
- 2 coaxial cables, 50 Ω , approximately 1 m, BNC connector

Generating a 1xEV-DO forward link signal with WinIQSIM

The WinIQSIM software can be downloaded at <http://www.rohde-schwarz.com> and is installed on a PC. The WinIQSIM software can be used to generate 1xEV-DO forward link signals, which are transferred on an SMIQ or AMIQ. An explanation is given below of how the test signal described in the 1xEV-DO Standard is generated. WinIQSIM version 3.91 or higher is assumed.

Selecting Start and Standard:

Start **WinIQSIM.exe**.

On the **File** menu, select the **New** option and select **1xEV-DO** from the list that follows. The 1xEV-DO dialog box appears.

Select **BS1** in the dialog box to configure base station 1 and the following dialog box is opened:

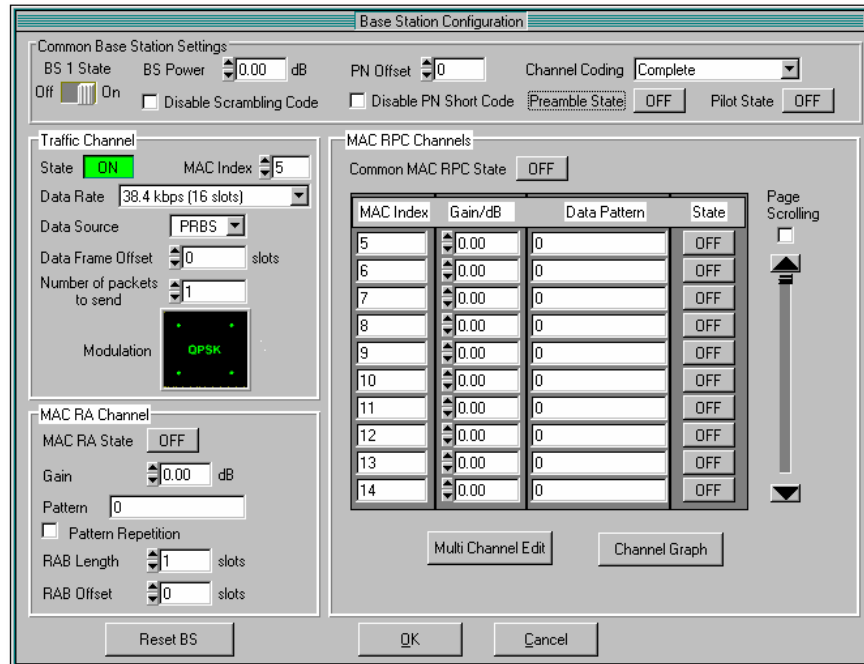


Fig. 2-1 WinIQSIM base station configuration prior to settings

Activate channel types:

In this **base station configuration**, the following settings are performed so that a full-slot signal of the maximum data rate is generated at 14 assigned MAC indices. This model is specified as a test standard for some tests in the 1xEV-DO Standard.

Set **Preamble State** to **ON** so that a preamble is contained in the signal and set **Pilot State** to **ON** so that the pilot is sent.

At **Traffic Channel**, select **Data Rate '2457.6 kbps (1 slot)'**; this is a 16-QAM modulated data signal for a preamble length of 64 chips.

At **MAC RA Channel**, the **MAC RA State** must be set to **ON** and the **RAB Length** set to **16 Slots**.

In the **MAC RPC Channels** section, set the **Common MAC RPC State** to **ON**. Use the **Multi Channel Edit** key to open the following dialog box, which allows a rapid MAC Index entry:

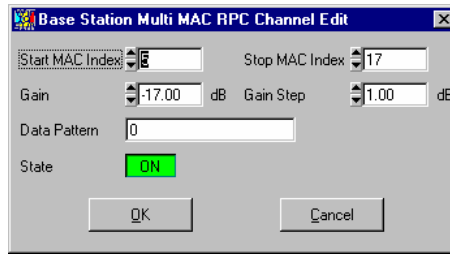


Fig. 2–2 WinIQSIM – Multi MAC RPC Channel Edit

To activate 13 more MAC codes for the test model, enter a **5** at **Start MAC Index**, and **17** at **Stop MAC Index**, and then set the **State** to **ON**. So that the RPC channels differ in terms of power, enter **-17 dB** at **Gain** and **1 dB** at **Gain Step**. After you click **OK**, the **base station configuration** will look as follows:

The model is configured:

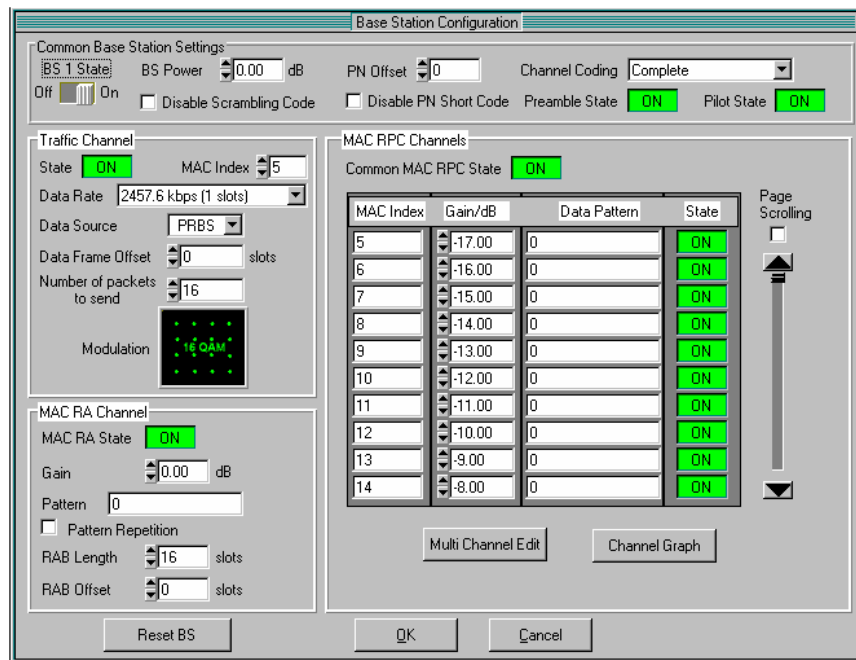


Fig. 2–3 WinIQSIM base station configuration of the finished model

Define trigger settings:

Then, set the trigger settings on the **SMIQ** menu by choosing the option **Trigger Output Settings**. For the **Current Mode: Mode 1** the **Restart Clock (SEQUENCE)** is defined. This means that the trigger at the slot limit is available every 80 ms at TRIG1 of the SMIQ Z5 BNC adapters.

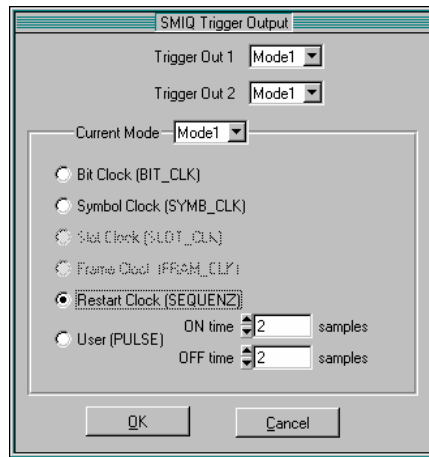


Fig. 2–4 WinIQSIM base station configuration of the finished model

Save and download to SMIQ:

Save this 1xEV-DO configuration by choosing **File|Save** as file 'DO_FFULL.IQS' (1xEV-DO Forward Link FULL Slot).

Connect the SMIQ either serially or by means of an IEC/IEEE bus card and IEC/IEEE bus cable to the SMIQ and, on the **SMIQ|TRANSMISSION** menu, load the generated signal under the name 'DO_FFULL' onto the SMIQ.

Default settings in 1xEV-DO BTS operating mode

At the default setting after PRESET, the analyzer is in SPECTRUM mode. The following basic settings of the code domain measurement are not activated until the 1xEV-DO BTS operating mode is selected by operating hotkey **1xEVDO BS**.

Table 2–1 Default setting of code domain measurement after preset

Parameter	Setting
Digital standard	CDMA 2000 MC1 (where MC1 stands for Multi Carrier 1 and thus describes CDMA2000 1X, that is a carrier and consequently also applicable to 1xEV-DO, since the RF parameters such as occupied bandwidth and channel spacings are compatible with CDMA2000)
Band class	Band class 0 (800 MHz band)
Sweep	CONTINUOUS
CDP mode	CODE CHAN AUTOSEARCH
CDP average	OFF (the CDP measurement is performed slot by slot and is not averaged for all slots)
Trigger setting	FREE RUN
Trigger offset	0 s
PN offset	0 chips
Threshold value	–40 dB
Channel type	PILOT
Mapping	AUTO (consequently, for channel type PILOT the I or Q branch is evaluated, depending on SELECT I/Q)
SELECT I/Q	I (the I branch is evaluated)
Code number	0
Slot number	0
Capture length	3 slots (where one slot contains 2048 chips and lasts 1.666 ms)
Evaluation	Screen A: CODE PWR RELATIVE Screen B: GENERAL RESULTS

The following conventions apply for displaying settings on the analyzer:

- [<Key>] Press a key on the front panel such as **[SPAN]**
- [<SOFTKEY>] Press a softkey such as **[MARKER → PEAK]**
- [<nn unit>] Enter a value and terminate by entering the unit such as **[12 kHz]**

The following conventions apply for displaying settings on the SMIQ:

- [<Key>] Press a key on the front panel such as **[FREQ]**
- <MENU> Choose a menu, parameter or a setting such as **DIGITAL STD**. The menu level is identified by indenting.
- <nn unit> Enter a value and terminate by entering the unit such as **12 kHz**

Measurement 1: Measuring the signal power

Measurement of the spectrum provides an overview of the 1xEV-DO signal and the carrier-oriented spurious emissions.

Test setup ➤ Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Settings on SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           878.49 MHz]
ARB MOD
  SET SMIQ ACCORDING TO WAVEFORM ...
    SET SMIQ ACCORDING TO WAVEFORM      ON
    IQ SWAP (VECTOR MODE)              ON
    TRIGGER OUT MODE                   ON
```

(These three settings are only required once after generator preset and are used to apply, in VECTOR MODE, the IQ SWAP and, in ARB MOD, the trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly present when a switch is made between different waveforms.)

```
SELECT WAVEFORM... select name 'DO_FFULL'
STATE:      ON
```

Setting on analyzer:

```
[PRESET]
[FREQUENCY:      878.49 MHz]
[AMPT:           0 dBm]
[1xEVDO BS]
[MEAS:           POWER]
```

Measurement on analyzer: The following are displayed:

- The spectrum of the 1xEV-DO signal
- The channel power of the signal within the 1.2288 MHz channel bandwidth

Measurement 2: Measuring the spectrum emission mask

The 1xEV-DO specification calls for a measurement which monitors compliance with a spectral mask in a range of at least ± 4.0 MHz around the 1xEV-DO carrier. To assess the power emissions within the specified range, signal power is measured with a 30 kHz filter. The ensuing trace is compared with the limit line defined in the 1xEV-DO specification depending on the selected band class.

Test setup ➤ Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors).

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer:	[PRESET]	<i>Band class 0 is thus selected</i>
	[FREQUENCY:	<i>878.49 MHz]</i>
	[AMPT:	<i>0 dBm]</i>
	[1xEVDO BS]	
	[MEAS:	<i>SPECTRUM EM MASK]</i>

Measurement on analyzer: The following are displayed:

- The spectrum of the 1xEV-DO signal
- The channel power
- The limit line defined in the standard
- Information on limit line violations (passed/failed)

Measurement 3: Measuring the relative code domain power and the frequency error

A measurement of the code domain power is shown in the following. In this case the basic parameters of the CDP measurements, which allow analysis of the signal, reset successively from values adjusted to the test signal to those that have not been adjusted in order to demonstrate the resulting effects.

Settings on SMIQ: ➤ Connect the RF output of the SMIQ to the RF Input of the analyzer.
 ➤ Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer: **[PRESET]**
 [FREQUENCY: 878.49 MHz]
 [AMPT: 10 dBm]
 [1xEVDO BS]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal

Screen B: Numeric results of CDP measurement including the frequency error

Setting: Synchronizing the reference frequencies

Synchronization of the transmitter and receiver to the same reference frequency reduces the 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 SMIQ (coaxial cable with BNC connectors)
- Settings on SMIQ: *SMIQ settings as for measurement 1*
- Setting on analyzer: *As for measurement 3, plus*
[SETUP: REFERENCE EXT]
- Measurement on analyzer: Screen B: Frequency error: The displayed frequency error should be < 10 Hz.

The reference frequencies of the analyzer and the device under test should be synchronized.

Setting: Behaviour with deviating center frequency setting

In the following setting, the behaviour of the DUT and analyzer on a deviating center frequency setting is shown.

- Settings on SMIQ: ➤ Tune the center frequency of the signal generator in 1 kHz steps and watch the analyzer screen:
- Measurement on analyzer: • Up to about 8.0 kHz frequency error, a CDP measurement is still possible on the analyzer. A difference in the measurement accuracy of the CDP measurement is not discernible up to this frequency error.
- Above a frequency error of 8.0 kHz, the probability of an impaired synchronization increases. The 'SYNC FAILED' message appears.
- Above a frequency error of 10 kHz, a CDP measurement becomes impossible. The 'SYNC FAILED' message appears.
- Settings on SMIQ: ➤ Set the signal generator center frequency again to 878.49 MHz:
[FREQ: 878.49 MHz]

The center frequency of the analyzer must agree with the frequency of the device under test to within a 8.0 kHz offset.

Measurement 4: Triggered measurement of relative code domain power

If the code domain power measurement is performed without external triggering, an extract is recorded from the test signal at a random point in time and attempts to detect the start of a slot in it. To detect this start, all possibilities of the PN sequence location have to be tested in Free Run mode. This requires computing time. This computing time can be reduced by creating an external (frame) trigger and entering the correct PN offset. The search range for the start of the slot and the PN offset are known and fewer options have to be tested.

Test setup

- Connect the RF output of the SMIQ to the RF input of the analyzer
- Connect the reference frequencies (refer to measurement 2)
- Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer: As for measurement 3, plus
[TRIG: EXTERN]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal
Screen B: Numeric results of CDP measurement

Trg to Frame: Timing offset between trigger event and start of the slot

The repetition rate of the measurement increases compared with measurement without an external trigger.

Setting: Trigger offset

Any delay of the trigger event compared to the start of the slot can be compensated by changing the trigger offset.

Setting on analyzer: As for measurement 3, plus
[TRIG:]
[TRIG OFFSET *100 μs]*

Measurement on analyzer: The parameter "Trg to Frame" in the numeric results table (screen B) changes:
Trg to Frame *-100 μs*

A trigger offset compensates analog delays of the trigger event.

Setting: Behaviour with wrong PN offset

A valid CDP measurement can only be performed with an external trigger if the PN offset set on the analyzer agrees with that of the transmit signal.

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer: Set PN offset to the new value:
[SETTINGS: *PN-OFFSET 200]*

Measurement on analyzer: The 'SYNC FAILED' message appears.

Setting on analyzer: Set PN offset to the new value:
[SETTINGS: *PN-OFFSET 0]*

Measurement on analyzer: The CDP display shows the test model again.

The setting of the PN offset on the analyzer must agree with the PN offset of the signal to be measured. The TRG TO FRAME value of the general results analysis is correct only if the PN offset agrees.

Measurement 5: Measuring the composite EVM

Composite EVM is the measurement of the mean square error of the total signal of a channel type. An ideal reference signal is generated from the demodulated data. The test signal and the reference signal are compared with each other; the squared deviation produces the Composite EVM measurement.

- Test setup
- Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
 - Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
 - Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer:

[PRESET]	
[FREQUENCY:	<i>878.49 MHz]</i>
[AMPT:	<i>10 dBm]</i>
<i>[1xEVDO BS]</i>	
[TRIG	<i>EXTERNAL]</i>
[RESULTS	<i>COMPOSITE EVM]</i>

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal

Screen B: Composite EVM (EVM for total signal)

Measurement 6: Measuring the peak code domain error

With the peak code domain error measurement, an ideal reference signal is generated from the demodulated data. The test signal and the reference signal of a channel type are compared with each other. The difference between the two signals is projected to the class of the channel-type spreading factor. 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
- Connect the RF output of the SMIQ to the RF input of the analyzer (coaxial cable with N connectors)
 - Connect the reference input (EXT REF IN/OUT) on the rear panel of the analyzer to the reference output (REF) on the SMIQ (coaxial cable with BNC connectors)
 - Connect external triggering of the analyzer (EXT TRIG GATE) to the SMIQ trigger (TRIGOUT1 at PAR DATA).

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer:

[PRESET]	
[FREQUENCY:	<i>878.49 MHz]</i>
[AMPT:	<i>0 dBm]</i>
<i>[1xEVDO BS]</i>	
[TRIG	<i>EXTERN]</i>
[RESULTS	<i>PEAK CODE DOMAIN ERR]</i>

Measurement on analyzer: The following are displayed:

Screen A:	Code domain power of signal
Screen B:	Peak code domain error

Measurement 7: Measurement of the RHO factors

A measurement of the RHO factors is shown in the following. The Standard specifies measurement of 3 RHO factors: RHO Pilot (only in the Pilot channel type), RHO_{overall-1} (RHO over all slots with start of averaging at the half slot boundary) and RHO_{overall-2} (RHO over all slots with start of averaging at the half slot boundary).

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

Settings on SMIQ: *SMIQ settings as for measurement 1*

Setting on analyzer:

[PRESET]
[FREQUENCY: 878.49 MHz]
[AMPT: 10 dBm]
[1xEVDO BS]

Measurement on analyzer: The following are displayed:

Screen A: Code domain power of signal

Screen B: Numeric results of CDP measurement including the RHO factors

3 Test Setup for Base Station Tests

NOTICE

Instrument damage caused by disregarding the following precautions!

Any non-compliance with the following precautions may cause damage to the instrument. Prior to putting the instrument into operation, check the following:

- The covers of the housing are in place and screwed on.
- Vents are not obstructed. Make sure that the air can escape freely through the vents at the sides. The minimum distance to the wall should therefore be at least 10 cm.
- The signal levels at the inputs do not exceed permissible limits.
- The outputs of the instrument are not overloaded or incorrectly connected. This particularly applies to the maximum permissible back-feed at the outputs, which is specified in the data sheet
- The ambient temperature must not exceed the range specified in the data sheet.

This chapter describes the default settings of the analyzer for operation as a 1xEV-DO base station tester. A condition that has to be met before measurements can start is that the analyzer is correctly configured and supplied with power, as described in Chapter 1 of the operating manual for the basic device. Furthermore, Application Firmware R&S FS-K84 must be enabled. Installation and enabling of the application firmware are explained in Chapter 1 of this software manual.

Standard Test Setup

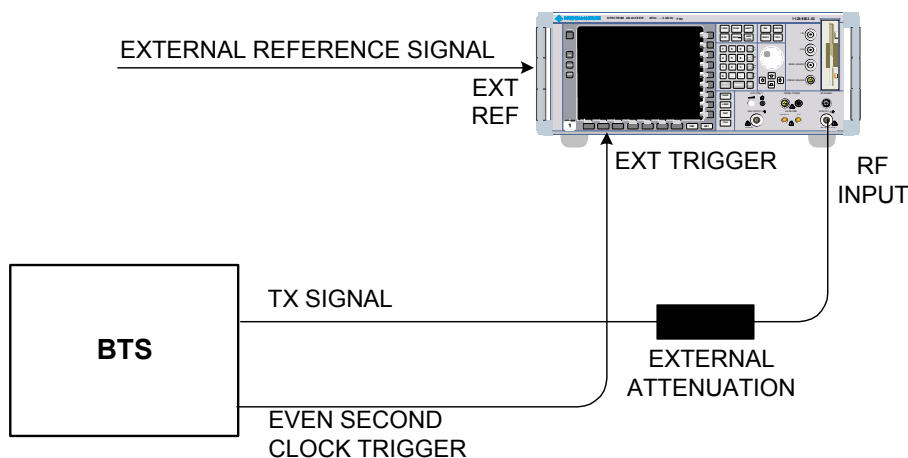


Fig. 3–1 BTS test setup

- Connect the antenna output (or TX output) of the base station by means of a power attenuator exhibiting suitable attenuation to the RF input of the analyzer.
The following level values for external attenuation are recommended to ensure that the RF input of the analyzer is protected and the sensitivity of the device is not impaired too much:

Maximum power	Recommended external attenuation
≥ 55 to 60 dBm	35 to 40 dB
≥ 50 to 55 dBm	30 to 35 dB
≥ 45 to 50 dBm	25 to 30 dB
≥ 40 to 45 dBm	20 to 25 dB
≥ 35 to 40 dBm	15 to 20 dB
≥ 30 to 35 dBm	10 to 15 dB
≥ 25 to 30 dBm	5 to 10 dB
≥ 20 to 25 dBm	0 to 5 dB
20 dBm	0 dB

- For signal measurements at the output of two–port networks, connect the reference frequency of the signal source to the rear reference input of the analyzer (*EXT REF IN/OUT*).
- To maintain the error limits called for in the 1xEV–DO specification during frequency measurement on base stations, the analyzer has to be operated on an external reference. The reference source might be a rubidium frequency standard, for example.
- If the base station has a trigger output, connect the trigger output of the base station to the rear trigger input of the analyzer (*EXT TRIG GATE*).

Default settings

- Enter the external attenuation. **[AMPT] [NEXT] [REF LVL OFFSET].**
- Enter the reference level. **[AMPT]**
- Enter the center frequency. **[FREQUENCY]**
- Set the trigger. **[TRIG]**
- During use, switch on external reference. **[SETUP] [REF: EXT]**
- Select the standard and the desired measurement. **[1xEVDO BS] [RESULTS]**
- Set the PN offset. **[SETTINGS] [PN OFFSET]**

4 Predefined Channel Tables

By default, the application firmware works in automatic Channel Search mode (softkey *CODE CHAN AUTOSEARCH*). However, there is also the option of using predefined channel tables and taking the code domain analysis as a basis. To do this, select the channel table and enable the predefined search mode (softkey *CODE CHAN PREDEFINED*). As an example or basis for customer-specific channel tables, some tables have been defined already. They are listed below. With redefined channel tables, it is assumed that the signals needing to be investigated have the same configuration in each slot (known as 1 slot signals). Should channels other than those that appear in the predefined channel tables of the firmware application be used, the original tables should be copied and the channels adapted in the copy. (Refer to the hotkey *CHAN CONF* on page 91.)

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type QPSK in channel type DATA and the following listed active codes in channel types.
(File name DOQPSK.)

Table 4–1 Base station channel table DOQPSK with QPSK modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	QPSK QPSK QPSK ... QPSK QPSK QPSK

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 8-PSK in channel type DATA and the following listed active codes in channel types.
(File name DO8PSK.)

Table 4–2 Base station channel table DO8PSK with 8-PSK modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	8-PSK 8-PSK 8-PSK ... 8-PSK 8-PSK 8-PSK

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 16-QAM in channel type DATA and the following listed active codes in channel types.
(File name DO16QAM.)

Table 4-3 Base station channel table with 16-QAM modulation in DATA area

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/mapping
PILOT	1	0.32	BPSK-I
MAC	5	2.64 (RA) 3.64 4.64 34.64 35.64	BPSK-I BPSK-I BPSK-I BPSK-Q BPSK-Q
PREAMBLE 64 chips long	1	3.32	BPSK-I
DATA	16	0.16 1.16 2.16 ... 13.16 14.16 15.16	16-QAM 16-QAM 16-QAM ... 16-QAM 16-QAM 16-QAM

Channel table with channel types PILOT/MAC – known as IDLE slot, since it does not contain any active channels in the DATA channel type.
(File name DO_IDLE.)

Table 4-4 Base station test model DO_IDLE for idle slot configuration

Channel type	Number of channels	Code channel (Walsh Code.SF)	Modulation/mapping
PILOT	1	0.32	BPSK-I
MAC	1	2.64 (RA)	BPSK-I

For further information on the channel table defaults refer to hotkey *CHAN CONF*.

The channel abbreviations are defined in Chapter 10, "Glossary".

5 Menu Overview

Application Firmware R&S FS-K84 (1xEV-DO base station tests) adds RF measurements and code domain power measurements for the 1xEV-DO Forward Link mobile radio standard to the analyzer.

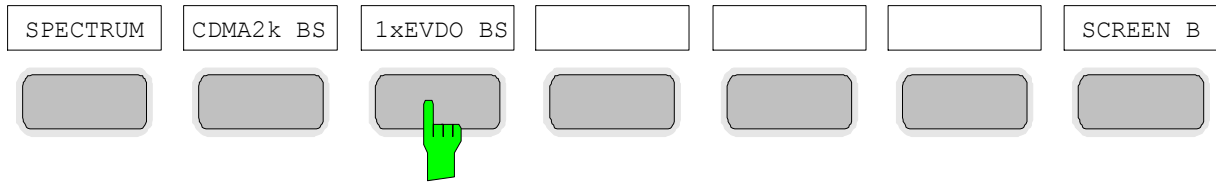


Fig. 5-1 Hotkey bar with enabled Application Firmware R&S FS-K82 and R&S FS-K84

After the application firmware has been called by operating hotkey **1xEVDO BS** a new hotkey bar is displayed at the bottom edge of the screen and the code domain analyzer is selected and started.

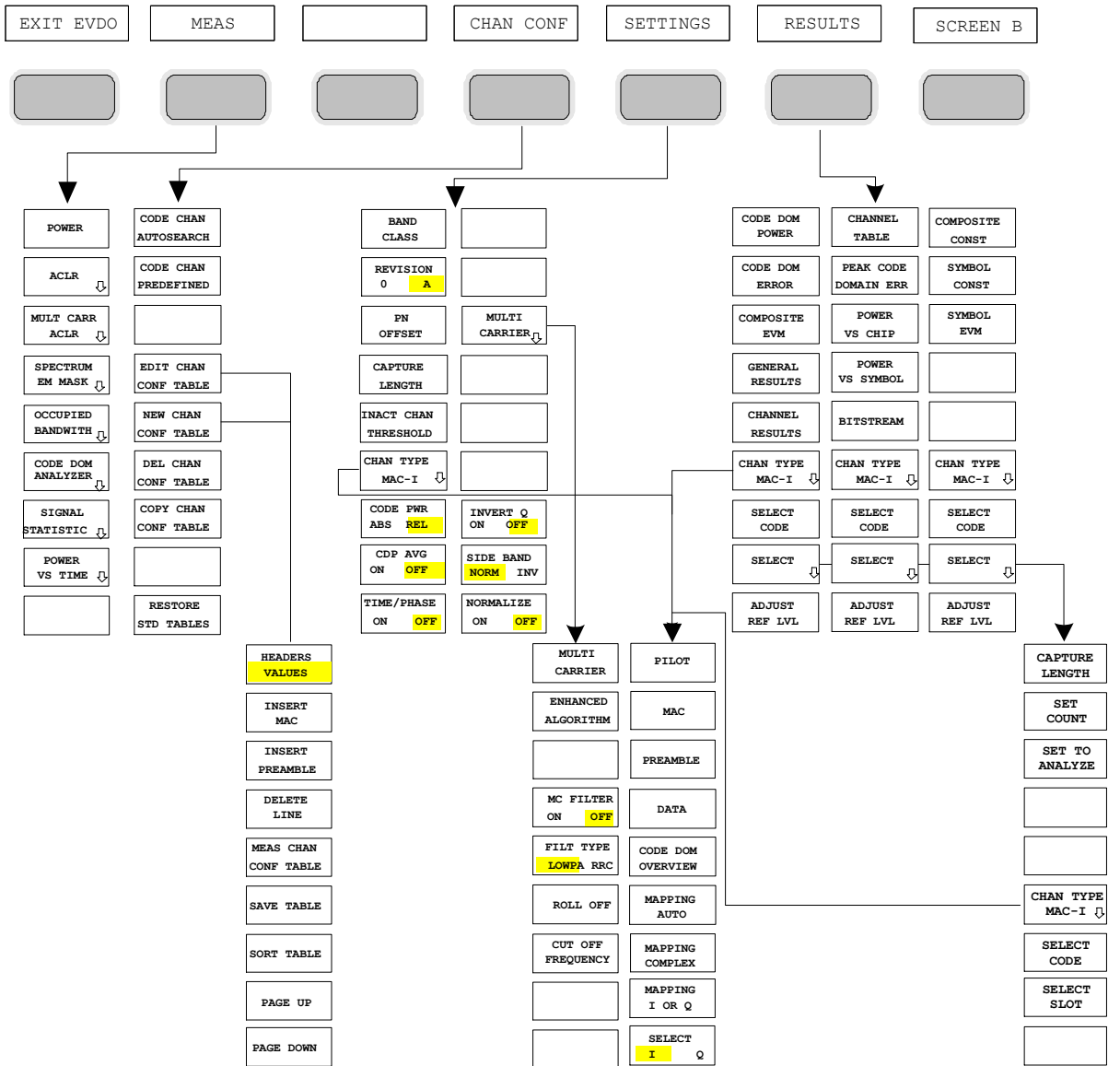


Fig. 5-2 Overview of the menus in Application Firmware R&S FS-K84

There are different analyses for the code domain analyzer. They can be selected by means of the *RESULTS* hotkey. The *SETTINGS* hotkey allows the application firmware to be parameterized. The PN offset of the base station or the band class can be set on this menu, for example. The *CHAN CONF* hotkey is used to set Channel Search mode for the code domain analyzer. Furthermore, the customer can also define his own channel tables.

The MEAS hotkey is identical to the MEAS key (on the right of the front panel) and is used to select the different RF measurements or the code domain analyzer.

Selection of the *CHAN CONF* or *RESULTS* hotkey automatically results in switching to the code domain analyzer.

Pressing the *EXIT EVDO* hotkey once exits R&S FS-K84. The hotkey bar of the basic device is displayed again and the analyzer goes to SPECTRUM, the default mode.

Transition from the SPECTRUM operating mode to the application firmware:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:

- Reference Level + Rev Level Offset
- Center Frequency + Frequency Offset
- Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

- External trigger sources are retained, while all other trigger sources result in Free Run mode.
- Additional trigger settings are retained.

Transition from the application firmware to the SPECTRUM operating mode:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:

- Reference Level + Rev Level Offset
- Center Frequency + Frequency Offset
- Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

- The trigger source is switched to FREE RUN and an analyzer frequency sweep is set with the SPAN equal to the double center frequency, or the maximum possible span, so that the center frequency remains unchanged at any event.

The measurements available in R&S FS-K84 can be selected by means of the MEAS hotkey or the MEAS key:

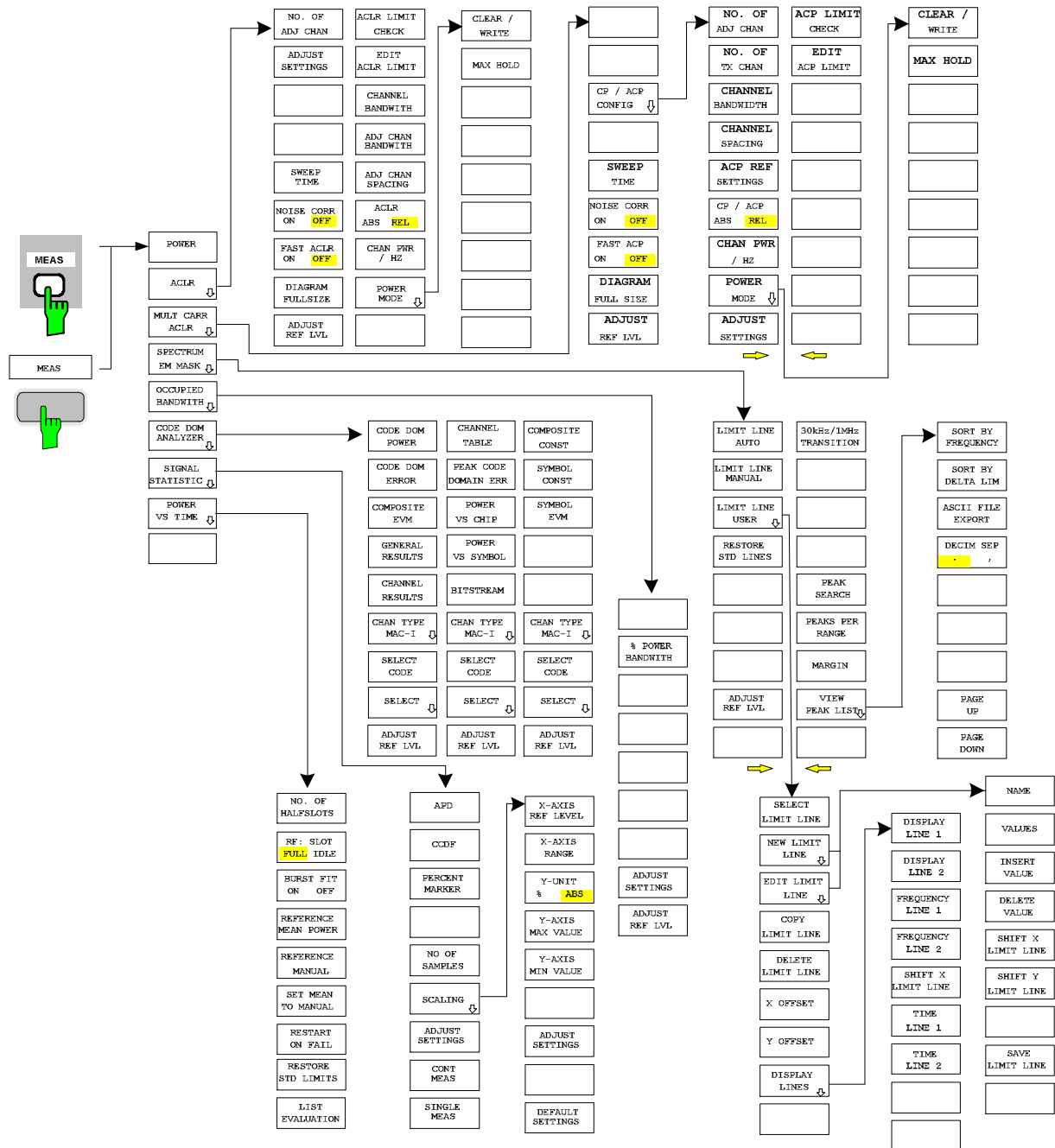


Fig. 5-3 Overview of menus

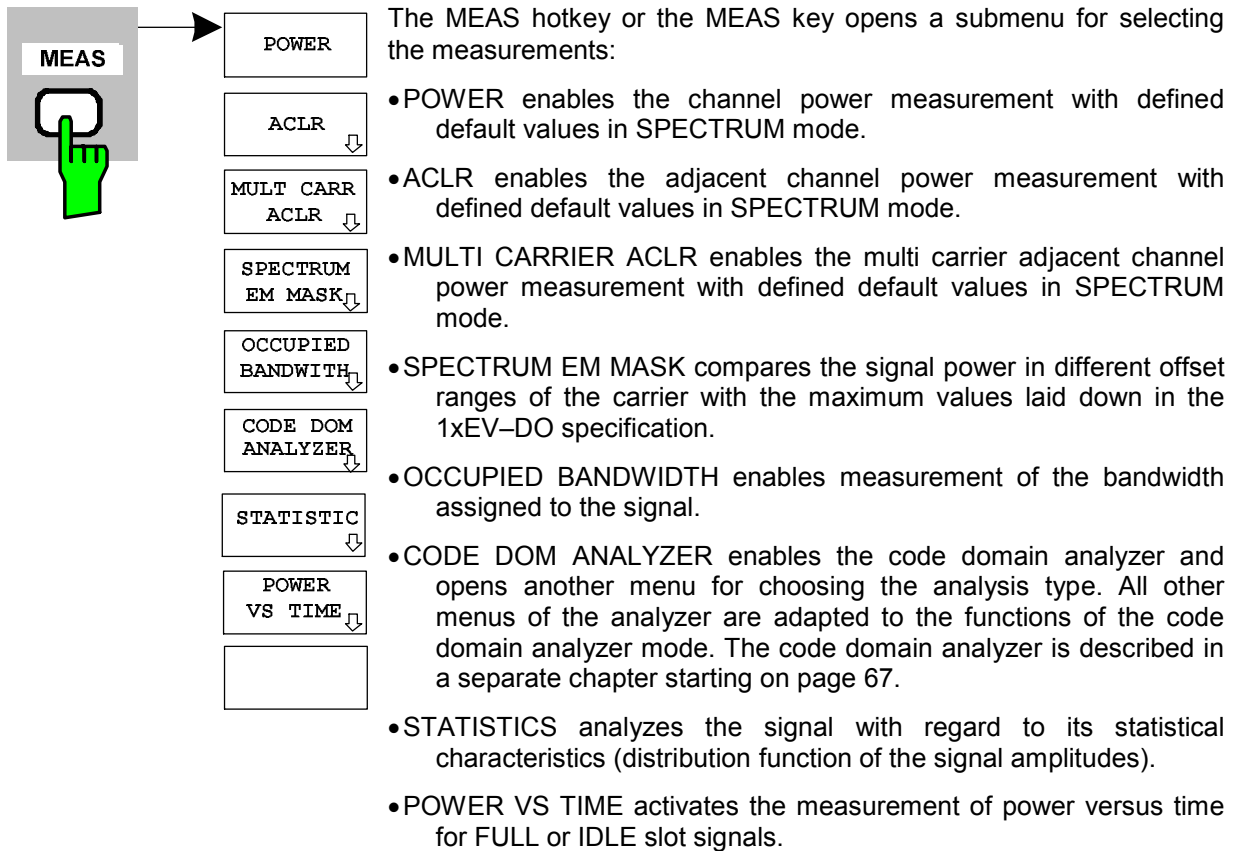
6 Configuration of 1xEV-DO Measurements

The most important measurements of the 1xEV-DO specification for base stations can be selected by means of the *MEAS* hotkey and *MEAS* key. They will be explained below on the basis of the softkey functions.

The *CODE DOM ANALYZER* softkey activates the code domain analyzer and guides the user to the submenus for selection of the analysis. Changing the assignment of the hotkey bar during transition to the application ensures that the most important parameters of the code domain analyzer can be directly accessed on the hotkey bar.

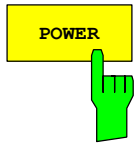
The *POWER*, *ACLR*, *SPECTRUM EM MASK*, *OCCUPIED BANDWIDTH*, and *STATISTICS* softkeys activate base station measurements with predefined settings, which are performed in *SPECTRUM* mode of the basic device. The measurements are performed with the parameters contained in the 1xEV-DO specification. The settings can be modified later.

MEAS key or *MEAS* hotkeys



Measuring channel power

MEAS key or MEAS hotkey



The *POWER* softkey enables measurement of the channel power of the 1xEV-DO signal.

The analyzer measures the RF signal power in the 1.2288 MHz bandwidth. The power is calculated by summation of the values at the trace points. The bandwidth and the associated channel power are displayed beneath the measurement screen.

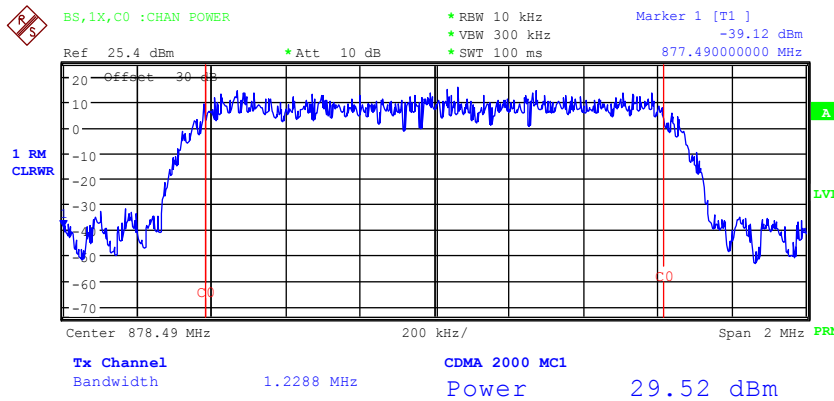


Fig. 6–1 Power measurement in the 1.2288 MHz transmission channel

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	
ADJACENT CHAN POWER	ON
ACP STANDARD	CDMA2000 MC1 (MC1 simply stands for multi carrier, i.e. a carrier)
NO OF ADJ CHANNELS	0 (main channel only)
FREQUENCY SPAN	2 MHz

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode, i.e. measurement parameters can be adapted to the requirements of the specific measurement.

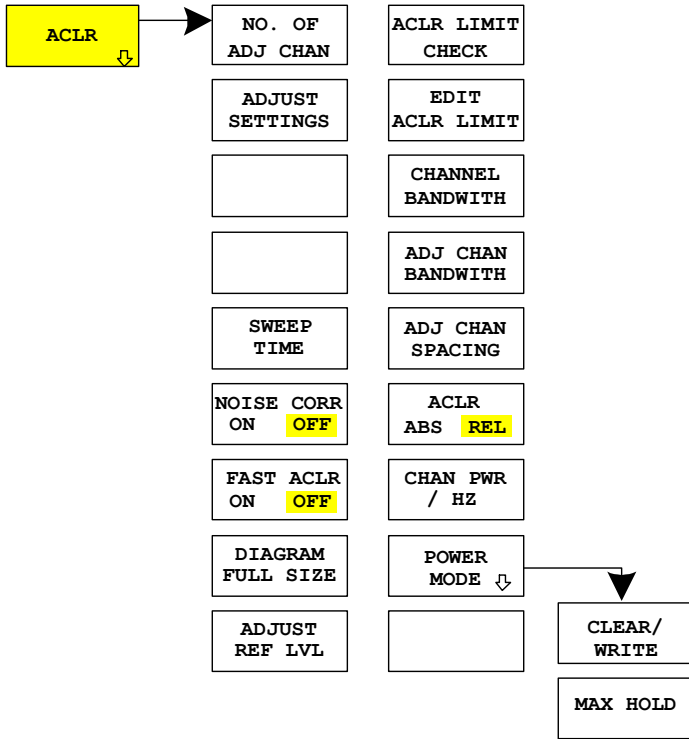
To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on re-entering this measurement: Level parameters RBW, VBW Sweep time Trigger settings	
---	--

IEC/IEEE bus command: :CONF:CDP:MEAS POW

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

Measuring adjacent channel power – ACLR

MEAS key or MEAS hotkey



The ACLR (Adjacent Channel Leakage Power Ratio) softkey enables measurement of the adjacent channel power. The settings and limit values are taken from the spurious measurement defined in the 1xEV-DO specification.

The analyzer measures the power of the useful channel and of the adjacent channels on the left and right sides. At the default setting, only two adjacent channels are taken into account. Measurement results are displayed beneath the measurement screen.

The limits depend on the band class setting (BAND CLASS softkey).

The ACLR limit check can be enabled or disabled by means of the ACLR LIMIT CHECK softkey.

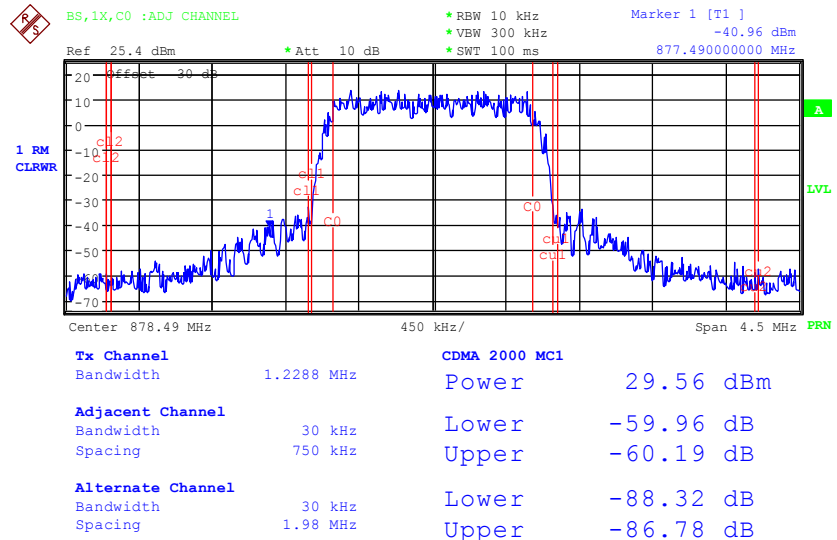


Fig. 6–2 Measuring adjacent channel power

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	
ADJACENT CHAN POWER	ON
ACP STANDARD	CDMA2000 MC1
NO OF ADJ. CHANNELS	2

Table 6–1 ACLR settings for band classes 0, 2, 3, 5, 9, 10, 11, 12

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	–45 dBc	none
Alternate	1.98 MHz	30 kHz	–60 dBc	–27 dBm
Alternate2	4.00 MHz	30 kHz	–60 dBc	–27 dBm

Table 6–2 ACLR settings for band class 7

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	750 kHz	30 kHz	–45 dBc	none
Alternate	1.98 MHz	30 kHz	–60 dBc	–27 dBm
Alternate2	4.00 MHz	30 kHz	none	–39.2 dBm

Table 6–3 ACLR settings for band classes 1, 4, 8, 14 and 15

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	–45 dBc	none
Alternate	1.25 MHz	30 kHz	–45 dBc	–9 dBm
Alternate2	1.98 MHz	30 kHz	–55 dBc	–22 dBm

Table 6–4 ACLR settings for band class 6

Adjacent channel type	Spacing	RBW	Rel. Limit	Abs. Limit
Adjacent	885 kHz	30 kHz	–45 dBc	none
Alternate	1.25 MHz	30 kHz	none	–13 dBm
Alternate2	1.45 MHz	30 kHz	none	–13 dBm

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode, i.e. measurement parameters can be adapted to the requirements of the specific measurement.

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

IEC/IEEE bus command: :CONF:CDP:MEAS ACLR

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



The *NO. OF ADJ CHAN* softkey enables input of the number $\pm n$ of adjacent channels which are taken into account for the adjacent channel power measurement.

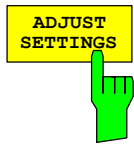
0 to 12 can be entered.

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

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

With higher numbers the procedure is expanded accordingly.

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



The *ADJUST SETTINGS* softkey automatically optimizes the settings of the analyzer for the selected power measurement.

All the analyzer settings relevant to power measurement within a specific frequency range (channel bandwidth) are then optimally set as a function of the channel configuration (channel bandwidth, channel spacing):

- Frequency span:
The frequency span must include all the channels to be analyzed as a minimum.
The double channel bandwidth is set as the span for measuring the channel power.
The span setting depends for adjacent channel power measurement on the channel spacing and the channel bandwidth of the adjacent channel ADJ, ALT1 or ALT2 farthest away from the transmission channel.
- Resolution bandwidth $RBW \leq 1/40$ of channel bandwidth
- Video bandwidth $VBW \geq 3 \times RBW$
- Detector RMS detector

The trace mathematics and the trace averaging are disabled.
The reference level is not affected by *ADJUST SETTINGS*. It has to be set separately by means of *ADJUST REF LVL*.

Adjustment is performed once; if necessary, the device settings can be changed again later.

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

With manual setting of the measurement parameters deviating from that performed with *ADJUST SETTINGS*, the following must be borne in mind for the different parameters:

Frequency span The frequency span must include at least all the channels needing to be measured.
This is the channel bandwidth when channel power is measured.
If the frequency span is large compared with the analyzed frequency section (or frequency sections), only a few pixels on the trace are available for the measurement.

Resolution bandwidth (RBW) To ensure an acceptable measurement speed and also the necessary selection (for inhibiting spectral components outside the channel you want to measure, especially the adjacent channels), the resolution bandwidth must be selected so that it is neither too small nor too large. As a rule of thumb, the resolution bandwidth has to be set to values between 1% and 4% of the channel bandwidth. A larger resolution bandwidth can be set when the spectrum within and around the channel to be measured has an even characteristic.

Video bandwidth (VBW) For a correct power measurement, the video signal must not be limited in terms of bandwidth. A band limitation of the logarithmic video signal would result in averaging and thus in a display of the power that would be too low (-2,51 dB at very small video bandwidth). The video bandwidth must therefore be at least three times higher than the resolution bandwidth.

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

$$VBW \geq 3 \times RBW.$$

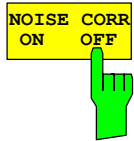
Detector The *ADJUST SETTINGS* softkey selects the RMS detector.
The RMS detector is selected because it always indicates the power correctly, irrespective of the characteristics of the signal you want to measure. Generally speaking, the sample detector would also be possible. However, it results in unstable results by virtue of the limited number of trace pixels for calculation of the power in the channel. An averaging, which is often performed to stabilize the measurement results, produces a level display that is too low and must therefore be avoided. The lower level display depends on the number of averagings and the signal characteristic in the channel needing to be measured.



The *SWEEP TIME* softkey enables entry of the sweep time. A longer sweep time results in more stable measurement results with the RMS detector.

This setting is identical to the *SWEEP TIME MANUAL* on the *BW* menu.

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



The NOISE CORR ON/OFF softkey enables correction of the measurement results by the background noise of the device, thus raising the dynamic range.

When the function is enabled, a reference measurement of the background noise on the device is performed first. The measured noise power is then subtracted from the power in the channel being analyzed. The background noise of the device depends on the selected center frequency, resolution bandwidth and level setting. The correction is therefore switched every time these settings are changed, and a corresponding message is displayed on the monitor.

To switch the background noise correction with the modified setting back on, the softkey must be pressed again. The reference measurement is then performed again.

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



The FAST ACLR softkey toggles between measurement by the IBW method (FAST ACLR OFF) and the time domain method (FAST ACLR ON).

With *FAST ACLR ON*, the power measurement is performed in the different channels in the time domain. The analyzer adjusts its center frequency in succession to the different channel center frequencies and measures the power with the set measuring time (i.e. sweep time/number of measured channels). The suitable RBW filters for the selected standard and frequency offset are used automatically.

The RMS detector is used for correct power measurement. This means that software correction factors are not necessary.

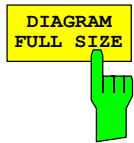
Measure values are displayed in a table, the power in the useful channel being output in dBm and the power in the adjacent channels in dBm (*ACLR ABS*) or dB (*ACLR REL*).

Selection of the sweep time (= measurement time) depends on the required reproducibility of the measurement results. The longer the selected sweep time, the more reproducible the measurement results will be, since the power measurement is then performed over a longer time.

As a rule of thumb, it can be assumed for a reproducibility of 0.5 dB (99% of the measurements are within 0.5 dB of the true measured value) that approximately 500 uncorrelated measured values are necessary (applies to white noise). The measured values are assumed to be uncorrelated when their spacing in time corresponds to the reciprocal value of the measurement bandwidth (= 1/BW).

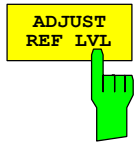
With 1xEV-DO the measurement bandwidth is 10 kHz, i.e. measured values at an interval of 10 μ s are assumed to be uncorrelated. Thus a measurement time (sweep time) of 50 ms per channel is required for 500 measured values. This is the default sweep time which the analyzer sets in coupled mode. Approximately 5000 measured values (i.e. the measurement time has to be extended to 500 ms) are required for a reproducibility of 0.1 dB (99% of all measurements are within 0.1 dB of the true measured values).

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



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

IEC/IEEE bus command: --



The *ADJUST REF LVL* softkey 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 the analyzer being overloaded or the dynamic response being limited by too low a signal-to-noise ratio. Since the measurement bandwidth is distinctly narrower for power channel measurements than the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level.

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



The *ACLR LIMIT CHECK* softkey enables and disables the limit check for the ACLR measurement .

IEC/IEEE bus command: :CALC:LIM:ACP ON
:CALC:LIM:ACP:ACH:RES?
:CALC:LIM:ACP:ALT1..11:RES?



The default settings of limits are defined at the start of the adjacent channel power measurement as a function of the selected band class (refer to the *BAND CLASS* softkey), as in the tables on page 33. Similarly, the values in these tables are restored on a change of band class. After the band class has been selected, a table can be opened in the ACLR measurement, however, by means of the *EDIT ACLR LIMITS* softkey and the limits for the ACLR measurement can be modified in the table..

ACP LIMITS				
CHAN	RELATIVE LIMIT CHECK		ABSOLUTE LIMIT CHECK	
	VALUE	ON	VALUE	ON
ADJ	-45 dBc	√	0 dBm	
ALT1	-60 dBc	√	-27 dBm	
ALT2	-60 dBc	√	-27 dBm	√

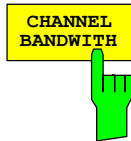
The following rules apply to limits:

- A separate limit can be defined for each of the adjacent channels. The limit applies simultaneously to the lower and upper adjacent channels.
- A relative limit and/or an absolute limit can be defined. Checks of both limits can be enabled independently of each other.
- Compliance with the active limits is checked independently of whether the limits are absolute or relative and whether the measurement itself is performed at absolute levels or at relative signal intervals. If both checks are active and if the higher of the two limits has been exceeded, the measured value concerned is identified.

Note: Measured values which violate the limit are preceded by an asterisk and identified in red.

IEC/IEEE bus command:

```
:CALC:LIM:ACP ON
:CALC:LIM:ACP:ACH 0dB,0dB
:CALC:LIM:ACP:ACH:STAT ON
:CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ACH:ABS:STAT ON
:CALC:LIM:ACP:ALT1 0dB,0dB
:CALC:LIM:ACP:ALT1:STAT ON
:CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT1:ABS:STAT ON
:CALC:LIM:ACP:ALT2..11 0dB,0dB
:CALC:LIM:ACP:ALT2..11:STAT ON
:CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm
:CALC:LIM:ACP:ALT2..11:ABS:STAT ON
```



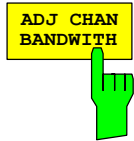
The CHANNEL BANDWIDTH softkey enables entry of the channel bandwidth for the transmission channel.

The useful channel bandwidth is normally determined by the transmission procedure. With 1xEV-DO measurements are performed at the default setting with a channel bandwidth of 1.2288 MHz.

When measuring by the IBW method (*FAST ACLR OFF*), the channel bandwidth is represented on the screen by two vertical lines to the left and right of the center of the screen. This allows visual inspection of whether the whole power of the signal being measured is within the selected channel bandwidth.

With the time domain method (*FAST ACLR ON*), the measurement is performed in zero span and the channel limits are not identified in this instance. The analyzer provides all available channel filters for selection of the channel bandwidth entry. Channel bandwidths that deviate from this cannot be set. Should deviating channel bandwidths be necessary, perform the measurement by the IBW method.

IEC/IEEE bus command: :SENS:POW:ACH:BWID 1.2288MHz



The ADJ CHAN BANDWIDTH softkey opens a table for defining the channel bandwidths for the adjacent channels.

ACP CHANNEL BW	
CHAN	BANDWIDTH
ADJ	30 kHz
ALT1	30 kHz
ALT2	30 kHz

When measuring by the IBW method (FAST ACLR OFF), the bandwidths of the different adjacent channels have to be entered numerically. Since it is common for all adjacent channels to have the same bandwidth, the other channels Alt1 and Alt2 are set to the bandwidth of the adjacent channel when the adjacent channel bandwidth (ADJ) is entered. Thus only one value needs to be entered in the case of equal adjacent channel bandwidths. The procedure is the same for the Alt2 channels (Alternate Channels 2) when the bandwidth of the Alt1 channel (Alternate Channel 1) is entered.

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

With the time domain method (FAST ACLR ON), the adjacent channel bandwidths are selected from the list of available channel filters. Use the IBW method for adjacent channel bandwidths that deviate from this.

```
IEC/IEEE bus command: :SENS:POW:ACH:BWID:ACH 30kHz
                      :SENS:POW:ACH:BWID:ALT1 30kHz
                      :SENS:POW:ACH:BWID:ALT2..11 30kHz
```



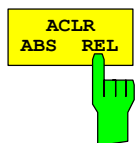
The ADJ CHAN SPACING softkey opens a table for defining the channel spacings.

CHANNEL SPACING	
CHAN	SPACING
ADJ	750 kHz
ALT1	1.98 MHz
ALT2	4.00 MHz

Since the adjacent channels frequently have the same spacing from each other, channel ALT1 and channel ALT2 are set to twice and three times the channel spacing of the adjacent channel, respectively, when the adjacent channel spacing (ADJ) is entered. Thus only one value needs to be entered in the case of identical channel spacings. The procedure for Alt2 channels is similar when the bandwidth of the Alt1 channel is entered.

Note: The channel spacings can be set independently of each other by overwriting the table from top to bottom.

```
IEC/IEEE bus command: :SENS:POW:ACH:SPAC:ACH 750kHz
                      :SENS:POW:ACH:SPAC:ALT1 1.98MHz
                      :SENS:POW:ACH:SPAC:ALT2..11 4MHz
```



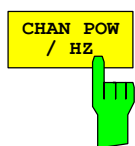
The ACLR ABS/REL softkey (channel power absolute/relative) toggles between absolute and relative measurement of the power in the channel.

ACLR ABS The absolute value of the power in the transmission channel and the adjacent channels is displayed in the unit of the Y axis such as dBm or dBμV.

ACLR REL In the case of adjacent channel power measurement (*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 relative power (CP/CP_{ref}) of the new channel to the reference channel is displayed. With dB scaling, the logarithmic ratio $10 \cdot \lg(CP/CP_{ref})$ is displayed. This means that the relative channel power measurement can also be used for universal adjacent channel power. In this instance each channel is measured separately.

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

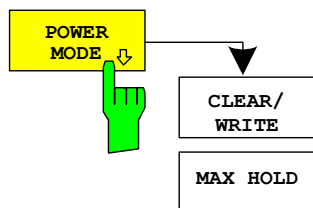


The *CHAN POW / HZ* softkey toggles between measurement of the total power in the channel and measurement of the power in the channel referred to 1 Hz of bandwidth .

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

The conversion factor is

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

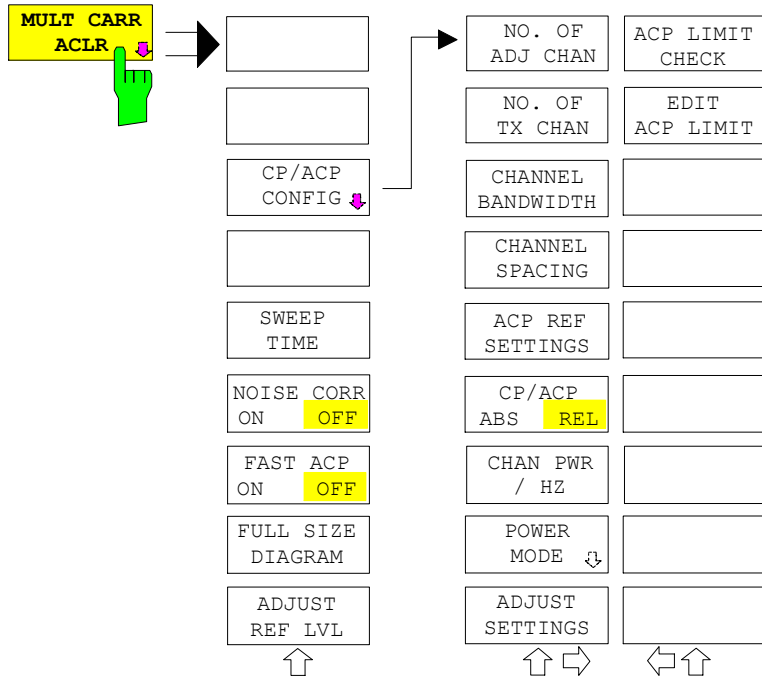


The *POWER MODE* sub menu allows to change between the normal (*CLEAR/WRITE*) and the max hold power mode. In the *CLEAR/WRITE* the channel power and the adjacent channel powers are calculated directly from the current trace. In *MAX HOLD* mode the power values are still derived from the current trace,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

IEC/IEEE bus command: :CALC:MARK:FUNC:POW:MODE WRIT|MAXH

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

MEAS key or MEAS hotkey



The *MULT CARR ACLR* (Multi Carrier Adjacent Channel Leakage Power Ratio) softkey enables measurement of the multi carrier adjacent channel power. The settings and limits are taken from the spurious emissions measurement defined in the 1xEV-DO specification.

The analyzer measures the power of the 4 useful channels and of the adjacent channels on the left and right sides. In the default setting, only two adjacent channels are taken into account. Measurement results are displayed beneath the measurement screen.

The limits depend on the band class setting (*BAND CLASS* softkey).

The ACLR limit check can be enabled or disabled by means of the *ACLR LIMIT CHECK* softkey.

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 1/2 of the TX spacing, thus the measurement on the TX channel can continue.

ADJACENT CHAN POWER	ON
ACP STANDARD	cdma2000 MC1
NO OF TX CHANNELS	4
NO OF ADJ. CHANNELS	2

Furthe band class depended settings are identical to the ACLR measurement.

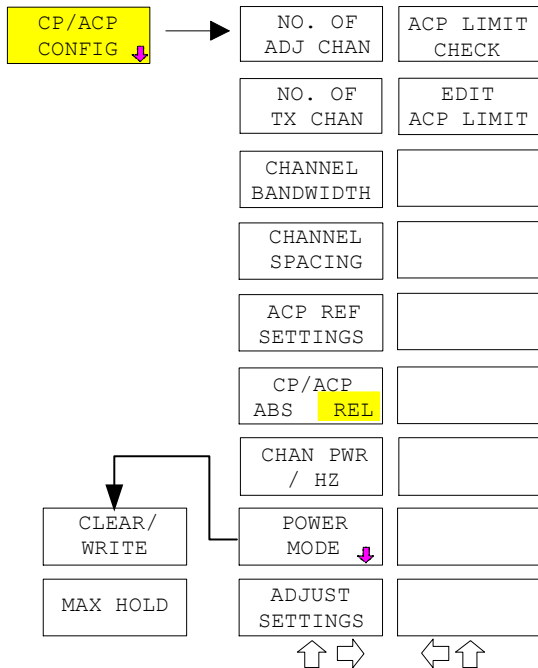
Departing from this setting, the analyzer can be operated in all the functions it features in SPECTRUM mode, i.e. all measurement parameters can be adapted to a specific measurement.

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

IEC/IEEE bus command: :CONF:CDP:MEAS MCAC

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



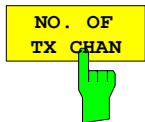
The *CP/ACP CONFIG* softkey opens a submenu for configuration of the multi carrier adjacent channel power measurement.

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.



This softkey behaves as in the adjacent channel power measurement – ACLR. Refer there.



The *NO. OF TX CHAN* softkey enables the entry of the number of carrier signals to be considered.

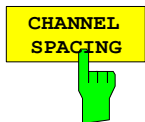
Numbers from 1 to 12 can be entered.

IEC/IEEE–bus command: :SENS:POW:ACH:TXCH:COUN 4



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

IEC/IEEE–bus command: :POW:ACH:BWID:CHAN 1.2288MHz
 :POW:ACH:BWID:ACH 30kHz
 :POW:ACH:BWID:ALT1 30kHz
 :POW:ACH:BWID:ALT2..11 30kHz



The *CHANNEL SPACING* softkey opens a table for defining the channel spacings of the TX channel and the adjacent channels.

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

IEC/IEEE–bus command:
 :SENS:POW:ACH:SPAC:CHAN 1.25MHz
 :SENS:POW:ACH:SPAC:ACH 750kHz
 :SENS:POW:ACH:SPAC:ALT1 1.98MHz
 :SENS:POW:ACH:SPAC:ALT2..11 4MHz

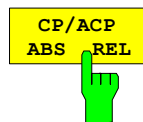


The *ACP REF SETTINGS* softkey opens a table for selecting the transmission channel to which the adjacent-channel relative power values should be referenced.

ACP REFERENCE CHANNEL
✓ TX CHANNEL 1
TX CHANNEL 2
TX CHANNEL 3
TX CHANNEL 4
TX CHANNEL 5
TX CHANNEL 6
TX CHANNEL 7
TX CHANNEL 8
TX CHANNEL 9
TX CHANNEL 10
TX CHANNEL 11
TX CHANNEL 12
MIN POWER TX CHANNEL
MAX POWER TX CHANNEL
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.

IEC/IEEE-bus command: : POW:ACH:REF:TXCH:MAN 1
 : POW:ACH:REF:TXCH:AUTO MIN
 : POW:ACH:REF:TXCH:AUTO MAX
 : POW:ACH:REF:TXCH:AUTO LHIG

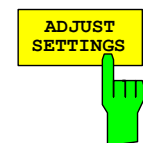


The *CP/ACP ABS/REL* softkey (channel power absolute/relative) switches between absolute and relative power measurement in the adjacent channels.

IEC/IEEE-bus command: : POW:ACH:MODE ABS

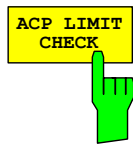


This softkey behaves as in the adjacent channel power measurement – ACLR. Refer there.



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):

IEC/IEEE-bus command: : POW:ACH:PRES MCAC



This softkey behaves as the `ACLR LIMIT CHECK` softkey in the adjacent channel power measurement – ACLR. Refer there.

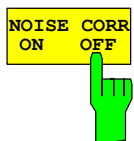


This softkey behaves as in the `EDIT ACLR LIMIT` softkey in the adjacent channel power measurement – ACLR. Refer there.

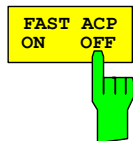


The function of the softkey is identical to the softkey `SWEEP TIME MANUAL` in the menu `BW`.

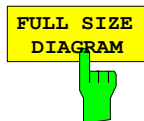
IEC/IEEE-bus command: `:SWE:TIM <value>`



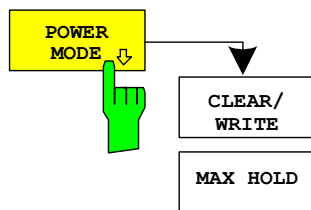
This softkey behaves as in the adjacent channel power measurement – ACLR. Refer there.



This softkey behaves as in the adjacent channel power measurement – ACLR. Refer there.

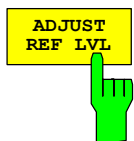


Dieser Softkey verhält sich wie bei der Messung der Nachbarkanalleistung – ACLR, siehe dort.



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

IEC/IEEE bus command: `:CALC:MARK:FUNC:POW:MODE
WRIT|MAXH`

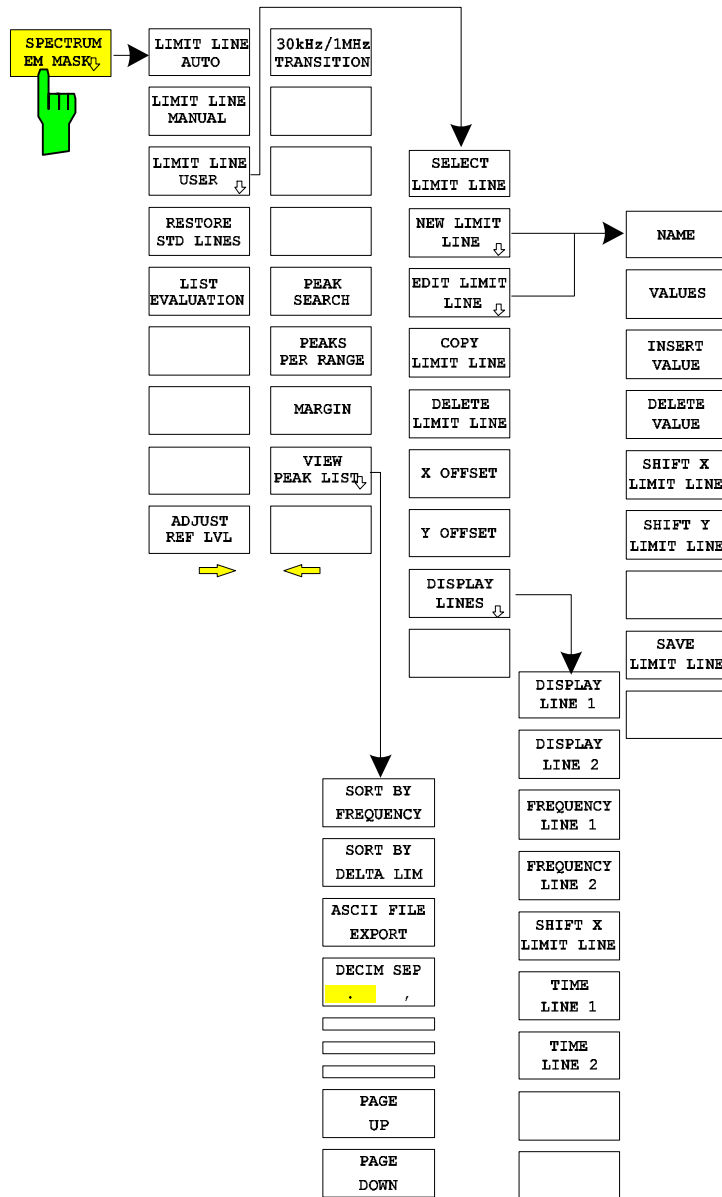


The `ADJUST REF LVL` softkey adjusts the reference level of the instrument to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without overloading the instrument or limiting the dynamic range by a too small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

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

Signal power check – SPECTRUM EM MASK

MEAS key or MEAS hotkey



The *SPECTRUM EM MASK* (Spectrum Emission Mask) softkey measures the signal power in defined offsets from the carrier and compares the power values with the spurious emission mask, specified in the cdma2000/1xEV-DO specification, in the near-carrier range from -4 MHz to 4 MHz.

The limits depend on the band class setting (*BAND CLASS* softkey).

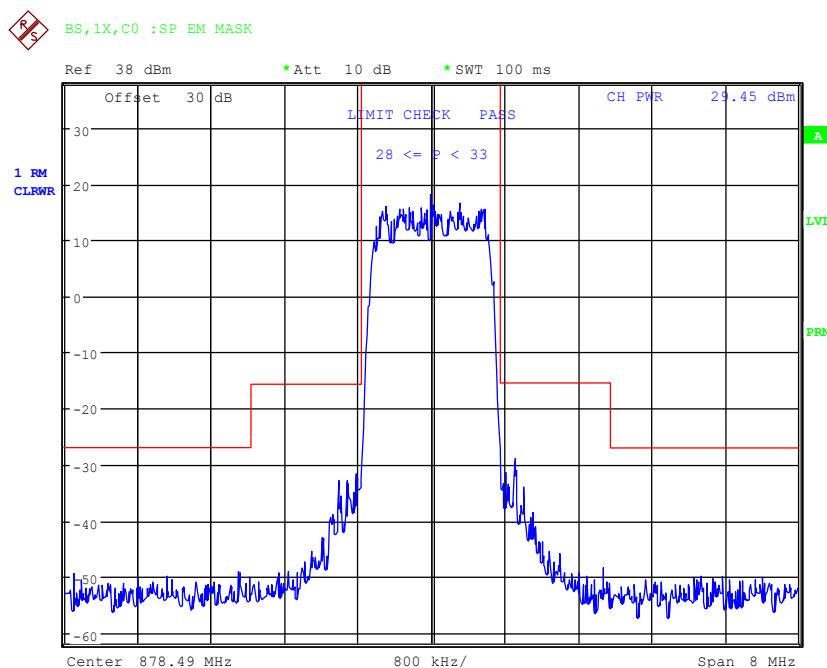


Fig. 6–3 Measuring the spectrum emission mask

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

ADJACENT CHAN POWER	ON
ACP STANDARD	CDMA2000 MC1
NO OF ADJ. CHANNELS	0
FREQUENCY SPAN	8 MHz
SWEEP TIME	100 ms
DETECTOR	RMS

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode. Changes to the RBW and VBW are limited, because they are specified by 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
- Trigger settings

IEC/IEEE bus command:

:CONF:CKP:MEAS ESP

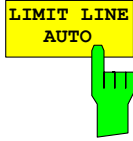
Query of result of limit line:

:CALC:LIM:FAIL?

Query of results of worst fail:

:CALC:LIM:ESP:CHEC:X?

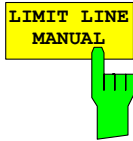
:CALC:LIM:ESP:CHEC:Y?



The LIMIT LINE AUTO softkey automatically selects the limit line for checking after the power in the useful channel has been determined. If the measurement is performed in *CONTINUOUS SWEEP* and if the channel power varies from sweep to sweep, it can result in continuous replotting of the limit line.

The softkey is activated on entering the spectrum emission mask measurement.

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



The LIMIT LINE MANUAL softkey gives you an opportunity to select the limit line manually. If this softkey is selected, the channel power measurement is not used for selecting the limit line but for determining its relative components. The power for the different frequency offsets is compared with the limit line specified by the user.

The softkey opens a table containing all predefined limit lines on the device:

Name of limit line
 P >= 33 dBm
 28 dBm <= P < 33 dBm
 P < 28 dBm

The name of the limit line specifies the range for the expected power, for which the limit line was defined.

IEC/IEEE bus command: `:CALC:LIM:ESP:MODE MANual`
`:CALC:LIM:ESP:VALue 28`
`'selects line 28 dBm <= P < 33`
`dBm`

The definition of the limit line names is described at the *LIMIT LINE USER* softkey.

Table 6–5 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power $P < 28$ dBm

Offset frequency	Limit	Type/name DOB0CR	RBW
–4.00 MHz	–55 dBc	relative to carrier power	30 kHz
–1.98 MHz	–55 dBc	relative to carrier power	30 kHz
–1.98 MHz	–45 dBc	relative to carrier power	30 kHz
–750 kHz	–45 dBc	relative to carrier power	30 kHz
+750 kHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–55 dBc	relative to carrier power	30 kHz
+4.00 MHz	–55 dBc	relative to carrier power	30 kHz

Table 6–6 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power 28 dBm $\leq P < 33$ dBm

Offset frequency	Limit	Type/name DOB0BA and DOB0BR	RBW
–4.00 MHz	–27 dBm	absolute	30 kHz
–1.98 MHz	–27 dBm	absolute	30 kHz
–1.98 MHz	–45 dBc	relative to carrier power	30 kHz
–750 kHz	–45 dBc	relative to carrier power	30 kHz
+750 kHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–27 dBm	absolute	30 kHz
+4.00 MHz	–27 dBm	absolute	30 kHz

Table 6–7 Band classes 0, 2, 3, 5, 9, 10, 11, 12 for carrier power $P \geq 33$ dBm

Offset frequency	Limit	Type/name DOB0AR	RBW
–4.00 MHz	–60 dBc	relative to carrier power	30 kHz
–1.98 MHz	–60 dBc	relative to carrier power	30 kHz
–1.98 MHz	–45 dBc	relative to carrier power	30 kHz
–750 kHz	–45 dBc	relative to carrier power	30 kHz
+750 kHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–45 dBc	relative to carrier power	30 kHz
+1.98 MHz	–60 dBc	relative to carrier power	30 kHz
+4.00 MHz	–60 dBc	relative to carrier power	30 kHz

The limits for band class 7 are derived from band class 0, but a -46 dBm/6.25 kHz limit is defined additionally between 3.25 MHz and 4 MHz. This limit is raised by 6.8 dB so that 30 kHz filters can be measured with the resolution filter. More power is "seen" in it, $10 \log 30 \text{ kHz} - 10 \log 6.25 \text{ kHz} = 6.8 \text{ dB}$. Accordingly the limit is $-46 \text{ dBm} + 6.8 \text{ dB} = -39.2 \text{ dBm}$.

Table 6–8 Band classes 7 for carrier power $P < 28$ dBm

Offset frequency	Limit	Type/name DOB7CA and DOB7R	RBW
-4.00 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-55 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-55 dBc	relative to carrier power	30 kHz
+3.25 MHz	-55 dBc	relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	absolute	30 kHz
+4.00 MHz	-39.2 dBm	absolute	30 kHz

Table 6–9 Band classes 7 for carrier power $28 \text{ dBm} \leq P < 33 \text{ dBm}$

Offset frequency	Limit	Type/name DOB7BA and DOB7BR	RBW
-4.00 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-27 dBm	absolute	30 kHz
-1.98 MHz	-27 dBm	absolute	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-27 dBm	absolute	30 kHz
+3.25 MHz	-27 dBm	absolute	30 kHz
+3.25 MHz	-39.2 dBm	absolute	30 kHz
+4.00 MHz	-39.2 dBm	absolute	30 kHz

Table 6–10 Band classes 7 for carrier power $P \geq 33 \text{ dBm}$

Offset frequency	Limit	Type/name DOB7AA and DOB7AR	RBW
-4.00 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-39.2 dBm	absolute	30 kHz
-3.25 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-60 dBc	relative to carrier power	30 kHz
-1.98 MHz	-45 dBc	relative to carrier power	30 kHz
-750 kHz	-45 dBc	relative to carrier power	30 kHz
+750 kHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-45 dBc	relative to carrier power	30 kHz
+1.98 MHz	-60 dBc	relative to carrier power	30 kHz
+3.25 MHz	-60 dBc	relative to carrier power	30 kHz
+3.25 MHz	-39.2 dBm	absolute	30 kHz
+4.00 MHz	-39.2 dBm	absolute	30 kHz

The limits for band classes 1, 4 and 8 are defined by separate limits. RBW switching is necessary in this instance. The 1 MHz channel filter is used for the 1 MHz segments. The frequency range is divided into three sub-segments. The user's sweep time is distributed over the segments as follows (k = filter sweep rate factor):

Segment1: -4.00 ... -2.25 MHz RBW = 1 MHz k = 850 SWT1 = SWT * 1/10
 Segment2: -2.25 ... +2.25 MHz RBW = 30 kHz k = 2.5 SWT2 = SWT * 8/10
 Segment3: +2.25 ... 4.00 MHz RBW = 1 MHz k = 850 SWT3 = SWT * 1/10

For larger spans, the sweep time is adjusted so that the three areas are swept at a constant filter sweep rate factor k.

For entering the limit "Stricter from" a check determines whether $P - 45 \text{ dBc} > -9 \text{ dBm}$. If this is the case, the measured value is compared with $P - 45 \text{ dBc}$, in all other cases with -9 dBm .

Table 6-11 Band classes 1, 4, 8, 14 and 15 for carrier power $P < 28 \text{ dBm}$

Offset frequency	Limit	Type/name DOB1CA and DOB1CR	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-50 dBc	relative to carrier power	30 kHz
-1.98 MHz	-50 dBc	relative to carrier power	30 kHz
-1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	-45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: -45 dBc / -9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	-50 dBc	relative to carrier power	30 kHz
+2.25 MHz	-50 dBc	relative to carrier power	30 kHz
+2.25 MHz	-13 dBm	absolute	1 MHz
+4.00 MHz	-13 dBm	absolute	1 MHz

Table 6–12 Band classes 1, 4, 8, 14 and 15 for carrier power 28 dBm \leq P < 33 dBm

Offset frequency	Limit	Type/name DOB1BA and DOB1BR	RBW
–4.00 MHz	–13 dBm	absolute	1 MHz
–2.25 MHz	–13 dBm	absolute	1 MHz
–2.25 MHz	–22 dBm	absolute	30 kHz
–1.98 MHz	–22 dBm	absolute	30 kHz
–1.98 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
–1.25 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
–1.25 MHz	–45 dBc	relative to carrier power	30 kHz
–885 kHz	–45 dBc	relative to carrier power	30 kHz
+885 kHz	–45 dBc	relative to carrier power	30 kHz
+1.25 MHz	–45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	–22 dBm	absolute	30 kHz
+2.25 MHz	–22 dBm	absolute	30 kHz
+2.25 MHz	–13 dBm	absolute	1 MHz
+4.00 MHz	–13 dBm	absolute	1 MHz

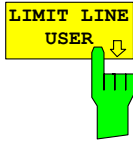
Table 6–13 Band classes 1, 4, 8, 14 and 15 for carrier power P \geq 33 dBm

Offset frequency	Limit	Type/name DOB1AA and DOB1AR	RBW
–4.00 MHz	–13 dBm	absolute	1 MHz
–2.25 MHz	–13 dBm	absolute	1 MHz
–2.25 MHz	–55 dBc	relative to carrier power	30 kHz
–1.98 MHz	–55 dBc	relative to carrier power	30 kHz
–1.98 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
–1.25 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
–1.25 MHz	–45 dBc	relative to carrier power	30 kHz
–885 kHz	–45 dBc	relative to carrier power	30 kHz
+885 kHz	–45 dBc	relative to carrier power	30 kHz
+1.25 MHz	–45 dBc	relative to carrier power	30 kHz
+1.25 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	Stricter of: –45 dBc / –9 dBm	relative to carrier power/absolute	30 kHz
+1.98 MHz	–55 dBc	relative to carrier power	30 kHz
+2.25 MHz	–55 dBc	relative to carrier power	30 kHz
+2.25 MHz	–13 dBm	absolute	1 MHz
+4.00 MHz	–13 dBm	absolute	1 MHz

The limits for band class 6 are derived from the limits of band classes 1, 4 and 8. The difference is that there is no dependence on carrier power and there is a gradient between 1.45 and 2.25 MHz.

Table 6–14 Band class 6 for all carrier power values

Offset frequency	Limit	Type/name DOB6_A and DOB6_R	RBW
-4.00 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-2.25 MHz	-26.6 dBm	absolute	30 kHz
-1.45 MHz	-13 dBm	absolute	30 kHz
-1.25 MHz	-13 dBm	absolute	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-885 kHz	-45 dBc	relative to carrier power	30 kHz
+885 kHz	-45 dBc	relative to carrier power	30 kHz
-1.25 MHz	-45 dBc	relative to carrier power	30 kHz
-1.25 MHz	-13 dBm	absolute	30 kHz
-1.45 MHz	-13 dBm	absolute	30 kHz
-2.25 MHz	-26.6 dBm	absolute	30 kHz
-2.25 MHz	-13 dBm	absolute	1 MHz
-4.00 MHz	-13 dBm	absolute	1 MHz



The LIMIT LINE USER softkey enables input of user-defined limit lines. The softkey opens the menus of the limit line editor, which are known from the basic device. The limit lines created by the user are included in the table for *LIMIT LINE MANUAL*.

The following limit line settings are sensible for base station tests: Trace 1, Domain Frequency, X-Scaling Relative, Y-Scaling Absolute, Spacing linear, Unit dBm.

Unlike the default limit lines on the device when the analyzer is supplied from the factory that conform to the standard specifications, the user-specified limit line can be specified for the whole frequency range (± 4.0 MHz from the carrier) only either relatively (referred to the reference level) or absolutely.

The supplied limit lines of AUTO and MANUAL modes can also be selected. The names are specified next to the type in the tables above and are defined as follows:

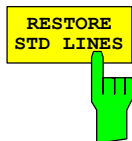
- 1) Standard in 2 characters
- 2) Link direction B for base station
- 3) Band class, the lowest digit being used in the case of more than one band class
- 4) Power classes A, B, C, where A is the highest power class and is not used for any power class dependency.
- 5) Type differentiation: A for absolute and R for relative

Example of 1xEV-DO band class 0, 2, 3, 5, 9, 10-12 for P<28 dBm:

```
DO      : 1xEV-DO
  B     : base station
    0   : lowest of band classes 0,2,3,5,9,10-12
    C   : lowest of the three power classes
    R   : relative line
=====
DOB0CR
```

The limit line names are given in the above tables next to the type/name.

IEC/IEEE bus command: refer to Table of Softkeys with Assignment of IEC/IEEE bus Commands



The RESTORE STD LINES softkey restores the limit lines defined in the standard to the state they were in when the device was supplied. In this way unintended overwriting of the standard lines can be undone.

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



The softkey *LIST EVALUATION* reconfigures the SEM output to a split screen. In the upper half the trace with the limit line is shown. In the lower half the peak value list is shown. For every range of the spectrum emission defined by the standard the peak value is listed. For every peak value the frequency, the absolute power, the relative power to the channel power and the delta limit to the limit line is shown. As long as the delta limit is negative, the peak value is below the limit line. A positive delta indicates a failed value. The results are then colored in red, and a star is indicated at the end of the row, for indicating the fail on a black and white printout.

If the list evaluation is active, the peak list function is not available. Since version 4.00 the peak list softkeys are moved to the side menu.

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

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

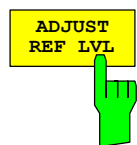
`:TRAC:DATA? LIST`

With this command the list evaluation results are queried in the following order:

`<no>`, `<start>`, `<stop>`, `<rbw>`, `<freq>`, `<power abs>`, `<power rel>`, `<delta>`, `<limit check>`, `<unused1>`, `<unused2>`

All results are float values.

<code>no</code>	: range number
<code>start</code>	: start frequency
<code>stop</code>	: stop frequency
<code>rbw</code>	: resolution bandwidth of range
<code>freq</code>	: frequency of peak
<code>power abs</code>	: absolute power in dBm of peak
<code>power rel</code>	: relative power in dBc (related to the channel power) of peak
<code>delta</code>	: distance to the limit line in dB (positive indicates value above the limit, fail)
<code>limit check</code>	: limit fail (pass = 0, fail =1)
<code>unused1</code>	: reserved (0.0)
<code>unused2</code>	: reserved (0.0)

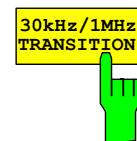


The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.

The softkey becomes active after the first sweep ends with measurement of the occupied bandwidth and thus the total power of the signal becomes known.

Adaptation of the reference level ensures that the signal path of the analyzer is not overloaded and the dynamic response is not restricted by a reference level that is too low.

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



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

The default value is dependend on the band class, refer to the tables above.

For multi carrier spectrum emission mask measurement this value can be extended. User specific limit lines shall than be defined and used.

IEC/IEEE bus command: `:CALC:LIM:ESP:TRAN`
`<numeric value>`



The *PEAK SEARCH* softkey activates a single evaluation of spectrum emission mask. The limit mask - reduced by an overall margin - is checked against the trace. The fail positions are marked by crosses as long as not a next sweep is performed. It is recommended to use single sweep. 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*. In addition the worst fail of each fail area without a peak is marked and added to the peak list.

IEC/IEEE bus command: :CALC:PEAK



The *PEAKS PER RANGE* softkey defines how many peaks are searched for within one range. The ranges are according to the band class setting (SETTINGS -> BAND CLASS) e.g. for BAND CLASS 0, 2, 3, 5, 9, 10, 11 and 12:

- from -4.00 MHz to -1.98 MHz from the carrier,
- from -1.98 MHz to -0.75 MHz from the carrier,
- the area from -0.75 MHz to +0.75 MHz around the carrier,
- from +0.75 to +1.98 MHz from the carrier
- from +1.98 MHz to +4.00 MHz from the carrier.

The default value of *PEAKS PER RANGE* is 25.

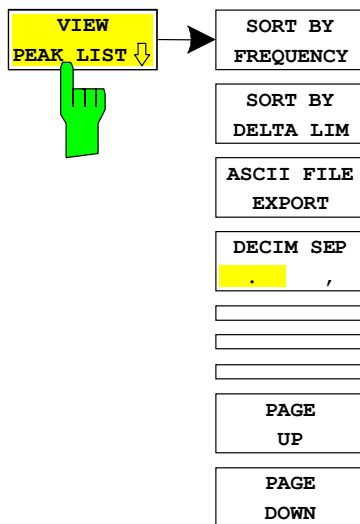
IEC/IEEE bus command: :CALC:PEAK:SUBR 1...50



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.

IEC/IEEE bus command: :CALC:PEAK:MARG -200dB...200dB



The *VIEW PEAK LIST* softkey opens the peak list. The list is empty if either no 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 range (LOWER side or UPPER side from carrier)
- the frequency,
- the level in dBc (relative to the carrier channel power)
- the delta level to the limit (negative deltas indicate a fail).

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 range, which can be sorted after pressing the *VIEW PEAK LIST* softkey in the order of the frequencies with *SORT BY FREQUENCY*.

The following figure shows a peak list:

VIEW PEAK LIST			
LOW-UP RANGE /RBW	FREQUENCY	LEVEL dBc	DELTA LIMIT dB
L1.980-4.000M/30k	875.4020 MHz	-54.25	0.74
L0.750-1.980M/30k	876.7620 MHz	-54.41	-9.41
Inner Range /30k	879.2400 MHz	-55.62	-10.62
U0.750-1.980M/30k	880.2180 MHz	-54.07	-9.07
U1.980-4.000M/30k	881.1460 MHz	-53.66	1.33

Fig. 6-4 Peak list of spectrum emission mask

IEC/IEEE bus command: :TRAC? FINa11

The comma separated values are :

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



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

IEC/IEEE bus command: --



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

IEC/IEEE bus command: --



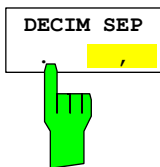
The *ASCII FILE EXPORT* softkey exports the peak list in ASCII format to a file.

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.

IEC/IEEE bus command: :MMEM:STOR:FIN 'A:\final.dat'

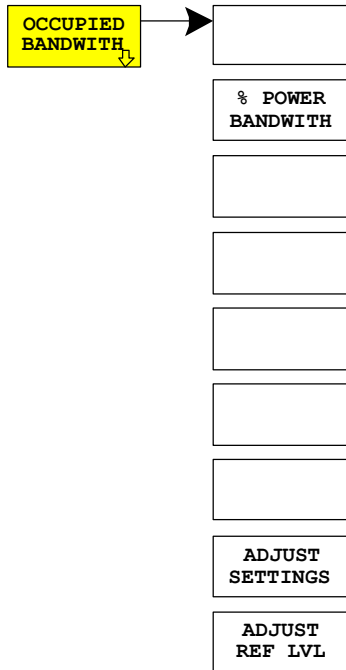


Different language versions of evaluation programs may require a different handling of the decimal point. It is therefore possible to select between default separators '.' (decimal point) and ',' (comma) using softkey *DECIM SEP*.

IEC/IEEE bus command: :FORM:DEXP:DSEP POIN | COMM

Measuring bandwidth occupied by the signal – OCCUPIED BANDWIDTH

MEAS key or MEAS hotkey



The *OCCUPIED BANDWIDTH* softkey enables measurement of the bandwidth occupied by the signal.

This measurement determines the bandwidth in which – in the initial state – 99% of the signal power are to be found. The percentage of the signal power that has to be included in the bandwidth measurement can be modified. The bandwidth and the frequency markers for the measurement are displayed in the Marker Info field at the top right corner of the display.

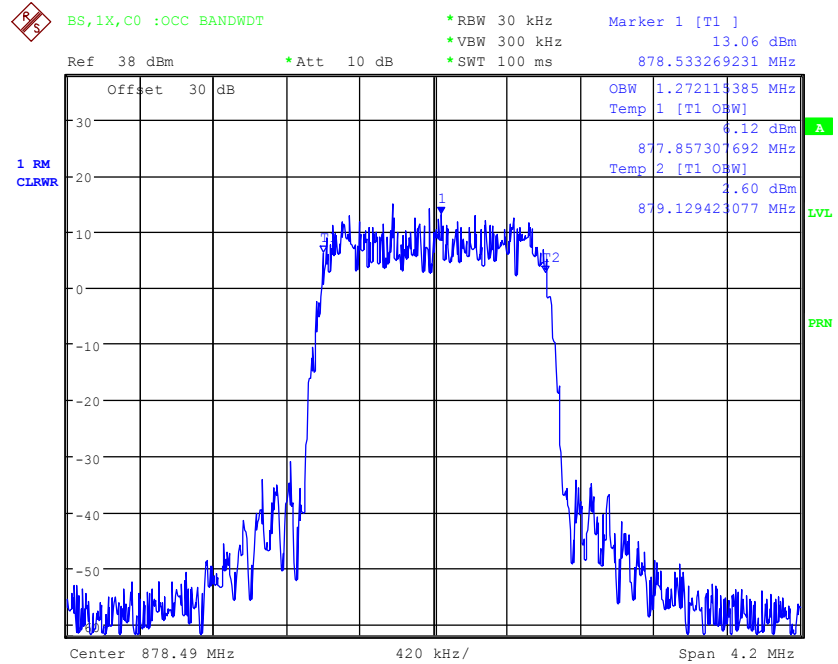


Fig. 6–5 Measuring occupied bandwidth

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

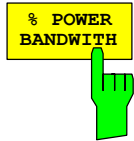
OCCUPIED BANDWIDTH	ON
FREQUENCY SPAN	4.2 MHz
SWEEP TIME	100 ms
RBW	30 kHz
VBW	300 kHz
DETECTOR	RMS

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode, i.e. measurement parameters can be adapted to the requirements of the 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
 Trigger settings

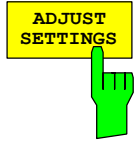
IEC/IEEE bus command: :CONF:CDP:MEAS OBAN

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



The *% POWER BANDWIDTH* softkey opens a field for entering the percentage power referred to the total power in the displayed frequency range, by means of which the occupied bandwidth is defined (percentage of total power).
The permissible range is 10% to 99.9%.

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



The *ADJUST SETTINGS* softkey adjusts the settings of the analyzer to the specified channel bandwidth for measurement of the occupied bandwidth.

All analyzer settings relevant for power measurement within a certain frequency range (channel bandwidth) such as:

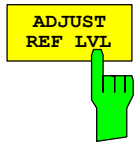
- Frequency span 3 x channel width
- Resolution bandwidth $RBW \leq 1/40$ of channel bandwidth.
- Video bandwidth $VBW \geq 3 \times RBW$.
- Detector RMS

are optimized.

The reference level is not affected by *ADJUST SETTINGS*. It must be set for optimum dynamics so that the maximum signal is close to the reference level.

Adjustment is performed once only but, if necessary, the device settings can again be changed afterwards.

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



The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured total signal power.

The softkey becomes active after the first sweep ends with measurement of the occupied bandwidth and thus the total power of the signal becomes known.

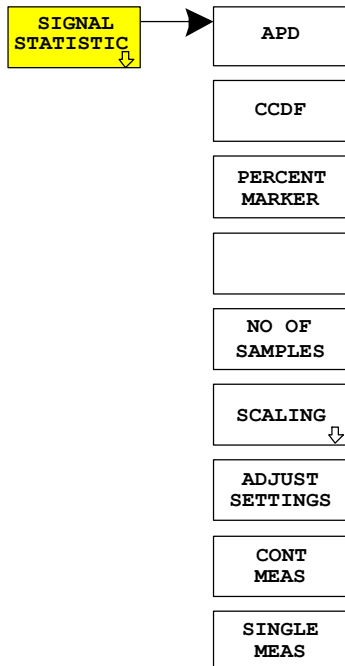
Adjustment of the reference level ensures that the signal path of the analyzer is not overloaded and the dynamic response is not restricted by a reference level that is too low.

Since the measurement bandwidth is distinctly narrower for power channel measurements than the signal bandwidth, the signal branch can be overloaded, even though the trace is still well below the reference level. When the measured channel power is identical to the reference level, the signal path is not overloaded.

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

Signal statistics

MEAS key or MEAS hotkey



The *STATISTICS* softkey launches measurement of the distribution function of signal amplitudes (complementary cumulative distribution function). The measurement can be switched, using the menu softkey, to amplitude power distribution (APD).

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

In addition, the crest factor, i.e. the difference between the maximum value and the mean power, is output in dB.

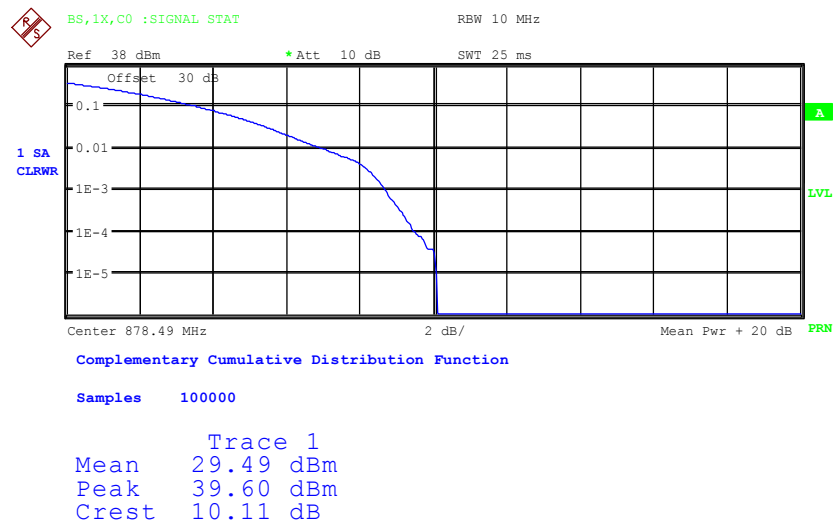


Fig. 6-6 CCDF of 1xEV-DO signal.

The softkey enables SPECTRUM mode with predefined settings:

The following user-specific settings are not modified so that the adaptation to the device under test is retained: Level parameters Center Frequency + Frequency Offset All trigger settings	
CCDF	ON
RBW	10 MHz
DETECTOR	SAMPLE

To restore adapted measurement parameters, the following parameters are saved on exiting and are set again on <u>re-entering</u> this measurement: Level parameters RBW NO OF SAMPLES Trigger settings	
--	--

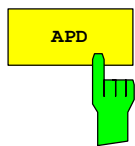
Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode, i.e. measurement parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE bus command: :CONF:CDP:MEAS CCDF

or
:CALC:STAT:CCDF ON

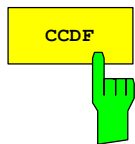
Query of results: :CALC:MARK:X?
:CALC:STAT:RES? MEAN |
PEAK |CFA | ALL

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 named measurements, separated by a comma: <mean pow>, <peak pow>, <crest factor>



The *APD* softkey enables the amplitude probability distribution function.

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



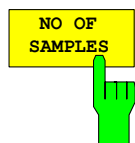
The *CCDF* softkey switches the complementary distribution function (complementary cumulative distribution function).

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



When the *CCDF* function is enabled, the *PERCENT MARKER* softkey supports positioning of marker 1 by entering a sought probability. This means that the power that will be exceeded with a given degree of probability can be determined in a simple manner. If marker 1 is disabled, it is automatically enabled.

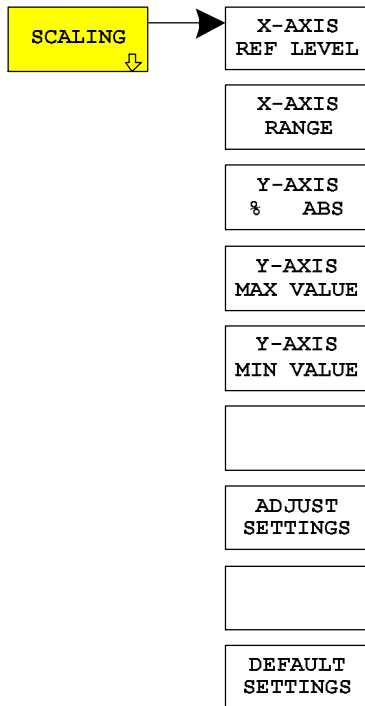
IEC/IEEE bus command: :CALC:MARK:Y:PERC 0...100%



The *NO OF SAMPLES* softkey sets the number of power measurement values that have to be taken into account for the distribution measurement function.

Note: *The overall measurement time is influenced by the selected number of samples as well as by the resolution bandwidth selected for the measurement, since the resolution bandwidth directly affects the sampling rate.*

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

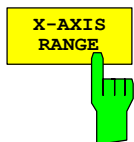


The *SCALING* softkey opens a menu on which the scaling parameters for the X axis and the Y axis can be modified.



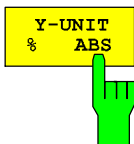
The *X-AXIS REF LEVEL* softkey changes the level settings of the device and sets the maximum measurable power. The function is identical to that of the *REF LEVEL* softkey on the *AMPT* menu. This value is mapped to the right diagram border for the *APD* function. For the *CCDF* function, this value is not directly represented in the diagram because the X axis is scaled relative to the measured *MEAN POWER*.

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



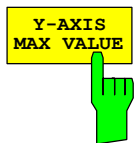
The *X-AXIS RANGE* softkey changes the level range that has to be covered by the distribution sampling function. The function is identical to that of the *RANGE LOG MANUAL* softkey on the *AMPT* menu.

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



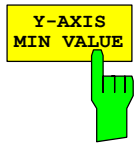
The *Y-UNIT % / ABS* defines the scaling type of the y-axis. The default value is absolute scaling.

IEC/IEEE bus command: :CALC:STAT:SCAL:Y:UNIT PCT



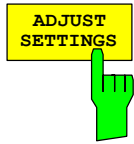
The *Y-AXIS MAX VALUE* softkey sets the upper limit of the displayed probability range. The values on the Y axis are normalized, i.e. the maximum value is 1.0. Since the Y axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade.

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



The Y-AXIS MIN VALUE softkey sets the lower limit of the displayed probability range. Since the Y axis is logarithmically scaled, the gap between the maximum and minimum values must be at least one decade. Permissible range of values $0 < \text{value} < 1$.

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

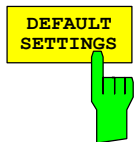


The ADJUST SETTINGS softkey optimizes the analyzer level settings according to the measured peak power in order to gain maximum sensitivity of the device.

The level area is set for the APD measurement according to the measured difference between the peak value and the minimum value of the power and, for the CCDF measurement, between the peak value and the mean value of the power in order to achieve maximum power resolution.

In addition, the probability scale of the selected number of measured values is adjusted.

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



The DEFAULT SETTINGS softkey resets the scaling on the X axis and the Y axis to the default (PRESET) settings.

X-axis reference level: -20 dBm

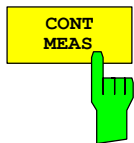
X-axis range for APD: 100 dB

X-axis range for CCDF: 20 dB

Y axis for upper limit: 1.0

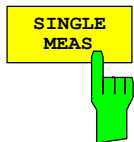
Y axis for lower limit: 1E-6

IEC/IEEE bus command: `:CALC:STAT:PRES`



The CONT MEAS softkey starts the collection of new sequences of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The next measurement is started automatically as soon as the indicated number of samples has been reached ("CONTinuous MEASurement").

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



The SINGLE MEAS softkey starts the collection of one new sequence of sample data and the calculation of the APD or CCDF trace, depending on the selected measurement. The measurement finishes after the displayed number of measured values has been reached.

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

Power versus Time

MEAS key or MEAS hotkey

POWER VS TIME ↓

NO. OF HALF SLOTS

RF: SLOT
FULL IDLE

BURST FIT
ON OFF

REFERENCE MEAN POWER

REFERENCE MANUAL

SET MEAN TO MANUAL

RESTART ON FAIL

RESTORE STD LIMITS

LIST EVALUATION

The **POWER VS TIME** Softkey enables the power versus time measurement as requested by the "emission envelope mask" measurement of the 1xEV-DO Standard.

Up to 36 halfslots are captured and postprocessed with trace averaging simultaneously. For a standard measurement of 100 halfslots only 3 data captures are necessary. An external trigger should be used in order to trigger on the slot boundary.

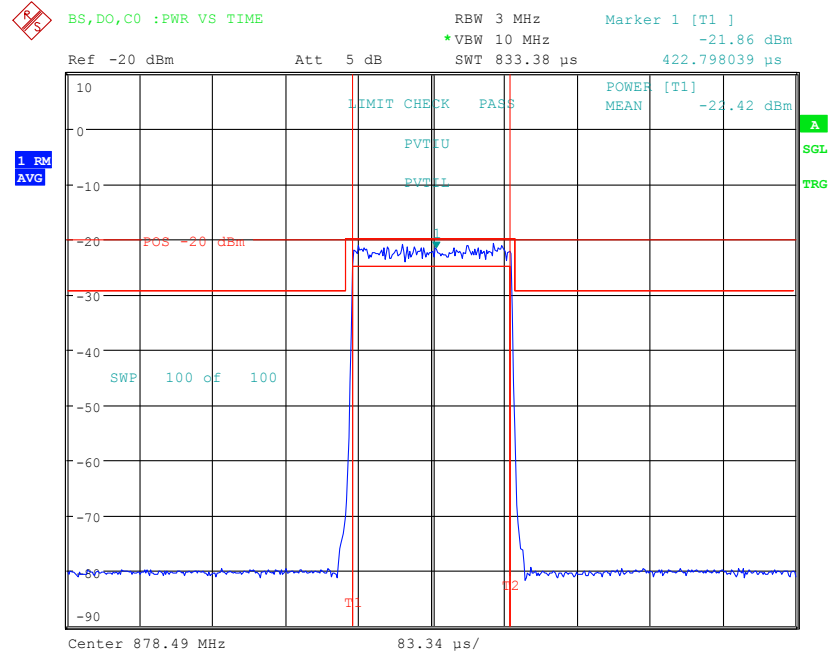


Fig. 6-7 PVT of a 1xEV-DO IDLE slot signal.

The softkey enables SPECTRUM mode with predefined settings:

The following user-specific settings are not modified so that the adaptation to the device under test is retained:

- Level parameters
- Center Frequency + Frequency Offset
- All trigger settings

FREQUENCY SPAN	Zero Span 0 Hz
SWEEP TIME	833.38 μs
RBW	3 MHz
VBW	10 MHz
DETECTOR	RMS
TRACE MODE	AVERAGE

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
- Trigger settings

Departing from these settings, the analyzer can be operated in many functions featured in SPECTRUM mode, i.e. measurement parameters can be adapted to the requirements of the specific measurement.

IEC/IEEE bus command: :CONF:CDP:MEAS PVT

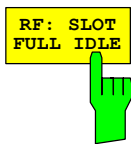
Query of results::

```
:CALC:MARK:FUNC:SUMM:MEAN:RES?
    'read the mean power
:TRAC:DAT? TRACE1 '512 points are returned
    'upon trace request
:CALC:LIM1:FAIL?
    'upper line failed
:CALC:LIM2:FAIL?
    'lower line failed
```



With the softkey *NO. OF HALFSLOTS* the number of halfslots for the averaging can be changed. Default value is 100.

IEC/IEEE bus command: :SENS:SWE:COUN <numeric_value>



The softkey *RF: SLOT FULL/IDLE* defines the expected signal: FULL slot or IDLE slot. Accordingly the limit lines and the borders for calculating the mean power are set. The lower and upper limit line are called *DOPVTFL/DOPVTFU* for FULL and *DOPVTIL/DOPVTIU* for IDLE mode. It is possible to change these lines with the standard limit line editor.

IEC/IEEE bus command: :CONF:CDP:RFSlot FULL | IDLE



The softkey *BURST FIT ON/OFF* is available if the *RF: SLOT IDLE* is selected.

With this softkey it is possible to activate an automatic burst alignment to the center of the diagram. Default this burst fitting is *OFF*. If active the burst fit algorithm searches the maximum and minimum gradient, between them the maximum peak is determined, and from this point the 7 dB down points are searched. If these are within plausible ranges the burst is centered in the screen, otherwise nothing will happen.

IEC/IEEE bus command: :CONF:CDP:PVT:BURS:CENT ON | OFF

REFERENCE
MEAN POWER

REFERENCE
MANUAL

SET MEAN
TO MANUAL



The standard asks for the sequence to first measure the FULL slot with the limit line relative to the mean power of the averaged time response. Therefore the softkey *REFERENCE MEAN POWER* in a FULL slot measurement should be selected. In this mode the mean power is calculated and the limit lines are relative to that mean power value. This value should be used also as the reference for the IDLE slot measurement. With the softkey *SET MEAN TO MANUAL* the current mean power value of the averaged time response is used to set as the fixed reference value for the limit lines. The mode is switched from *REFERENCE MEAN POWER* to *REFERENCE MANUAL*. Now the IDLE slot can be selected and the measurement sequence can be finished.

The manual mode can also be selected via the *REFERENCE MANUAL* softkey. Then a user defined value can be entered as the reference value for the limits.

IEC/IEEE bus command:

```
:CALC:LIM:PVT:REF AUTO|MANUAL|ONCE
:CALC:LIM:PVT:RVAL <value> in dBm
```

RESTART
ON FAIL



The function of the softkey *RESTART ON FAIL* will only take effect if the device is in *SINGLE SWEEP*.

Default this function is not active.

If switched on, at the end of the single sweep the limit line over all result is evaluated. The sweep will be restarted if this result is FAILED. If the result is MARGIN or PASSED the sweep is finished.

IEC/IEEE bus-command: :CONF:CDP:PVT:FRES ON | OFF

RESTORE
STD LINES

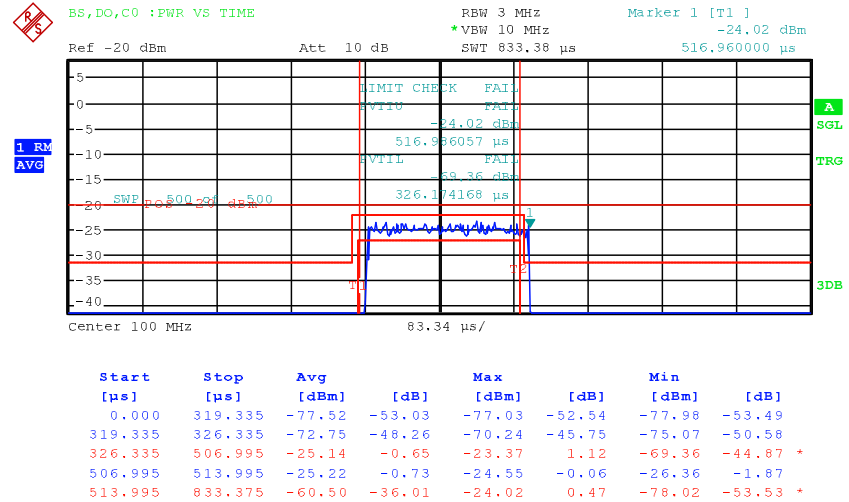


The *RESTORE STD LINES* softkey restores the limit lines defined in the standard to the state they were in when the device was supplied. In this way unintended overwriting of the standard lines can be undone.

IEC/IEEE bus command: :CALC:LIM:PVT:RESTore



The softkey *LIST EVALUATION* reconfigures the Power versus Time output to a split screen. In the upper half the trace with the limit lines is shown. In the lower half the average, maximum and minimum value list is shown. For every range of the PVT defined by the limit lines x-values the values are listed. If the measured value is not within the limit tolerance the results are colored in red, and a star is indicated at the end of the row, for indicating a fail on a black and white printout. This function is available since version 4.20.



IEC/IEEE bus command: :CONF:CDP:BTS:PVT:LIST[:STAT] ON|OFF

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

:CONF:CDP:BTS:PVT:LIST:RES?

With this command the list evaluation results are queried in the following order:

- <no>, <start>, <stop> ,
- <avg power abs>, <avg power rel > ,
- <max power abs>, <max power rel > ,
- <min power abs>, <min power rel > ,
- <limitcheck>, <unused1>, <unused2>

All results are float values.

- no : range number
- start : start time
- stop : stop time
- avg power abs : average absolute power in dBm
- avg power rel : average relative power in dB (relative to mean power)
- max power abs : average absolute power in dBm
- max power rel : average relative power in dB (relative to mean power)
- min power abs : average absolute power in dBm
- min power rel : average relative power in dB (relative to mean power)
- limit check : limit fail (pass = 0, fail =1)
- unused1 : reserved (0.0)
- unused2 : reserved (0.0)

Code Domain Measurements on 1xEV-DO Signals

Application Firmware R&S FS-K84 makes a code domain analyzer available. With its help, the measurements called for in the 1xEV-DO specification in respect of the power of the different codes can be performed. In addition, the modulation quality (EVM and RHO factors), frequency error and trigger-to-frame time, and also peak code domain error are determined. Constellation analyses and bit stream analyses are similarly available. The calculation of the timing and phase offsets of the channels for the first active channel can be enabled (refer to the *TIME/PHASE* softkey). The observation period can be adjusted in multiples of the slot by means of the *CAPTURE LENGTH* softkey.

Basically, there are the following results classes for the analyses:

- Results that take the total signal into account over the whole period of observation
- Results that take the total signal into account over a slot
- Results that take a channel type (such as MAC) into account over the whole period of observation
- Results that take a channel type (such as MAC) into account over a slot
- Results that take a code in a channel type (such as MAC) into account over the whole period of observation
- Results that take a code in a channel type (such as MAC) into account over a slot

A slot with 1xEV-DO is a basic time unit of 1.666 ms duration and corresponds to the expression power control group (PCG) with CDMA2000. Every slot consists of two half-slots that are identically structured. Each half-slot contains 1024 chips, which are distributed as shown below according to the different channel types:

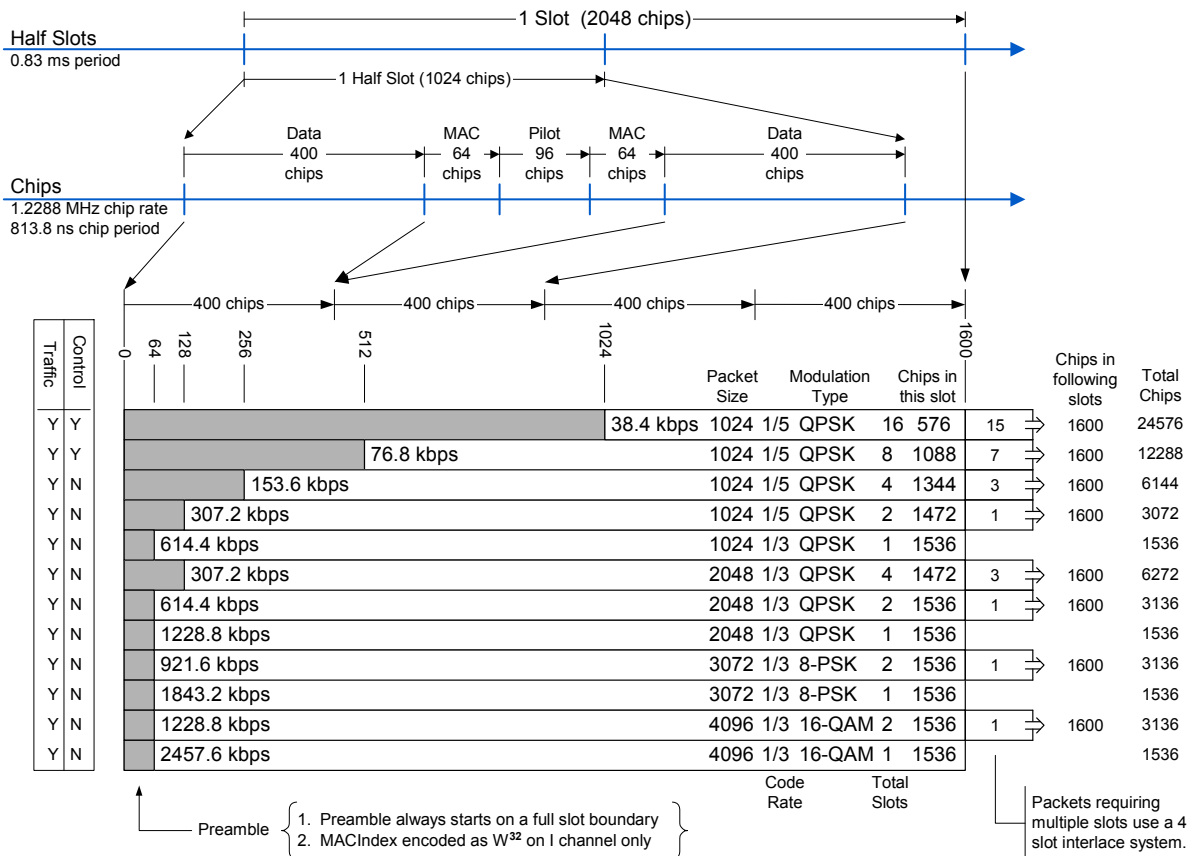


Fig. 6–8 Slot structure, chip distribution and preamble lengths.

From the slot structure it can be seen that with the 1xEV-DO forward link there are 4 channel types which are sent at exclusive times in the diagram shown above:

- **PILOT:** The PILOT channel type comprises 96 chips and is located in the center of each half-slot. It must be present in the signal for the base station signal to be detected. In the PILOT channel type, only the 0.32 channel on the I branch is active.¹ With spreading factor 32, the BPSK-I and, hypothetically, BPSK-Q modulation are used. Hypothetically because no signal should be present on the Q branch.
- **MAC:** The Medium Access Control channel type is 64 chips in front of and behind the PILOT. The MAC channel type contains the reverse activity (RA) channel and the MAC reverse power control (RPC) channels with which the power of the active terminals is controlled. The MAC indices described in the Standard MAC can be simply transformed into Walsh codes. For further details refer to the chapter entitled "Relationship between Mac Index and Walsh Codes", starting on page 167. The analysis for the MAC channel type takes place with spreading factor 64. There is BPSK-I and BPSK-Q modulation.
- **DATA:** The DATA channel type is located with a length of up to 400 chips at the beginning and end of each half slot. The useful data proper are transmitted in it. As shown in the figure, there are packets that transmit their data distributed over 1, 2, 4, 8 or 16 slots, depending on the transmission rate. Initially, a PREAMBLE range is transmitted, being between 64 and 1024 chips long – followed by the data. If more than one slot is required for transmission, the other data of this data packet follow at intervals of four slots, then without another preamble. In the DATA channel type, QPSK, 8-PSK and 16-QAM modulation types are used. Analysis takes place with a spreading factor of 16.
- **PREAMBLE:** As can be seen from the figure, the first 64 to 1024 chips of the DATA channel type are replaced at the beginning of a data packet by the PREAMBLE channel type. Depending on the transmission speeds being used and whether the start of data of the packet is missed, there are therefore preambles of different length in the signal. The application firmware detects the preambles automatically. If the PREAMBLE channel type is examined and there is no preamble in the signal, this is indicated by means of 'PREAMBLE MISSING'. Spreading factor 32 applies similarly to the PREAMBLE channel type as for the PILOT channel type. Again, only a BPSK-I modulated channel should occur, but with variable code number.

Depending on the result class, the customer sets the channel type, the slot number and the code number in order to obtain the results for the analyses he requires. In addition, mapping can be set. In this case it is necessary to specify whether just the I branch or just the Q branch or the complex signal consisting of I and Q should be analyzed. The Standard generally expects a separate Code Domain Power analysis for I and Q. The 'Mappings' column in the table below indicates which analyses in the application firmware work with the different mapping modes. For the analyses in which this is possible, there is the option of setting mapping itself and thus analyzing separately for I or Q, or of analyzing the signals as in Complex mode. For the Code Domain Power analysis, there are also the results across all slots demanded by the Standard, in addition to the slot-by-slot method of calculation.

¹ The notation 0.32 means code number 0 at spreading factor 32 (code class 5, because $2^5=32$)

The analyses of the code domain analyzer are performed on a split screen. The screen is divided into two halves for this.

The upper screen (screen A) displays analyses which vary by means of the codes. The lower screen (screen B) displays all other analyses.

Table 6–15 Overview of the analyses

Code dimension			Time dimension		Mappings	
Analyses on screen A	Total signal	One channel type		All slots	One slot	I or Q/ complex/ overview
		All codes	One code			
Code domain power		✓		✓ AVG ON	✓ AVG OFF	I or Q/ complex/ overview
Code domain error power		✓			✓	I or Q/ complex/ overview
Channel table	✓				✓	Not used
Analyses on screen B	Total signal	One channel type		All slots	One slot	I or Q/ complex/ overview
		All codes	One code			
GENERAL RESULTS	✓			✓	✓	Not used
Channel Results		✓	✓		✓	I or Q/ complex
Power versus Chip	✓				✓	Not used
Power versus symbol			✓		✓	I or Q/ complex
Composite EVM (modulation accuracy)	✓			✓		Not used
Composite constellation		✓			✓	Not used
Peak code domain error		✓		✓		I or Q/ complex
Symbol constellation			✓		✓	DATA: complex Others: I or Q/ complex
Symbol EVM			✓		✓	DATA: complex Others: I or Q/ complex
Bit stream			✓		✓	DATA: Complex Others: I or Q, complex

The number of results for the analyses depends with the Code Domain Power analysis, for example, on the spreading factor and with the Bit Stream analysis on the number of bits. At a chip rate of 1.2288 MHz, the symbol rate results as 1.2288MHz/spreading factor. The bit rate depends on how many bits describe a symbol in the modulation type being used. Due to the different PREAMBLE lengths, the DATA area is shortened depending on the PREAMBLE. All relationships can be seen in the table below:

Table 6-16 Relationship between symbol rate, spreading factor, number of symbols, number of bits, number of chips and channel type

Channel type	Spreading factor	Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code			
						Mapping I or Q	Mapping complex		
PILOT	32	38.4 ksps	BPSK-I or BPSK-Q	96*2 = 192	6	6		12	
MAC	Rev. 0 64	19.2 ksps	BPSK-I or BPSK-Q	64*4 = 256	4	4		8	
	Rev. A 128	9.6 ksps			2	2		4	
PRE-AMBLE	Rev. 0 32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length	64:	2	2		4
					128:	4	4		8
					256:	8	8		16
					512:	16	16		32
					1024:	32	32		64
	Rev. A 64	19.2 ksps	BPSK-I or BPSK-Q	Preamble length	64:	1	1		2
					128:	2	2		4
					256:	4	4		8
					512:	8	8		16
					1024:	16	16		32
DATA	16	76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4- PreambleChips= DataNettoChips	Mapping always complex Modulation type:				
						QPSK	8-PSK	16-QAM	
					1600-0 = 1600	100	200	300	400
					1600-64 = 1536	96	192	288	384
					1600-128 = 1472	92	184	276	368
					1600-256 = 1344	84	168	252	336
					1600-512 = 1088	68	136	204	272
					1600-1024 = 576	36	72	104	144

The channel type for which a result has to be displayed is selected with the help of the CHAN TYPE softkey and the code number and the slot for which a result has to be displayed are selected SELECT CODE and SELECT SLOT. Let us assume that the MAC channel type, code 2.64 (Walsh code number 2 for spreading factor 64) and slot 1 have been selected. On screen A, the Code Domain Power analysis is relative and on screen B the symbol EVM analysis is active. Screen A will thus display the Code Domain Power analysis of slot 1 (with MAC the default setting of the Code Domain Power analysis is that the I branch is displayed). In this instance code 2.64 is shown selected in red. In the lower half of the screen, the EVM symbol for analysis of code 2.64 in slot 1 with, aptly, four values, one for each symbol, can be seen. Incidentally, the MAC reverse activity (RA) channel was examined in this example. In the 1xEV-DO system, it has MAC index 4 as a general rule, which is transmitted as described in the section on the "Relationship between Mac Index and Walsh Codes" (page 167) on the code 2.64 I branch.

The code domain analyzer can be operated in two modes. In CODE CHAN AUTOSEARCH mode it performs an automatic search for active channels in the whole code domain. In the other mode, CODE CHAN PREDEFINED, the user has the option of determining the active channels in the signal by means of selectable and editable tables of his own accord. The automatic channel search is then replaced by this user input.

Messages:

The code domain analyzer expects the presence of pilot channel 0.32 in the PILOT channel type. If it is not detected because the center frequency or the signal level has not been set properly, or because the PN OFFSET or Q-INVERT or SIDE BAND INVERT do not match the signal, or because no valid signal has been applied, the 'SYNC FAILED' message is issued.

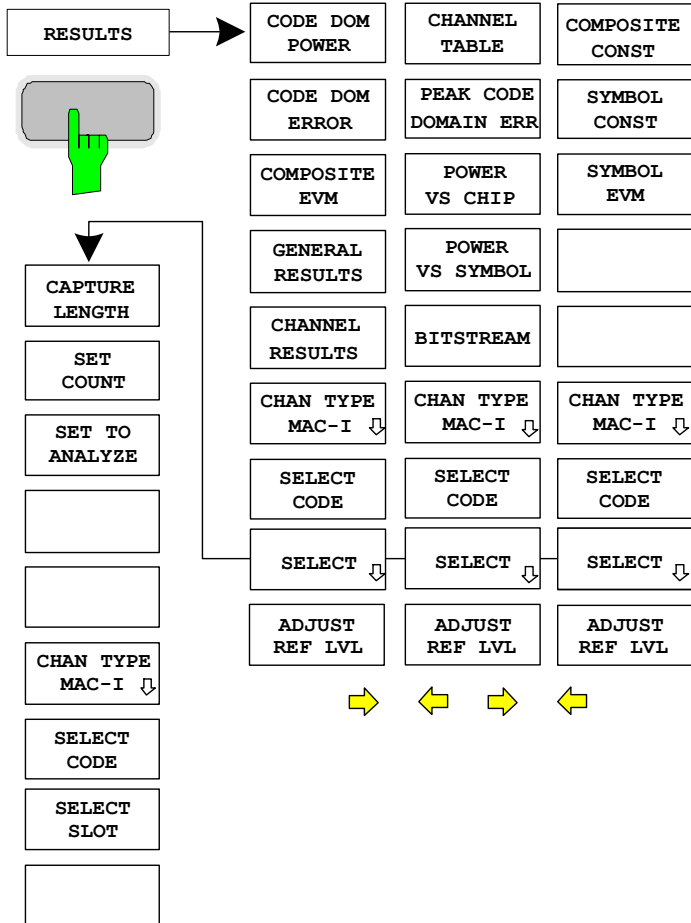
If the PREAMBLE channel type (*CHAN TYPE* softkey) is examined, signals may still be applied that do not exhibit a PREAMBLE channel type in every slot or the slot currently being examined. The reason for this is that the PREAMBLE is only ever transmitted in the first slot of a data packet. When signals are transmitted that are not identical in each slot but are repeated with reference to a trigger event, a repetitive measurement is possible by means of external triggering. Otherwise, each sweep produces a new result, which reflects the changing slot assignments.

For it to be possible to detect that, when the PREAMBLE channel type is selected, it is not present in the slot or, in the case of analyses working over all slots, it is not available in at least one of the slots, the 'PREAMBLE MISSING' message is issued.

For remote control, registers are available for these messages and can be interrogated in the status reporting system.

Presentation of analyses – RESULTS

The *RESULTS* hotkey or the *MEAS* hotkey and then the *CODE DOM ANALYZER*.



The *RESULTS* hotkey opens the submenu for choosing the analysis. On the main menu, the most important analyses are offered for rapid access, and advanced analyses are available on the side menus.

Note: To go to the far side menu, press the *NEXT* hard key twice.

You can choose from the following analyses:

CODE DOM POWER	Code domain power analysis, depending on the CODE PWR ABS/REL softkey, in relative or absolute scaling
CODE DOM ERROR	Code domain error power analysis
COMPOSITE EVM	Square difference between the test signal and ideal reference signal
GENERAL RESULTS	Tabulated general results
CHANNEL RESULTS	Tabulated results that do not refer to the channel type or the selected channel
CHANNEL TABLE	Channel occupancy table
PEAK CODE DOMAIN ERR	Projection of the error between the test signal and the ideal reference signal to the spreading factor of the channel type and subsequent summation over the symbols of each slot of the differential signal
POWER VS CHIP	Power of the total signal of a slot at chip level
POWER VS SYMBOL	Power of the selected channel and the selected slot over all symbols
BITSTREAM	Display of decided bits
COMPOSITE CONST	Composite constellation analysis
SYMBOL CONST	Symbol constellation analysis
SYMBOL EVM	Error vector magnitude analysis

The *CHAN TYPE* softkey opens a submenu for setting the channel type, mapping and the I/Q selection.

By entering a code number (*SELECT CODE* softkey), a channel can be selected for the SYMBOL CONST, SYMBOL EVM, BITSTREAM and POWER VS SYMBOL analyses.

Using the *SELECT SLOT* softkey, a slot can be selected for the CODE DOM POWER, CODE ERROR, CHANNEL TABLE, SYMB CONST, SYMBOL EVM, BITSTREAM, COMPOSITE CONST and POWER VS SYMBOL analyses.

You can use *ADJUST REF LVL* to obtain optimum matching of the device reference level to the signal level.

The following user-specific settings are not modified on the first access following presetting:

- Level parameters
- Center Frequency + Frequency Offset
- Input Attenuation + Mixer Level

The following user-specific settings are transferred as follows:

- External trigger sources are retained, while all other trigger sources result in Free Run mode.
- Additional trigger settings are retained.

To restore adjusted level parameters, they are saved on exiting the code domain analyzer and reset on re-entering the code domain analyzer.

The most important measurement settings, which are based on the displays, are grouped above the diagram:

BS, DO, C1	:CODE POWER	TYPE:	MAC-I
		Code	2.64
DB	CF 1.93125 GHz	Slot	1

Fig. 6-9 Function fields of diagrams

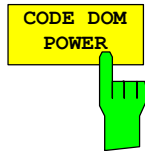
The meanings are as follows:

- 1st column: Mobile radio system (base station 1xEV-DO) BS, DO
 Band class (class 0-12) abbreviated such as C1 for 1900 MHz band
 Name of selected analysis: such as CODE POWER
 (blank line)
 Unit of y axis such as dB for relative power
- 2nd column: (blank line)
 (blank line)
 Center frequency of the signal. such as CF 1.93125 GHz
- 3rd column: channel type and mapping : such as TYPE: MAC-I

CHANNEL TYPE the channel type is specified as follows:
 ALL for analysis POWER VS CHIP/GENERAL RESULTS/COMP. EVM
 PILOT for channel type PILOT
 MAC for channel type MAC
 PREAMB for channel type PREAMB
 DATA for channel type DATA

MAPPING the mapping is specified as follows:
 (No text) for analysis entered as "not used" in Table 6-15 at mapping
 -IQ for analyses that only allow IQ mapping in Table 6-15 for channel type DATA, or Complex mapping
 -I for I or Q mapping and I selection, or overview screen A
 -Q for I or Q mapping and Q selection, or overview screen B

Walsh code and spreading factor of selected code: for example code 2.64
 Selected slot number slot 1



The *CODE DOM POWER* softkey selects the Code Domain Power (CDP) analysis with relative scaling.

With the Code Domain Power analysis, allowance is made for one channel type over precisely one slot. The power values of the different codes are determined and plotted in a diagram. In this diagram, the x axis is the code number and the y axis is a logarithmic level axis. The number of codes on the x axis depends on the channel type. It can be set by means of the *CHAN TYPE* softkey. The slot needing to be analyzed can be set by means of the *SELECT SLOT* softkey.

If the *CDP AVG* softkey is set to ON, an averaged analysis is performed over all included slots, not just over a single slot. The averaged analysis is called for by the Standard, but assumes with channel types DATA and PREAMBLE that preambles of different length do not occur in the slots.

The power of the channels is referred in the default setting to the total power in the selected channel type (such as MAC).

Apart from this relative display, there is also the option of specifying the absolute power. It can be enabled by means of the *CODE PWR ABS/REL* softkey. The unit of the y axis is dBm, accordingly, for absolute analysis and dB for relative analysis.

The power values of the active and unassigned codes are displayed in different colors:

- Yellow active channel
- Cyan inactive code

A channel in *CODE CHAN AUTOSEARCH mode* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the *INACT CHAN THRESHOLD* softkey) is exceeded. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user-defined channel table is identified as active.

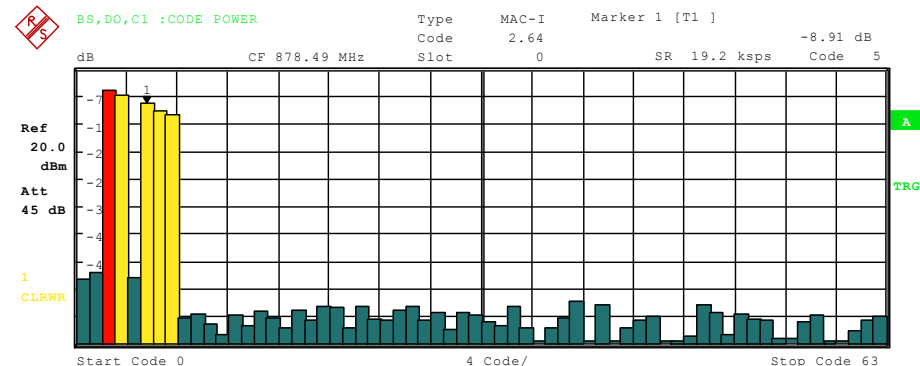


Fig. 6–10 CDP diagram for MAC-I

Mapping can also be set on the *CHAN TYPE* menu. An AUTO MODE is featured; it causes complex mapping to be analyzed separately for the DATA channel type and mapping for the I or Q branch to be analyzed separately for the other channel types. In the latter case the I/Q selection can be set by means of the *SELECT I/Q* softkey. For an overview of two code domain power measurement for separate analysis of the I and Q branches, there is similarly the *CODE DOM OVERVIEW* softkey on the *CHAN TYPE* menu, which can be used to switch to Overview mode. In Overview mode, the I branch is analyzed on screen A and the Q branch on screen B.

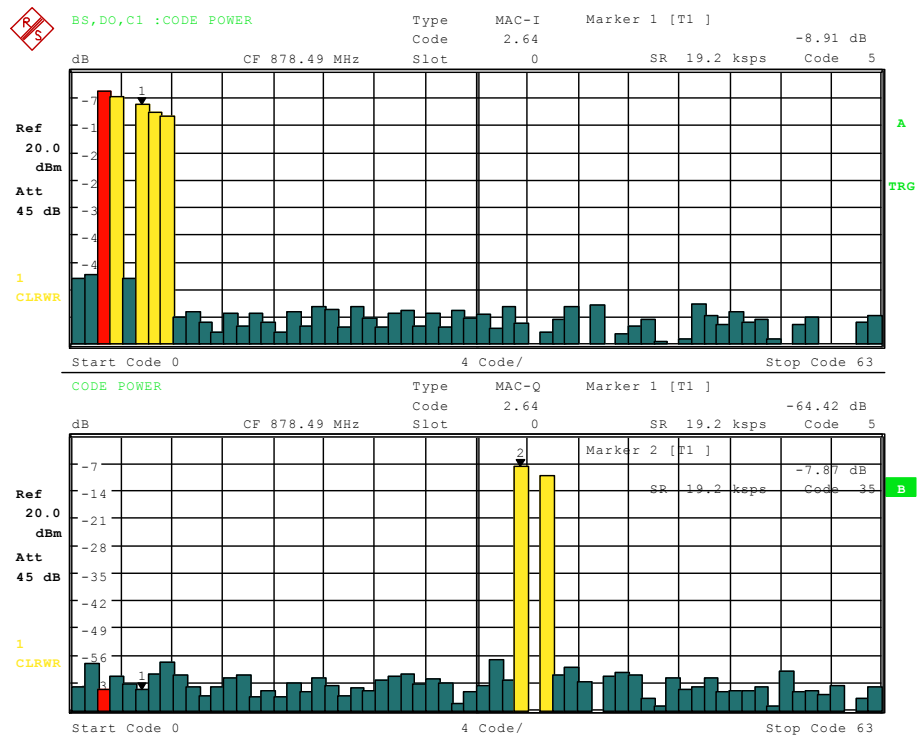


Fig. 6–11 CDP diagram in Overview mode for MAC

Another option for obtaining an overview of the CDP is to enable *MAPPING COMPLEX*, since the code domain power is then constantly displayed as a complex analysis on screen A for the selected channel type.

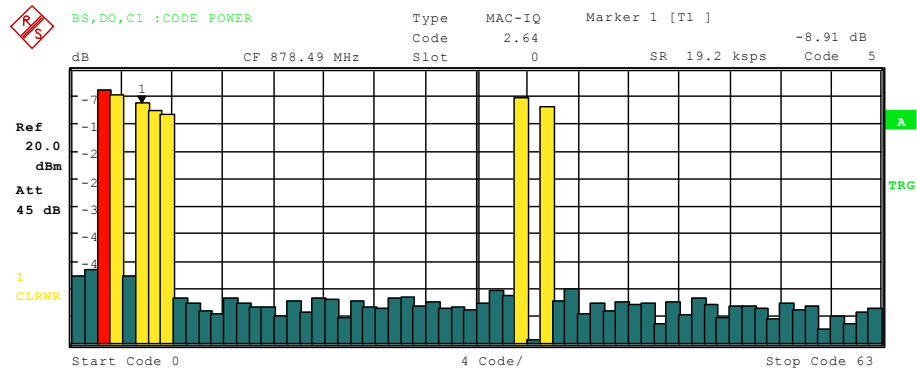
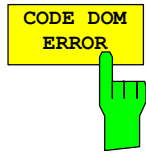


Fig. 6–12 CDP complex analysis diagram for MAC-IQ

If the DATA channel type is examined (not shown in these figures), it will be seen that the complex analysis is approximately 3 dB higher than the separate I or Q analysis. This is absolutely correct, for 50% of the power values are distributed to I and Q, respectively, for the complex modulation types of the DATA channel type.

By entering a code number (refer to the *SELECT CODE* softkey), a code can be highlighted for more detailed displays. The code is displayed in red. The selection of more detailed analyses (such as *SYMBOL CONSTELLATION*) for unassigned codes is possible but not meaningful, since the results are not valid.

IEC/IEEE bus command: :CALC<1>:FEED "XPOW:CDP:RAT" (relative)
 :CALC<1>:FEED "XPOW:CDP" (absolute)
 :CDP:OVER ON | OFF



The *CODE DOM ERROR* softkey selects the analysis of the code domain error power (CDEP).

The code domain error–power measurement outputs the power value difference between the measured and ideally generated reference signal for each code of a channel type in dB. Since it is an error power, active and inactive channels can be assessed jointly at a glance with this analysis.

With the code domain error–power analysis, allowance is made for one channel type over precisely one slot and the error powers are determined for the different codes and plotted in a diagram. In this diagram, the x axis is the code number and the y axis is a logarithmic level axis, dB being the unit. The number of codes on the x axis depends on the channel type. It can be set by means of the *CHAN TYPE* softkey. The slot needing to be analyzed can be set by means of the *SELECT SLOT* softkey. Averaging over all slots, as with the Code Domain Power analysis, cannot be enabled.

The power values of the active and unassigned codes are displayed in different colors:

- Yellow active channel
- Cyan inactive code

A channel in *CODE CHAN AUTOSEARCH mode* (Automatic Channel Search mode) is termed active when the minimum power entered by the user (refer to the *INACT CHAN THRESHOLD* softkey) is exceeded. In *CODE CHAN PREDEFINED* mode, each code channel contained in the user–defined channel table is identified as active.

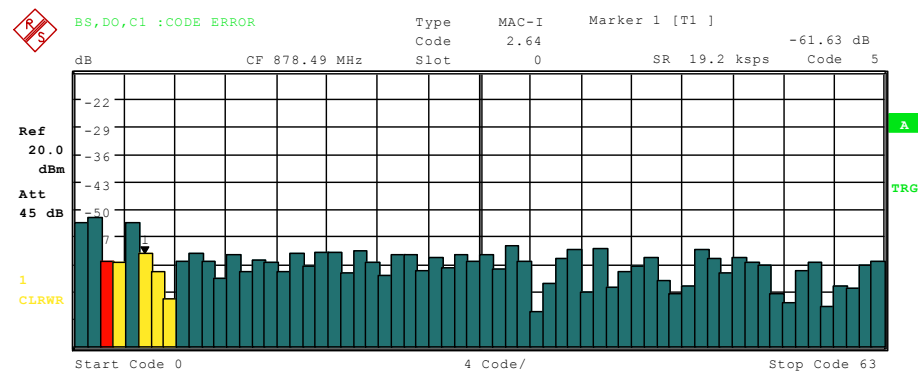
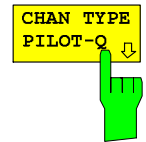


Fig. 6–13 CDEP diagram for MAC-I



Mapping can also be set on the *CHAN TYPE* menu. An *AUTO MODE* is featured; it causes complex mapping to be analyzed separately for the DATA channel type and mapping for the I or Q branch to be analyzed separately for the other channel types. In the latter case the I/Q selection can be set by means of the *SELECT I/Q* softkey. For an overview of two code domain error–power measurements for separate analysis of the I or Q branches, there is similarly the *CODE DOM OVERVIEW* softkey on the *CHAN TYPE* menu, which can be used to switch to Overview mode. In Overview mode, the I branch is analyzed on screen A and the Q branch on screen B.

Another option for obtaining an overview of the CDEP is to enable *MAPPING COMPLEX*, since the code domain error power is then constantly displayed as a complex analysis on screen A for the selected channel type.

By entering a code number (refer to the *SELECT CODE* softkey), a code can be highlighted for more detailed displays. The code is displayed in red.

The selection of more detailed analyses (such as *SYMBOL CONSTELLATION*) for unassigned codes is possible but not meaningful, since the results are not valid.

IEC/IEEE bus command: :CALC<1>:FEED "XPOW:CDEP"
:CDP:OVER ON | OFF



The *COMPOSITE EVM* softkey selects the analysis of the error vector magnitude (EVM) over the total signal (modulation accuracy).

In the Composite EVM measurement, the square root is determined from the square of the error between the real and imaginary components of the test signal and of an ideally generated reference signal.

The measurement result consists of one composite EVM measurement value per slot. The number of slots can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the *COMPOSITE EVM* analysis takes into account the whole signal over the whole period of observation.

Only the channels detected as being active for this channel type are used to generate the ideal reference signal. In the case of a channel which is not detected as being active on account of, say, low power, the difference between the test signal and the reference signal and the composite EVM is therefore very large (refer to the figure).

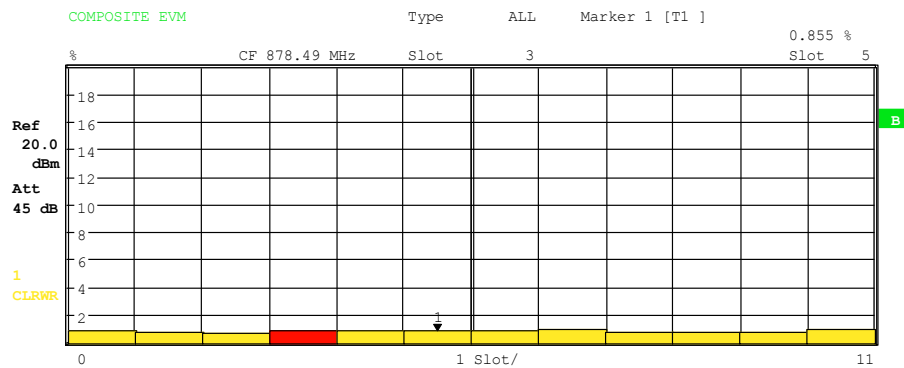


Fig. 6-14 Display of Composite EVM when all channels contained in the signal were detected as active

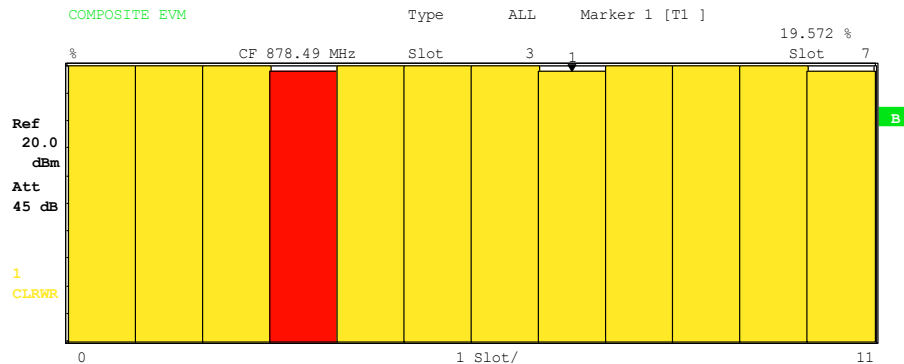
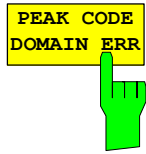


Fig. 6-15 Display of Composite EVM when one code channel was not detected as active

As with the selection of a code in the CDP or CDEP diagram, there is the option in the Composite EVM diagram of selecting a slot. Selection is performed by entering the slot number (refer to the *SELECT SLOT* softkey). The selected slot is displayed as a red bar.

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



The *PEAK CODE DOMAIN ERR* softkey selects the analysis of the peak code domain error.

With the peak code domain–error measurement, there is a projection of the error between the test signal and the ideally generated reference signal to the spreading factor. The value of the spreading factor is automatically determined by the channel type (refer to Table 6–16). The unit on the y axis is dB.

The measurement result consists of a numerical value per slot for the peak code domain error. The number of slots can be set by means of the *CAPTURE LENGTH* softkey. Accordingly, the peak code domain–error analysis allows for a channel type over the whole period of observation.

Only the channels detected as being active are used to generate the ideal reference signal for the peak code domain error. If an assigned code is not detected as being active on account of low power, the difference between the test signal and the reference signal is very large. The R&S FS-K84 therefore displays a peak code domain error that is too high (refer to figure).

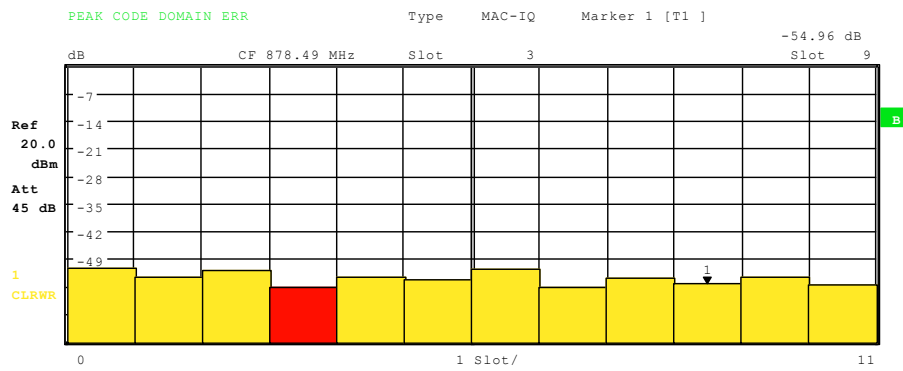


Fig. 6–16 Peak code domain error in the event of all channels contained in the signal being detected as active

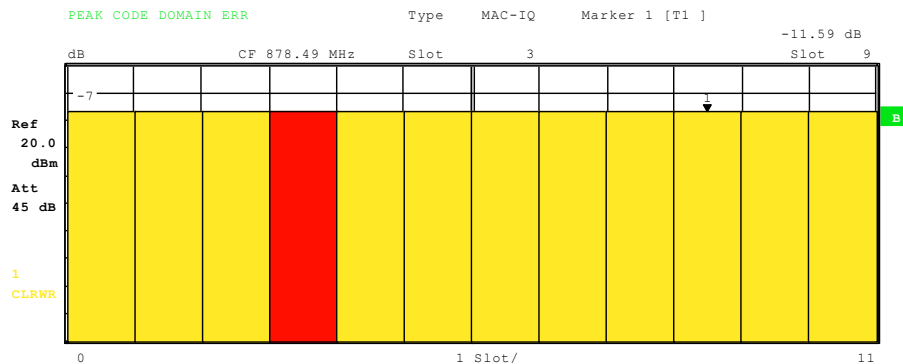
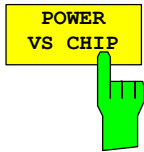


Fig. 6–17 Peak code domain error in the event of one channel not being detected as active

As with the selection of a code channel in the CDP or CDEP diagram, there is the option of selecting a slot in the peak code domain–error diagram. Selection is performed by entering the slot number (refer to the *SELECT SLOT* softkey). The selected slot is displayed as a red bar.

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



The *POWER VS CHIP* softkey enables the power versus chip analysis.

The absolute power is displayed in dBm per chip time for the selected slot. There are thus 2048 power values as a trace. This analysis accordingly makes allowance for the total signal for the duration of one slot.

With the help of the Power versus Chip analysis, it is simple to identify which channel types in the slot have power on account of the symmetrical structure of the 1xEV-DO forward link signal (refer to the section "Code Domain Measurements on 1xEV-DO Signals" on page 67).

The slot to be examined can be selected by means of the *SELECT SLOT* softkey.

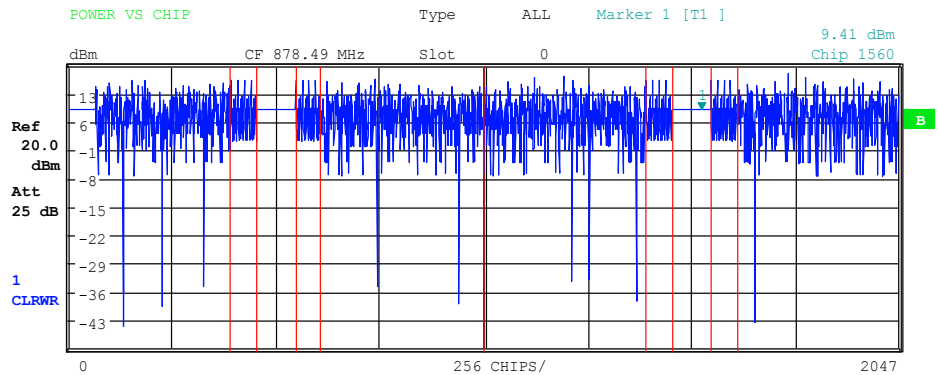


Fig. 6-18 Power versus Chip for all channel types active

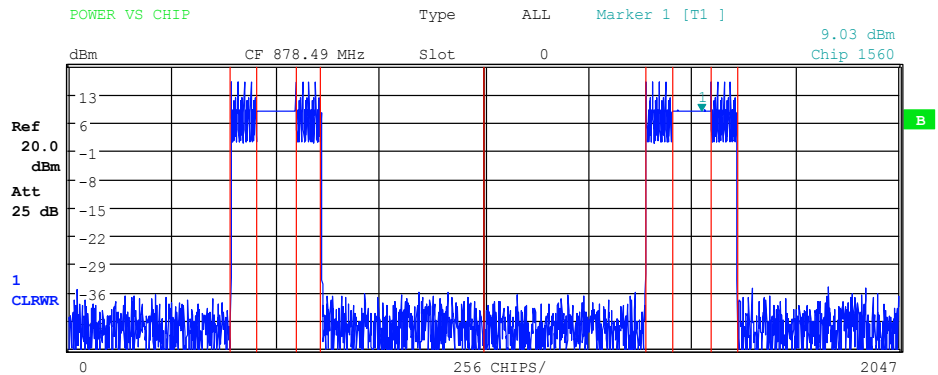
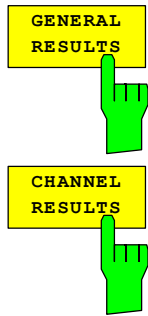


Fig. 6-19 Power versus Chip for IDLE slot (only PILOT and MAC active)

IEC/IEEE bus command: :CALC2:FEED "XTIM:CDP:PVCH"



The *GENERAL RESULTS* and *CHANNEL RESULTS* softkeys feature the numerical analysis of the measurement results on two pages. The two pages are broken down as follows:

GENERAL RESULTS		Type	ALL	EXT	
CF 878.49 MHz					
Global Results for Set 0:					
Ref	Carr Freq Error	-32.79	mHz	RHO Pilot	0.99992
	Carr Freq Error	-0.00	ppm	RHO ov-1/-2	0.99992/0.99993
	Chip Rate Error	0.11	ppm	RHO MAC	0.99992
	Trg to Frame	203.323850	ns	RHO DATA	0.99992
Att	Results for Set 0 / Slot 0:				
40 dB	Power PILOT	-0.53	dBm	Data Modulation Type	16-QAM
	Power MAC	-0.52	dBm	Act. MAC Channels	5
	Power DATA	-0.44	dBm	Act. DATA Channels	16
1	Power PREAMBLE	-0.51	dBm	Preamble Length	64 Chips
CLWR	Composite EVM	0.85	%	RHO	0.99993
	Max. Pwr DATA	-14.48	dB	Max. inact. Pwr MAC	-58.30 dB
	Min. Pwr DATA	-15.84	dB		
CHANNEL RESULTS		Type	PILOT-I	EXT	
CF 878.49 MHz					
Results for Channel Type: PILOT / Set: 0 / Slot: 0					
Ref	Power	-0.54	dBm	IQ Imbalance	0.05 %
	Pk CDE (SF 32/I)	-60.19	dB	IQ Offset	0.35 %
Att	Channel Results for Channel Type: PILOT-I / Slot: 0				
40 dB	Symbol Rate	38.4	ksps	Timing Offset	--- ns
	Channel.SF	0.32		Phase Offset	--- mrad
1	Channel Power Rel	-0.00	dB	Channel Power Abs	-0.54 dBm
CLWR	Symbol EVM	0.05	% rms	Symbol EVM	0.08 % Pk
	Modulation Type	BPSK-I			

Fig. 6–20 General results and channel results

The softkey *GENERAL RESULTS* shows a table of numerical results. With firmware version 4.x beside RHO Pilot also RHO MAC and RHO DATA are evaluated and shown. If all slots of the analyzed set of IQ data do only contain IDLE SLOTS the value of RHO DATA is 0.

The top part of *GENERAL RESULTS* presents global results that display the total signal over the whole period of observation (all slots):

Carrier Freq Error:

Specifies the frequency error referred to the set center frequency of the analyzer. The absolute frequency error is the sum of the frequency error of the analyzer and that of the device under test.

Differences of more than 8.0 kHz between transmitter and receiver frequency impair the synchronization of the CDP measurement. If at all possible, the transmitter and the receiver should be synchronized (refer to the Getting Started chapter). The frequency error is available in Hz as the unit, on the one hand, and in ppm referred to the carrier frequency, on the other.

Chip Rate Error:

Specifies the chip rate error (1.2288 Mcps) in ppm. A large chip rate error results in symbol errors and, consequently, possibly in the CDP measurement not being able to perform synchronization. This measurement result is also valid if the analyzer was not able to synchronize onto the 1xEV-DO signal.

Trigger to Frame:	This measurement result reproduces the timing offset from the beginning of the acquired signal section until the start of the first slot. In the case of triggered data acquisition, this corresponds to the timing offset frame-trigger (+ trigger-offset) – start of the first slot. If the analyzer was not able to synchronize onto the 1xEV-DO signal, the value of Trg to Frame is not meaningful. If the <i>FREE RUN</i> trigger is selected, dashes (—) are displayed.
RHO Pilot:	Specifies the RHO quality parameter for the area of the pilot channel calculated over all slots, as called for in the Standard.
RHO overall-1:	Specifies the RHO quality parameter calculated for over all chips and over all slots, where the averaging limit is on the half-slot limit, as called for in the Standard.
RHO overall-2:	Specifies the RHO quality parameter calculated for over all chips and over all slots, where the averaging limit is on the quarter-slot limit, as called for in the Standard.
RHOData:	Read out values from IEC/IEEE bus.
RHOMac:	Read out values from IEC/IEEE bus.

The bottom part of General Results shows results applicable to the selected slot (*SELECT SLOT*):

Power PILOT:	Absolute power measurements in dBm in the PILOT channel type.
Power MAC:	Absolute power measurements in dBm in the MAC channel type.
Power DATA:	Absolute power measurements in dBm in the DATA channel type.
Power PREAMBLE:	Absolute power measurements in dBm in the PREAMBLE channel type.
Composite EVM:	The composite EVM value is the difference between the test signal and ideal reference signal (refer to the <i>COMPOSITE EVM</i> softkey).
Data Modulation Type:	Modulation type of the DATA channel type.
Act. MAC Channels:	Number of active MAC channels.
Act. DATA Channels:	Number of active DATA channels.
Preamble Length:	Length of the preamble in chips, 0 if no preamble is present in this slot. .
RHO:	Specifies the RHO quality parameter calculated over a slot. (As in CDMA2000 BTS R&S FS-K82).

IEC/IEEE bus command:

```
:CALCulate<1|2>:MARKer<1>:FUNction:CDPower[:BTS]:RESult?
RHO | MACCuracy | PCDerror | FERRor | FERppm | CERRor |
TFRame I IQOFFset | IQIMbalance | SRATe | CHANnel | SFACtor
| TOFFset | POFFset | CDPabsolute | CDPRelative | EVMRms |
EVMPeak | RHOPilot | RHO1 | RHO2 | PPILot | PMAC | PDATa |
PPReamble | MACTive | DACTive | PLENgth | MTYPe | DMTYPe |
RHOData | RHOMac
```

The General Result Display shows in addition the following three results:

The maximum inactive MAC channel power, which is the highest inactive channel from the I- and Q-branch of the MAC channel type is shown as *Max. inact. Pwr MAC* in dB.

The minimum and maximum DATA channel power, which is the smallest and highest value of the I- and Q-branch of the DATA channel type is shown as *Min. Pwr DATA* and *Max. Pwr Data*.

IEC/IEEE bus command:

```
:CALC:MARK:FUNC:CDP:RES? PDMax      (Power Data Max)
                          PDMin      (Power Data Min)
                          IPMMax     (Inactiv Power MAC Max)
```

The CHANNEL RESULTS analysis is subdivided into two halves. The top part displays results that depend on the selected channel type (CHAN TYPE softkey) and the selected slot:

Power: The total power of the channel type. This result is identical to one from the bottom half of General Results and is listed again, because the Channel Power Rel relative to this value is displayed from this point on.

Pk CDE: The *PEAK CODE DOMAIN ERR* measurement specifies a projection of the difference between test signal and ideal reference signal to the spreading factor that belongs to the channel type. This spreading factor is output in brackets.

IQ Imbalance: IQ imbalance of the signal in %

IQ Offset: DC offset of the signal in %

The lower part of CHANNEL RESULTS displays the results of measurements on the selected channel in the specified channel type and of the selected slot.

Symbol Rate: Symbol rate with which the channel is transmitted

Code.SF: Number of the code and its associated spreading factor

Timing Offset: Timing offset between the selected channel and the first active channel in the channel type. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Phase Offset: Phase offset between the selected channel and the first active channel in the channel type. This measurement can be enabled by means of the *TIME/PHASE* softkey.

Chan Pow rel. / abs.:

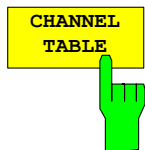
Channel power relative (referred to the total power of the channel type) and absolute channel power.

Symbol EVM Pk / RMS:

Peak or mean value of the results of the error vector magnitude measurement (refer to the *SYMBOL EVM* softkey). The measurement provides information about the EVM of the selected channel for the selected slot at symbol level.

If the *MAX/MIN HOLD* or *AVERAGE* trace statistics are enabled using the *TRACE* hardkey, the values are interlinked accordingly from one analysis to the next. The Active MAC or DATA Channels, Data Modulation Type, Symbol Rate, Channel.SF and Mapping values are not statistically interlinked. In the case of the values which have an expectation value of 0 (Carr Freq Error, Trg to Frame, IQ Imbal/Offset, Timing and Phase Offset), the maximum value is formed in such a way that the maximum is sought among the absolute values and then output with sign. In this way it is possible to determine the largest deviation including the direction of the deviation. The minimum value is formed in the same way.

IEC/IEEE bus command: :CALC2:FEED "XTIM:CDP:ERR:SUMM"
 :CALC<1|2>:MARK<1>:FUNC:CDP[:BTS]:RES?
 RHO | MACC | PCD FERR | FERP |
 CERR | TFR I IQOF | IQIM |
 SRAT | CHAN | SFAC | TOFF | POFF |
 CDP | CDPR | EVMR | EVMP |
 RHOP | RHO1 | RHO2 | PPIL | PMAC | PDAT |
 PPR | MACT | DACT | PLEN | MTYP | DMType



The CHANNEL TABLE softkey selects the Channel Occupancy Table analysis, in which all active channels are displayed.

The channel assignment table can theoretically contain 146 entries. One in the PILOT and one in the PREAMBLE channel type, 16 in the DATA channel type and theoretically 64 on the I and 64 on the Q branch of the MAC channel type. In reality, not more than 64 MAC codes should be assigned, since the Standard only provides for 64 MAC indices. The Channel Occupancy Table analysis makes allowance for the total signal over precisely one slot. The slot needing to be analyzed can be set by means of the SELECT SLOT softkey.

The channels are listed in the following channel type order: PILOT, MAC, PREAMBLE, DATA. Within the channel types, the channels are sorted in ascending code number order.

BS,DO,C0 :CHANNEL TAB

CF 878.49 MHz

Type	Chan.SF	Symb Rate ksps	Modulation	Pwr Abs dBm	Pwr Rel dB	T Offs ns	Ph Offs mrad
Ref	PILOT	0.32	38.4	BPSK-I	-0.76	-0.00	0.00
10.0	MAC	2.64	19.2	BPSK-I	-6.71	-5.91	0.00
dBm	MAC	3.64	19.2	BPSK-I	-7.70	-6.91	-0.84
Att	MAC	5.64	19.2	BPSK-I	-9.71	-8.91	1.57
40 dB	MAC	6.64	19.2	BPSK-I	-11.72	-10.92	0.86
	MAC	7.64	19.2	BPSK-I	-12.72	-11.92	-0.78
	MAC	35.64	19.2	BPSK-Q	-8.67	-7.87	0.88
	MAC	37.64	19.2	BPSK-Q	-10.68	-9.88	0.65
1	PRE64	7.32	38.4	BPSK-I	-0.79	-0.00	0.00
CLRWR	DATA	0.16	76.8	8-PSK	-12.83	-12.04	0.00
	DATA	1.16	76.8	8-PSK	-12.83	-12.05	0.16
	DATA	2.16	76.8	8-PSK	-12.82	-12.03	0.49

Fig. 6-21 Channel table

The following parameters are determined for the channels:

Channel type: Specifies the channel type of the active channel. Possible values are PILOT, MAC and DATA. For the PREAMBLE channel, the length in chips is similarly specified, thus resulting in the following options for the PREAMBLE channel type: PRE64, PRE128, PRE256, PRE512 or PRE1024.

CHAN.SF: The number of the Walsh code of the active channel including spreading factor. The spreading factor depends on the channel type.

Symb. Rate: Symbol rate with which the channel is transmitted

Modulation/mapping

The DATA channel type can contain QPSK, 8-PSK or 16-QAM modulated channels; there is BPSK-I or BPSK-Q modulation for the other channel types.

Pwr Abs / Pwr Rel:

Specification of the absolute and relative power (referred to the total power in the channel type) of the channel.

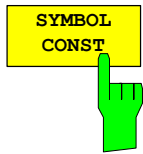
T Offs: Timing offset. Timing offset between this channel and the first active channel can be enabled by means of the TIME/MEAS softkey.

Ph Offs: Phase offset. Phase offset between this channel and the first active channel can be enabled by means of the TIME/MEAS softkey.

A data channel is referred to as active in CODE CHAN AUTOSEARCH mode when it exhibits the minimum power (refer to the INACT CHAN THRESHOLD softkey). In CODE CHAN PREDEFINED mode, all code channels contained in the channel table are marked as active.

If the TIME/PHASE softkey is set to ON, the maximum value of the TIMING and PHASE OFFSET is displayed together with the associated channel type and channel on the right-hand side above the channel table. Since the TIMING and PHASE values of each active channel can be either negative or positive, the absolute values are compared and the maximum is then displayed with the original sign.

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



The *SYMBOL CONST* softkey selects the analysis of the constellation diagram at symbol level.

Analysis of the symbols is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot. The number of symbols on the x axis is between 2 and 100 (refer to Table 6–16).

Evaluation of the constellation diagram is possible for unassigned codes, but the results are meaningless since unassigned code channels do not contain data. For orientation, the unit circle is added to the figure.

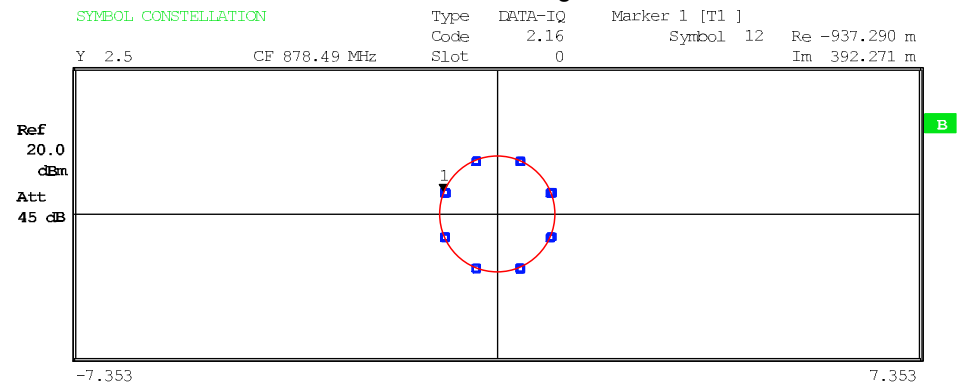
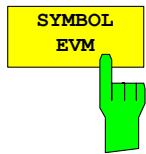


Fig. 6–22 Symbol constellation diagram

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



The *SYMBOL EVM* softkey selects the analysis for the symbol error vector magnitude. Analysis of the EVM is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot. The number of symbols on the x axis is between 2 and 100 (refer to Table 6–16).

Evaluation of the symbol error vector magnitude for unassigned codes is possible, but the results are not valid.

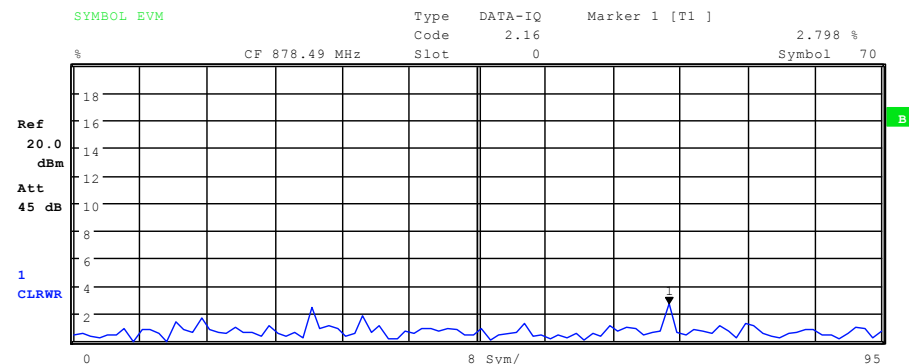


Fig. 6–23 Error vector magnitude for one slot of a channel

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



The *BITSTREAM* softkey selects the "Bit Stream" analysis".

Analysis of the different bits is performed for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot .

Depending on the symbol rate of the channel type and on the number of chips of the channel type, and also on the modulation type, a minimum of 4 and a maximum of 400 bits can be contained in a slot; refer to Table 6–16 on page 70. With QPSK modulated channels, one symbol always consists of two bits; with 8–PSK the number is three bits 3 and with 16–QAM it is four bits. With BPSK modulated channels, a symbol consists of one bit (either the I component or the Q component is assigned; for complex analysis a 2BPSK is displayed with I and Q components).

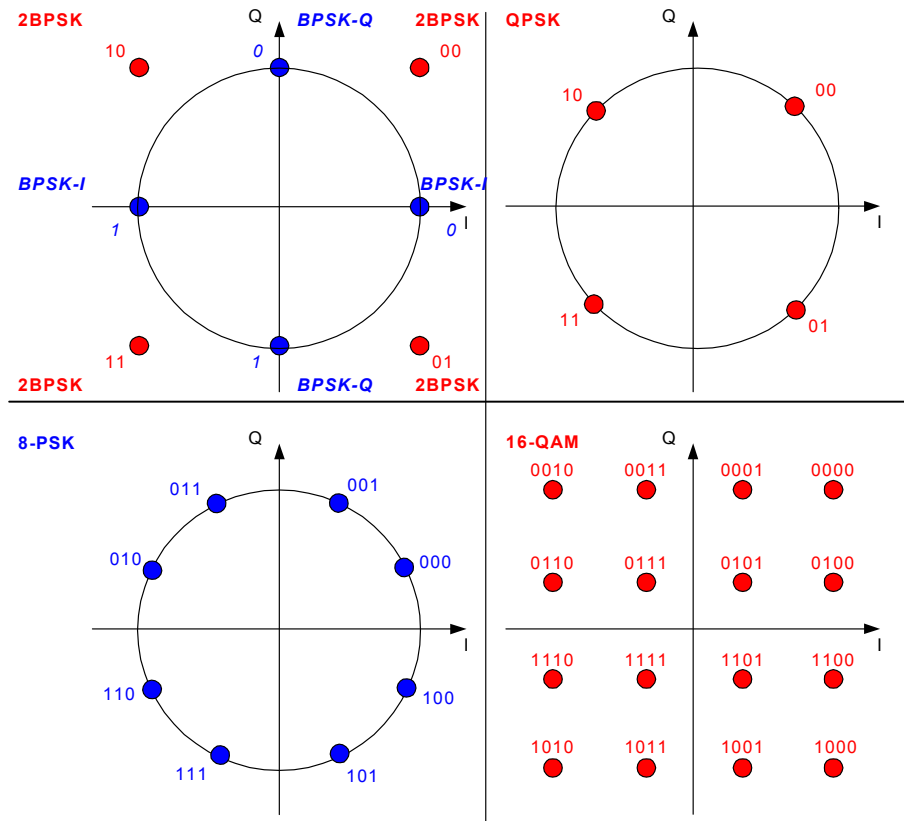


Fig. 6–24 Constellation diagrams for BPSK, QPSK, 8–PSK and 16–QAM including bit values

Depending on the channel type, there are the following modulated channels in the 1xEV-DO system:

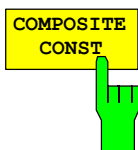
Table 6–17 Relationship between channel type and modulation type

Kanaltyp	Modulation
PILOT	BPSK-I
MAC	BPSK-I / BPSK-Q
PREAMBE	BPSK-I
DATA	QPSK / 8-PSK / 16-QAM

An analysis of the bit stream for unassigned codes is indeed possible, but since the results are not meaningful on account of the missing data, all bits are identified as invalid in this case by '-'.
 The marker can be used to scroll in the bit stream.

BITSTREAM		Type	DATA-IQ
CF 878.49 MHz		Code	2.16
		Slot	0
0	101 010 110 111 001 010 000 010 101 000		
30	010 100 010 000 010 000 010 111 100 000		
60	111 011 000 010 000 001 101 000 001 010		
90	111 010 110 011 011 001 010 110 101 001		
120	111 000 010 011 110 011 110 001 100 101		
150	011 011 000 100 100 001 110 011 001 100		
180	110 011 011 100 100 110 001 000 011 001		
210	010 101 000 001 001 110 001 101 100 001		
240	110 100 011 101 010 101 000 101 101 111		
270	010 011 000 011 110 101		

Fig. 6–25 Demodulated bits for a slot of a channel in the channel type IEC/IEEE bus command: :CALC2:FEED "XTIM:CDP:BSTR"



The *COMPOSITE CONST* softkey selects the analysis of the constellation diagram at chip level.
 With the *COMPOSITE CONST*, the total signal is taken into account by means of the selected channel type over the selected slot (*SELECT SLOT* softkey).
 A constellation point is plotted for each chip in the diagram. The number of chips depends on the selected channel type and, in the case of *PREAMBLE* and *DATA*, on the length of the preamble and can vary between 64 and 1600 chips.
 For orientation, the unit circle is added to the figure.

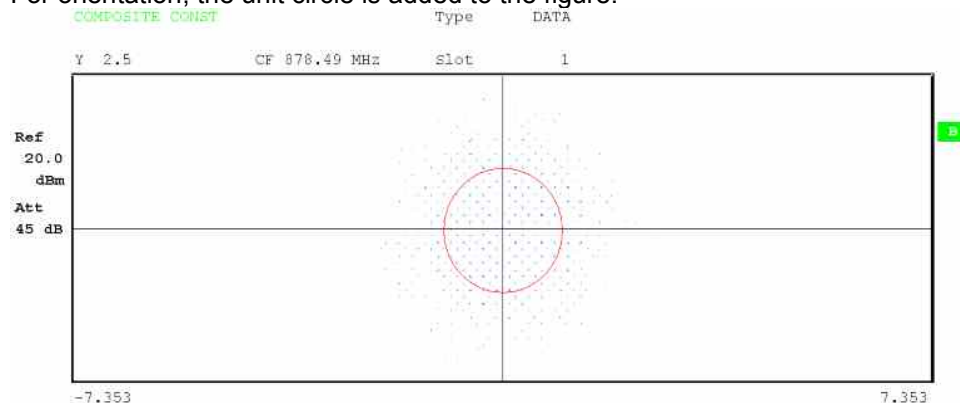
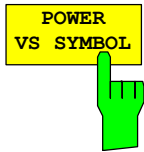


Fig. 6–26 Composite constellation diagram

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



The *POWER VS SYMBOL* softkey selects the Power versus Symbol analysis. The analysis outputs the absolute power in dBm at each symbol time for the selected code (*SELECT CODE* softkey) in the set channel type (*CHAN TYPE* softkey) and the selected slot (*SELECT SLOT* softkey). This means that this analysis makes allowance for results of a code in the selected channel type for one slot. The number of symbols on the x axis is between 2 and 100 (refer to Table 6–16).

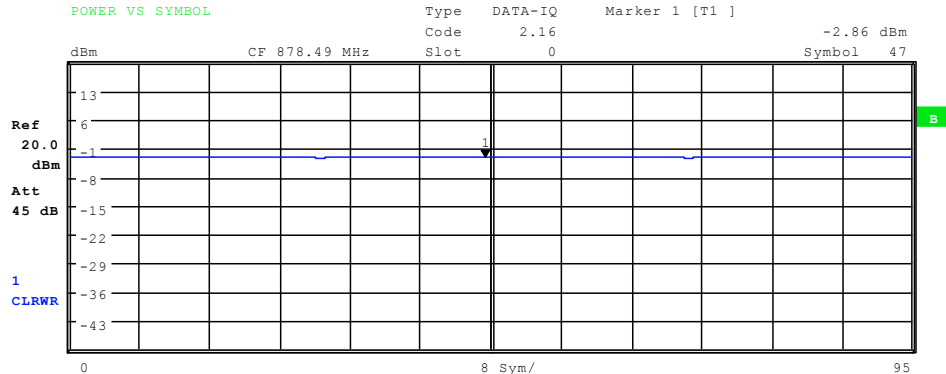
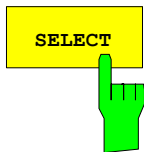
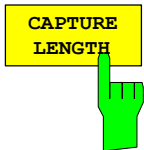


Fig. 6–27 Power versus Symbol for one slot of a channel in the channel type

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

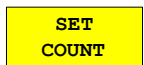


The *SELECT* softkey opens a submenu to define the capture configuration and the selection of the slot and channel for the evaluation.



The *CAPTURE LENGTH* softkey allows entry of the number of slots to be acquired. The input is always made as a multiple of the slot. The range is between 2 and 36 for the Analyzers R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP. For all analyses that exhibit a value per slot on the x axis the maximum value on the x axis is the set *CAPTURE LENGTH* – 1.

IEC/IEEE bus command: `:[SENS:]CDP:IQL 2..36 (2..12)`



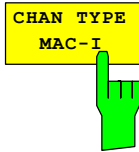
This function offers the possibility for the **R&S FSQ** to capture up to 1824 slots (more than 3 seconds) with a *SINGLE SWEEP* and then post process all the data with *SET TO ANALYZE*.



If the *SET COUNT* is set to 1 (default value), the device behaves as before and with the *CAPTURE LENGTH* the number of slots can be set.

For R&S FSQ the *SET COUNT* can be adjusted in the range of 1..57. Is the *SET COUNT* greater than 1 the *CAPTURE LENGTH* will be implicitly set to 32 slots and become unavailable. The *SET COUNT* defines then how many SETS of 32 slots shall be captured consecutively into the IQ RAM of the R&S FSQ. With the *SET TO ANALYZE* softkey the set for which the results are calculated can be defined. The range is from 0...(SET COUNT–1).

IEC/IEEE bus command: `:[SENS:]CDP:SET:COUN 1..57 (FSQ)`
`:[SENS:]CDP:SET:[VAL]`
`<numeric_value> (FSQ)`

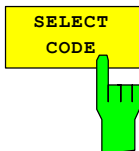


By operating the *CHAN TYPE* softkey, you go to a submenu on which you can set the following parameters:

- Channel type: *PILOT*, *MAC*, *PREAMBLE* or *DATA*
- Code Domain Overview mode can be enabled/disabled
- Mapping mode: *AUTO*, *COMPLEX* or *I OR Q* (whether I or Q branch is analyzed)
- *SELECT I/Q*: With separate *I OR Q* analysis, this determines which branch will be displayed.

On the second line of the *CHAN TYPE* softkey, the setting performed in the submenu is shown in its short form. Precise details of this softkey are provided on page 105 .

IEC/IEEE bus command: `: [SENS:]CDP:CTYP PIL | MAC | PRE | DATA`



You can use the *SELECT CODE* softkey to select a code. All analyses that take the results for a code into account specify the results for the newly selected channel: *POWER VS SYMBOL*, *CHANNEL RESULTS*, *BITSTREAM*, *SYMBOL CONSTELLATION* and *SYMBOL EVM*.

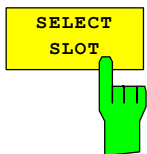
In the analyses *CODE DOMAIN POWER*, *CODE DOMAIN ERROR POWER* and *CHANNEL TABLE* (all on screen A), the selected code is identified in red to distinguish it.

Codes are entered in decimal format.

The rotating wheel behaviour depends on the analysis on screen A and is geared to the graphic display. With *CODE DOMAIN POWER* and *CODE DOMAIN ERROR POWER*, it is always the adjacent channel that is selected. With the channel table, the rotating wheel is used to scroll through the list. In this instance, the channel type and the selection of I or Q are reset automatically if this is required by the new channel that has to be selected.

The maximum settable value depends on the spreading factor of the channel type. *PILOT*, *PREAMBLE*: 0..31, *MAC*: 0..63 and *DATA* 0.63.

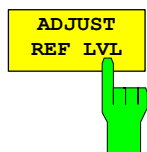
IEC/IEEE bus command: `: [SENS:]CDP:CODE 0...31 | 63 | 15,`
(depending on the channel type)



The *SELECT SLOT* softkey is used to select a slot. Slots are entered in decimal format. In this instance the range of values is from 0 to (Capture–Length–1); refer to the *CAPTURE LENGTH* softkey. All analyses that take the results for a slot into account specify the results for the newly selected slot: (*CODE DOMAIN POWER*, *CODE DOMAIN ERROR POWER*, *CHANNEL TABLE*, *POWER vs CHIP*, *POWER vs SYMBOL*, *COMPOSITE CONSTELLATION*, *GENERAL RESULTS*, *CHANNEL RESULTS*, *BITSTREAM*, *SYMBOL CONSTELLATION* and *SYMBOL EVM*)

In the analyses *COMPOSITE EVM* and *PEAK CODE DOMAIN ERROR*, the selected slot is highlighted in red.

IEC/IEEE bus command: `: [SENS:]CDP:SLOT 0 ...`
(CAPTURE_LENGTH-1)

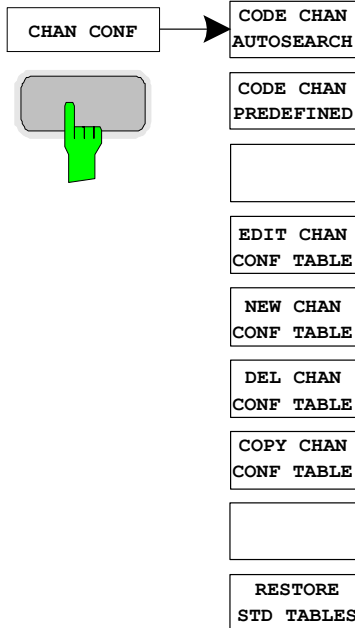


The *ADJUST REF LVL* softkey adjusts the reference level of the analyzer to the measured channel power. This ensures that the settings of the RF attenuation and the reference level are optimally adjusted to the signal level without the analyzer being overloaded or the dynamic response being limited by a too low signal-to-noise ratio.

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

Measurement configuration

CHAN CONF hotkey



The *CHAN CONF* hotkey opens a submenu with the configuration options for the channel search. On this submenu, predefined channel tables can be selected and are then taken as a basis for measurements of the code domain analyzer.

When the hotkey is selected, a table containing the channel tables stored on the hard disk of the measuring instrument is opened. The table is used merely to obtain an overview; one of the tables can be selected for the measurement only after the *CODE CHAN PREDEFINED* softkey has been operated. The *RECENT* entry is the channel table of the last Code Domain Power analysis to be performed.

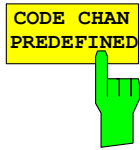
IEC/IEEE bus command: :CONF:CDP [:BTS]:CTAB:CAT?



The *CODE CHAN AUTOSEARCH* softkey supports measurements of the code domain power analyzer in Autosearch mode. In this mode, all channel types are searched according to their spreading factors for active channels. A channel is active when the minimum power, referred to the total power, entered by the user is exceeded (refer to the *INACT CHAN THRESHOLD* softkey).

CODE CHAN AUTOSEARCH mode is the default search mode with which the CDP analysis starts. It is primarily used to provide the user with an overview of the channels contained in the signal. If the signal contains channels which are not detected as being active in Autosearch mode, the CDP analysis can be performed with predefined channel configurations by changing to *CODE CHAN PREDEFINED* mode.

IEC/IEEE bus command: :CONF:CDP [:BTS]:CTAB[:STAT] OFF



The *CODE CHAN PREDEFINED* softkey switches the CDP analysis to the measuring mode with the help of predefined channel tables. In this mode, there is no search for active channels, but the channels of a channel table defined before the measurement are assumed to be active.

When the softkey is selected, a table containing all the channel tables stored on the measuring instrument is opened. The CDP analysis is switched to "Predefined Channel Table" mode. In this instance, the last table of the automatic search mode is taken as a basis for the measurement. This table is available at the *RECENT* entry .

Switching to one of the predefined channel tables is done by selecting the corresponding table entry and operating one of the unit keys or by pressing Enter; the selected channel table is taken as a basis for the analysis as from the next measurement. A tick marks the selected channel table.

When the R&S FS-K84 leaves the factory, the following channel tables are stored on the measuring instrument:

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type QPSK in channel type DATA. (File name: DOQPSK).

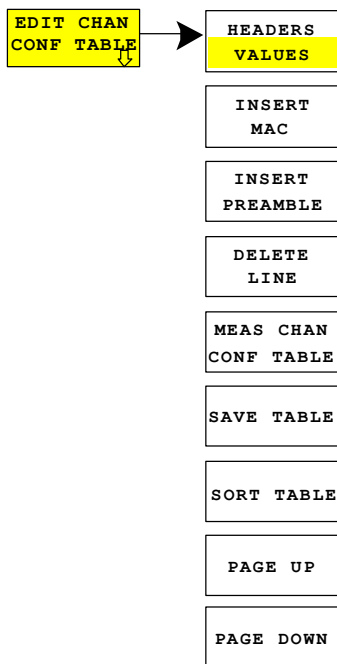
Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 8-PSK in channel type DATA (File name DO8PSK).

Channel table with channel types PILOT/MAC/PREAMBLE/DATA with modulation type 16-QAM in channel type DATA. (File name DO16QAM).

Channel table with channel types PILOT/MAC – known as IDLE slot, since it does not contain any active channels in the DATA channel type. (File name DO_IDLE).

For a precise definition of the channel tables refer to Chapter 4.

```
IEC/IEEE bus command: :CONF:CDP[:BTS]:CTABLE[:STATE] ON
                      :CONF:CDP[:BTS]:CTAB:SEL "DOQPSK"
```



The *EDIT CHAN CONF TABLE* softkey opens the selected channel table in which the channel configuration can be modified. In addition, a submenu is opened with the softkeys required for editing the channel table.

EDIT CHANNEL TABLE					
NAME:	DO16QAM				
COMMENT:	Base Station Main 2457.6 kbps (1 Slot) 16-QAM				
TYPE	CHAN.SF	SYMBOL RATE [ksps]	MODULATION/MAPPING	CDP REL [dB]	STATUS
PILOT	0.32	38.4	BPSK-I	0.0	ACTIVE
MAC	2.64	19.2	BPSK-I	0.0	ACTIVE
MAC	3.64	19.2	BPSK-I	0.0	ACTIVE
MAC	4.64	19.2	BPSK-I	0.0	ACTIVE
MAC	34.64	19.2	BPSK-Q	0.0	ACTIVE
MAC	35.64	19.2	BPSK-Q	0.0	ACTIVE
PRE64	2.32	38.4	BPSK-I	0.0	ACTIVE
DATA	0.16	76.8	16-QAM	0.0	ACTIVE
DATA	1.16	76.8	16-QAM	0.0	ACTIVE
DATA	2.16	76.8	16-QAM	0.0	ACTIVE
DATA	3.16	76.8	16-QAM	0.0	ACTIVE
DATA	4.16	76.8	16-QAM	0.0	ACTIVE
DATA	5.16	76.8	16-QAM	0.0	ACTIVE
DATA	6.16	76.8	16-QAM	0.0	ACTIVE
DATA	7.16	76.8	16-QAM	0.0	ACTIVE
DATA	8.16	76.8	16-QAM	0.0	ACTIVE
DATA	9.16	76.8	16-QAM	0.0	ACTIVE
DATA	10.16	76.8	16-QAM	0.0	ACTIVE
DATA	11.16	76.8	16-QAM	0.0	ACTIVE
DATA	12.16	76.8	16-QAM	0.0	ACTIVE
DATA	13.16	76.8	16-QAM	0.0	ACTIVE
DATA	14.16	76.8	16-QAM	0.0	ACTIVE
DATA	15.16	76.8	16-QAM	0.0	ACTIVE

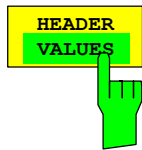
Fig. 6-28 Table for editing a channel configuration

As a general rule, each of the channel tables stored on the measuring instrument can be modified at will. The edited table is not stored automatically on the hard disk of the measuring instrument but only by selecting the *SAVE TABLE* softkey. This prevents a table from being accidentally overwritten (such as one of the channel models).

If a table is edited that is currently the basis for the Code Domain Power analysis, the edited table is used for the next measurement immediately after being saved. The effects of the changes in the table are therefore immediately visible. Here again, the edited table is not saved on the hard disk of the measuring instrument until the *SAVE TABLE* softkey has been selected.

If a table is edited that is stored on the hard disk of the measuring instrument but is not currently enabled, the changes will not be visible until it has been saved (*SAVE TABLE* softkey) and then enabled.

If the CHAN parameter of a channel is modified, a check of the code domain conflicts is performed after pressing the input (units keys). If a code domain conflict is detected, the associated channels are identified by an asterisk. You are given the opportunity of eliminating the code domain conflicts. When a table with code domain conflicts is used for a CDP analysis, the results are invalid.



The HEADER/VALUES softkey sets the focus of the edit option either to the entries in the table or to the table header.

Editing the table header (*HEADER*):

Overwriting of saved tables can be avoided by changing the name of a table. A table name must not consist of more than 8 characters.

IEC/IEEE bus command:

```
:CONF:CDP[:BTS]:CTAB:NAME "NEW_TAB"
```

Editing table entries (*VALUES*):

The actual data of the channel table are edited here. The following entries are available for each of the channels contained in the table (confirm an input with the help of the units keys):

TYPE: Defines the channel type, either PILOT, MAC, PRE64, PRE128, PRE256, PRE512, PRE1024 or DATA. With the PREAMBLE channel type, the length of the preamble is entered simultaneously in chips. The entry cannot be edited, because the PILOT channel and the 16 DATA channels are always available, and MAC and PREAMBLE can be inserted by means of the *INSERT* softkeys.

CHAN.SF: The channel number is entered for the channel in this column. The spreading factor is inserted automatically depending on the channel type (refer to Table 6–16 on page 70). Invalid entries are rejected.

SYMBOL RATE: Symbol rate with which the channel is transmitted. It depends directly on the spreading factor of the channel type (refer to Table 6–16) and cannot therefore be edited.

MODULATION: The modulation type is entered here. With channel types PILOT, MAC and PREAMBLE, mapping is specified too – that is, whether a channel will transmit on the I or Q branch. The following settings are possible:
 PILOT: BPSK–I (permanent, edit not possible)
 MAC : BPSK–I / BPSK–Q
 PREAMBLE: BPSK–I / BPSK–Q
 DATA: QPSK / 8–PSK / 16–QAM

CDP REL.: Informative entry of the relative channel power (referred to the total power in the channel type). The entry cannot be edited and only exists for the *RECENT* table; it is used to detect channels with low power.

STATUS: Status of the channel (active/inactive). When a change of channel status occurs, a channel that has been entered in the table can be hidden in the Code Domain Power analysis without having to remove the corresponding entry from the table. Only channels having an "active" channel status are used for the CDP analysis.

IEC/IEEE bus commands:

```
:CONF:CDP:CTAB:DATA 0,5,0,0,0,0,1,0.0,
                    1,6,35,1,0,0,1,0.0"
'Selects PILOT 0.32 BPSK-I and 'MAC 35.64 BPSK-Q..
```

```
:CONF:CDP[:BTS]:CTAB:COMM "Comment for new
table"
```

INSERT
MAC



The *INSERT MAC* softkey adds a new entry to the table. Entries can be made in any order.

IEC/IEEE bus command: --

(integrated in the :CONF:CDP[:BTS]:CTAB:DATA command)

INSERT
PREAMBLE



The *INSERT PREAMBLE* softkey makes it possible to add the Preamble channel to the channel table.

INSERT PREAMBLE	
PRE64	PREAMBLE 64 CHIPS
PRE128	PREAMBLE 128 CHIPS
PRE256	PREAMBLE 256 CHIPS
PRE512	PREAMBLE 512 CHIPS
PRE1024	PREAMBLE 1024 CHIPS

Fig. 6-29 Table of Preamble selection

IEC/IEEE bus command: --

(integrated in the :CONF:CDP[:BTS]:CTAB:DATA command)

DELETE
LINE



The *DELETE LINE* softkey deletes the selected line from the table.

IEC/IEEE bus command: --

MEAS CHAN
CONF TABLE



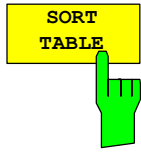
The *MEAS CHAN CONF TABLE* softkey initiates a measurement in *CODE CHAN AUTOSEARCH* mode. The measurement results are applied to the open channel table. The softkey is only available in *CODE CHAN AUTOSEARCH* mode.

IEC/IEEE bus command: --



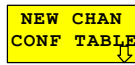
The *SAVE TABLE* softkey saves the table with its specified name. Note: Editing of the channel models and saving with the original name results in the models being overwritten.

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



The *SORT TABLE* softkey sorts the table according to channel types (PILOT, MAC, PREAMBLE, and DATA) and in channel number order within the channel types.

IEC/IEEE bus command: --



- HEADERS VALUES
- INSERT MAC
- INSERT PREAMBLE
- DELETE LINE
- MEAS CHAN CONF TABLE
- SAVE TABLE
- SORT TABLE
- PAGE UP
- PAGE DOWN

The *NEW CHAN CONF TABLE* softkey opens a submenu that is identical with that described for the *EDIT CHAN CONF TABLE* softkey. Unlike *EDIT CHAN CONF TABLE*, a new channel table with the PILOT channel type and channel 0.32 and the 16 DATA channel types for *NEW CHAN CONF TABLE*. The name of the table has still not been fixed at present:

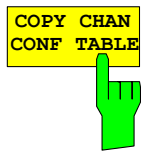
EDIT CHANNEL TABLE					
NAME:					
COMMENT:					
TYPE	CHAN.SF	SYMBOL RATE [ksps]	MODULATION/MAPPING	CDP REL [dB]	STATUS
PILOT	0.32	38.4	BPSK-I	0.0	ACTIVE
DATA	0.16	76.8	16-QAM	0.0	ACTIVE
DATA	1.16	76.8	16-QAM	0.0	ACTIVE
DATA	2.16	76.8	16-QAM	0.0	ACTIVE
DATA	3.16	76.8	16-QAM	0.0	ACTIVE
DATA	4.16	76.8	16-QAM	0.0	ACTIVE
DATA	5.16	76.8	16-QAM	0.0	ACTIVE
DATA	6.16	76.8	16-QAM	0.0	ACTIVE
DATA	7.16	76.8	16-QAM	0.0	ACTIVE
DATA	8.16	76.8	16-QAM	0.0	ACTIVE
DATA	9.16	76.8	16-QAM	0.0	ACTIVE
DATA	10.16	76.8	16-QAM	0.0	ACTIVE
DATA	11.16	76.8	16-QAM	0.0	ACTIVE
DATA	12.16	76.8	16-QAM	0.0	ACTIVE
DATA	13.16	76.8	16-QAM	0.0	ACTIVE
DATA	14.16	76.8	16-QAM	0.0	ACTIVE
DATA	15.16	76.8	16-QAM	0.0	ACTIVE

Fig. 6-30 Creating a new channel configuration



The *DEL CHAN CONF TABLE* softkey deletes the selected table. The current table in *CODE CHAN PREDEFINED* mode cannot be deleted.

IEC/IEEE bus command: :CONF:CDP[:BTS]:CTAB:DEL



The *COPY CHAN CONF TABLE* softkey copies the selected table. The system asks the name under which you want to save the copy.

IEC/IEEE bus command:
:CONF:CDP[:BTS]:CTABe:COPY "CTAB2"



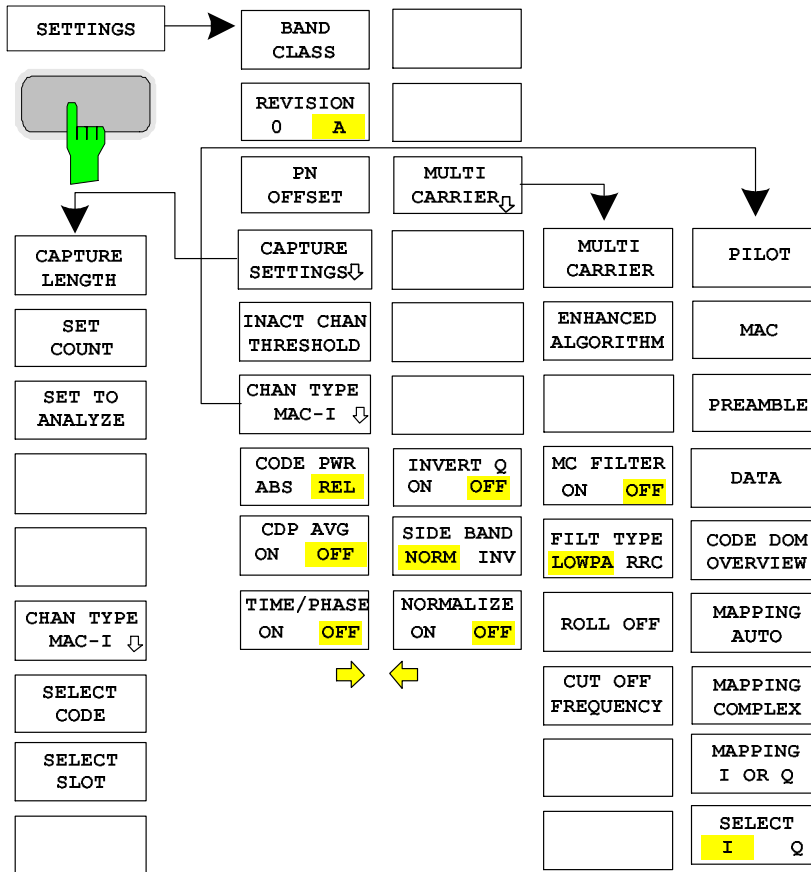
The *RESTORE STD TABLES* softkey restores the channel tables defined in Chapter 4, "Predefined Channel Tables", to the state in which they were in when the device left the factory. In this way unintentional overwriting of the channel table can be undone.

IEC/IEEE bus command:

```
:CONF:CDP[:BTS]:CTAB:REST
```

Configuring the firmware application – SETTINGS

SETTINGS hotkey

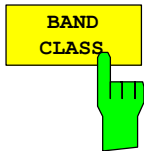


The *SETTINGS* hotkey opens a submenu for setting the measurement parameters of the firmware application.

The *BAND CLASS* softkey is a setting parameter for the RF measurements "adjacent channel power" and "spectrum emission mask".

All other softkeys configure the measurements in the code domain analyzer.

The softkeys *CAPTURE SETTINGS* and *MULTI CARRIER* are leading in the submenus as shown in the drawing on the right.



The *BAND CLASS* softkey allows input of the used frequency band for the RF measurements, adjacent channel measurement and spectrum emission mask. The selection is made from a table in which the name of the band class is displayed.

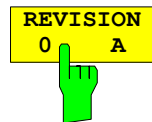
Entry of the center frequency is not restricted by the band class selection.

BAND CLASS SELECTION	
Band Class	0 (800 MHz Band)
✓ Band Class	1 (1900 MHz Band)
Band Class	2 (TACS Band)
Band Class	3 (JTACS Band)
Band Class	4 (Korean PCS Band)
Band Class	5 (450 MHz Band)
Band Class	6 (2 GHz Band)
Band Class	7 (700 MHz Band)
Band Class	8 (1800 MHz Band)
Band Class	9 (900 MHz Band)
Band Class	10 (Secondary 800 MHz Band)
Band Class	11 (400 MHz European PAMR Band)
Band Class	12 (800 MHz PAMR Band)
Band Class	14 (US PCS 1.9GHz Band)
Band Class	15 (AWS Band)

Fig. 6–31 Band class selection

You can scroll in the table, and the entry currently being used is checked, while a bar displays the selected entry; click ENTER to apply the value. The numerical value is specified over the IEC/IEEE bus.

IEC/IEEE bus command: :CONF:CDP:BCL <band_class>



The softkey *REVISION 0/A* allows to define whether a revision 0 (subtype 0/1) signal or a revision A (subtype 2) signal is analyzed.

In the default mode (revision 0) the analysis software behaves unchanged. With firmware version 3.90 the revision A mode can be selected.

In revision A the number of active users is increased. Therefore the spreading factor (number of orthogonal codes) is doubled within the channel type MAC and the channel type PREAMBLE. See table below:

Channel type	Spreading factor		Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code		
							Mapping I or Q	Mapping complex	
PILOT	32		38.4 ksps	BPSK-I or BPSK-Q	96*2 = 192	6	6	6	12
MAC	Rev. 0	64	19.2 ksps	BPSK-I or BPSK-Q	64*4 = 256	4	4	4	8
	Rev. A	128	9.6 ksps			2	2	2	4
PRE-AMBLE	Rev. 0	32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length				
					64:	2	2	4	4
					128:	4	4	8	8
					256:	8	8	16	16
					512:	16	16	32	32
					1024:	32	32	64	64
	Rev. A	64	19.2 ksps	BPSK-I or BPSK-Q	64:	1	1	2	2
					128:	2	2	4	4
					256:	4	4	8	8
					512:	8	8	16	16
					1024:	16	16	32	32
DATA	16		76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4- PreambleChips= DataNettoChips		Mapping always complex Modulation type:		
							QPSK	8-PSK	16-QAM
					1600-0 = 1600	100	200	300	400
					1600-64 = 1536	96	192	288	384
					1600-128 = 1472	92	184	276	368
					1600-256 = 1344	84	168	252	336
					1600-512 = 1088	68	136	204	272
					1600-1024 = 576	36	72	104	144

Table 6-18 Relationship between symbol rate, spreading factor, number of symbols, number of bits, number of chips and channel type

Depending on the channel type and selected evaluation the amount of returned trace data (TRAC:DATA? TRACe1 | TRACe2) in the MAC and PREAMBLE channel differs between revision 0 and A. This is also listed in the table above.

The analysis detects all the channels on a per slot basis. Therefore changing channel configuration or modulation over the recorded slots is recognized.

The new modulation types of revision A within some of the MAC channels is detected. The new modulation types are:

ON/OFF keying ACK on the I branch (OOKA-I),

ON/OFF keying ACK on the Q branch (OOKA-Q),

ON/OFF keying NACK on the I branch (OOKN-I) and the

ON/OFF keying NACK on the Q branch (OOKN-Q).

Via remote the commands for querying the trace data or result summary data are extended for the modulation type in the following numbering scheme:

6 = OOKA-I

7 = OOKA-Q

8 = OOKN-I

9 = OOKN-Q

If the 2 bits within an ON/OFF keying modulation are identical, the modulation is not possible to be recognized as an ON/OFF keying modulation. If both bits are containing '1' information (ON) the modulation is identical to a BPSK and will be recognized as BPSK. If both bits are containing '0' information (OFF) there is no power within that code and slot and therefore no modulation is detected.

Is the evaluation set to MAPPING COMPLEX the separate I and Q branch detection within the result summary is not any longer selected and the modulation type will be a 2BPSK with the coding number 5 via remote.

IEC-Bus-command: :CONF:CDP[:BTS]:REV 0 | A

PN
OFFSET



The *PN OFFSET* softkey allows entry of the base station PN offset, which is used to distinguish between the base stations with 1xEV-DO.

The PN offset determines the offset in the circulating PN sequence in multiples of 64 chips with reference to the event second clock trigger.

IEC/IEEE bus command: :[SENS:]CDP:PNOF 0...511

CAPTURE
SETTINGS



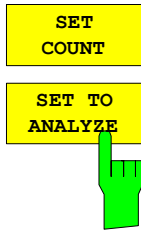
The *SELECT* softkey opens a submenu to define the capture configuration and the selection of the slot and channel for the evaluation.

CAPTURE
LENGTH



The *CAPTURE LENGTH* softkey allows entry of the number of slots to be acquired. The input is always made as a multiple of the slot. The range is between 2 and 36 for the Analyzers R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP. For all analyses that exhibit a value per slot on the x axis the maximum value on the x axis is the set CAPTURE LENGTH - 1.

IEC/IEEE bus command: :[SENS:]CDP:IQL 2..36 (2..12)

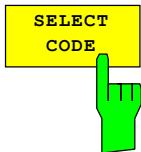


This function offers the possibility for the R&S FSQ to capture up to 1824 slots (more than 3 seconds) with a SINGLE SWEEP and then post process all the data with *SET TO ANALYZE*.

If the *SET COUNT* is set to 1 (default value), the device behaves as before and with the *CAPTURE LENGTH* the number of slots can be set.

For R&S FSQ the *SET COUNT* can be adjusted in the range of 1...57. If the *SET COUNT* greater than 1 the *CAPTURE LENGTH* will be implicitly set to 36 slots and become unavailable. The *SET COUNT* defines then how many SETS of 36 slots shall be captured consecutively into the IQ RAM of the R&S FSQ. With the *SET TO ANALYZE* softkey the set for which the results are calculated can be defined. The range is from 0... (*SET COUNT*-1).

```
IEC-Bus-command:      : [SENS:]CDP:SET:COUN 1..57 (FSQ)
                    : [SENS:]CDP:SET:[VAL]
                    <numeric_value> (FSQ)
```



You can use the *SELECT CODE* softkey to select a code. All analyses that take the results for a code into account specify the results for the newly selected channel: POWER VS SYMBOL, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM.

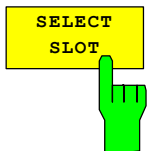
In the analyses CODE DOMAIN POWER, CODE DOMAIN ERROR POWER and CHANNEL TABLE (all on screen A), the selected code is identified in red to distinguish it.

Codes are entered in decimal format.

The rotating wheel behaviour depends on the analysis on screen A and is geared to the graphic display. With CODE DOMAIN POWER and CODE DOMAIN ERROR POWER, it is always the adjacent channel that is selected. With the channel table, the rotating wheel is used to scroll through the list. In this instance, the channel type and the selection of I or Q are reset automatically if this is required by the new channel that has to be selected.

The maximum settable value depends on the spreading factor of the channel type. PILOT, PREAMBLE: 0..31, MAC: 0..63 and DATA 0.63.

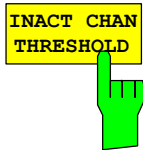
```
IEC/IEEE bus command: : [SENS:]CDP:CODE 0..31 | 63 | 15,
                    (depending on the channel type)
```



The *SELECT SLOT* softkey is used to select a slot. Slots are entered in decimal format. In this instance the range of values is from 0 to (*Capture-Length*-1); refer to the *CAPTURE LENGTH* softkey. All analyses that take the results for a slot into account specify the results for the newly selected slot: (CODE DOMAIN POWER, CODE DOMAIN ERROR POWER, CHANNEL TABLE, POWER vs CHIP, POWER vs SYMBOL, COMPOSITE CONSTELLATION, GENERAL RESULTS, CHANNEL RESULTS, BITSTREAM, SYMBOL CONSTELLATION and SYMBOL EVM)

In the analyses COMPOSITE EVM and PEAK CODE DOMAIN ERROR, the selected slot is highlighted in red.

```
IEC/IEEE bus command: : [SENS:]CDP:SLOT 0 ... (CAPTURE_LENGTH-1)
```



The *INACT CHAN THRESHOLD* softkey allows entry of the minimum power that an individual channel must have in the MAC or DATA channel type, compared with the total signal of the channel type, to be regarded as the active channel.

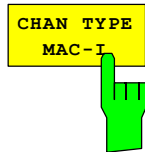
Channels below the specified threshold are regarded as "inactive".

With the PILOT channel type, the code 0.32 is normally expected on the I branch, synchronization will not otherwise take place and the 'SYNC FAILED' message failed appears. In the PREAMBLE channel type, only one code is normally assigned and thus the optimum detection threshold is permanently -4.5 dB below the total power of the PREAMBLE channel type.

The two measurements *COMPOSITE EVM* and *PEAK CODE DOMAIN ERR*, which are specified as measurements on the total signal, are performed using the list of active channels. Distortions of these two measurements always occur when active channels are not detected as being active and unassigned codes are wrongly given the status of "occupied channel". *INACT CHAN THRESHOLD* can therefore be used to influence the results of the two measurements.

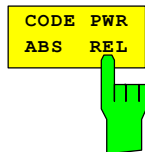
The default value is -40 dB. If not all channels contained in the signal are detected automatically, *INACT CHAN THRESHOLD* must be decremented.

IEC/IEEE bus command: :[SENS:]CDP:ICTR -100 dB ... 0 dB



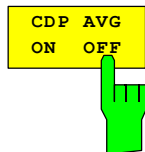
The *CHAN TYPE* softkey branches to a separate submenu. This will be explained after the Settings menu.

IEC/IEEE bus command: :[SENS:]CDP:CTYP PIL | MAC | PRE | DATA



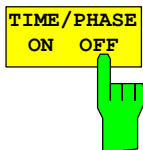
The *CODE PWR ABS/REL* softkey selects for the CODE DOMAIN POWER analysis whether the y-values should be displayed as absolute (dBm) or relative (dB). In Relative mode the reference is the total power of the channel type.

IEC/IEEE bus command: :CALC<1>:FEED "XPOW:CDP:RAT" (relative)
:CALC<1>:FEED "XPOW:CDP" (absolute)



The CDP AVG softkey is available for the code domain analysis. If it is ON, the code domain analysis is averaged over all slots. This analysis is required by the 1xEV-DO Standard. It presumes, however, with the DATA and PREAMBLE channel types that preambles of different length do not occur in the slots. This averaging is not permitted otherwise. If averaging is active, then it will be necessary, in the function field above the CDP display *SLOT:*, to read *ALL*. To be able to measure signals of any configuration, the default value is OFF.

IEC/IEEE bus command: :[SENS:]CDP:AVERage ON | OFF



The TIME/PHASE ON/OFF softkey supports specific enabling and disabling of the Timing and Phase Offset analysis of the channels for the pilot. If the value of the softkey is OFF (default setting) or there are more than 50 active channels in the signal, dashes ('—') are entered in the channel occupancy and in the Channel Results analysis for timing and phase offset. If the softkey is ON, the analysis will take place and the values will be displayed.

IEC/IEEE bus command: :[SENS:]CDP:TPM ON | OFF

MULTI CARRIER

ENHANCED ALGORITHM

MC FILTER ON OFF

FILT TYPE LOWPA RRC

ROLL OFF

CUT OFF FREQUENCY

The softkey *MULTI CARRIER* activates an additional mode in the signal processing to improve the processing of multi carrier signals. This allows the measurement on one carrier out of a multi carrier signal with 1.23 MHz carrier spacing even with identical PN offset values on all carriers.

This multi carrier mode has by default two features switched on:

- improved algorithm for signal detection on multi carrier signals
- additional low pass filter

For that reason the softkey *ENHANCED ALGORITHM* and *MC FILTER* are switched on if the *MULTI CARRIER* is activated. The filter type LOWPA (for low pass filter) is selected.

From this base setting the enhanced multi carrier algorithm can be switched on or off with the *ENHANCED ALGORITHM* softkey.

With respect to the *MC FILTER* there are also different configurations possible: The *MC FILTER ON/OFF* softkey allows to switch the additional filter on or off.

If the *ENHANCED ALGORITHM* and the *MC FILTER* are switched off the multi carrier mode is deactivated and the *MULTI CARRIER* softkey becomes grey. To restart the multi carrier mode it is necessary to repress the *MULTI CARRIER* softkey.


The softkey *FILT TYPE LOWPA/RRC* allows the selection between the automatically activated low pass filter and a configurable RRC filter with integrated hamming window. If the RRC filter is selected further two softkeys become available. These are the softkeys *ROLL OFF* and *CUT OFF FREQUENCY*. The first defines the roll off factor, meaning the type of decay of the filter curve, between 0.01 and 0.99 in 0.01 steps – default value is 0.02. The second softkey defines the cut off frequency. This is the frequency where the cut off of the filter begins – here the default value is 1.25 MHz and the value is adjustable between 0.1 MHz and 2.4 MHz in Hz-steps.

If the *MULTI CARRIER* softkey is switched off also the further settings became unavailable.

Please be aware that the low pass filter is influencing the measured signal quality (like RHO or EVM) in comparison without an additional filter and the improved algorithm will slightly increase the calculation time.

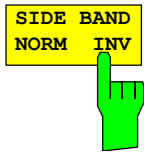
```
IEC/IEEE bus command: :CONF:CDP:MCAR ON | OFF
                    :CONF:CDP:MCAR:MALGO ON | OFF
                    :CONF:CDP:MCAR:FILT[:STATE] ON | OFF
                    :CONF:CDP:MCAR:FILT:TYPE LPASs | RRC
                    :CONF:CDP:MCAR:FILT:ROFF <numeric_value>
                    :CONF:CDP:MCAR:FILT:COFR <numeric_value>
```

INVERT Q ON OFF



The *INVERT Q* softkey inverts the sign of the Q component of the signal. The default setting is OFF.

```
IEC/IEEE bus command: :[SENS]:CDP:QINV OFF
```

The *SIDE BAND NORM / INV* softkey chooses between measurement of the signal in normal (NORM) and inverted spectral position (INV).

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

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

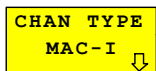
The default setting is NORM.

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



The *NORMALIZE ON / OFF* softkey eliminates the DC offset from the signal. The default setting of the parameter is OFF.

IEC/IEEE bus command: : [SENS:] CDP: NORM OFF



PILOT

MAC

PREMABLE

DATA

CODE DOM OVERVIEW

MAPPING AUTO

MAPPING COMPLEX

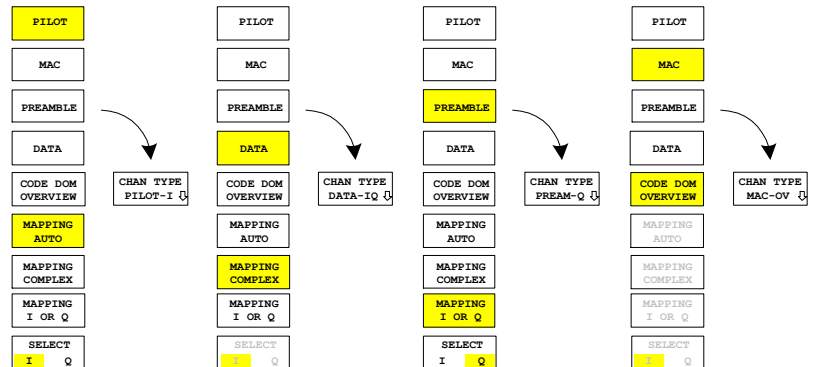
MAPPING I OR Q

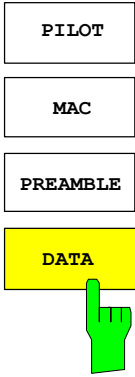
SELECT I Q

The menu shown on the left is opened with the *CHAN TYPE* softkey. This softkey is present on both the SETTINGS and the RESULTS menus.

On the *CHAN TYPE* menu, the channel type and mapping mode can be set. Furthermore, it is possible to select I/Q on it, and the Code Domain Overview mode can be enabled and disabled.

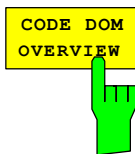
Depending on the menu settings, the second line of the *CHAN TYPE* softkey is labeled in the following examples:





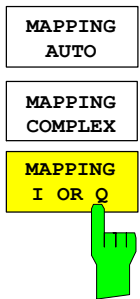
The *PILOT*, *MAC*, *PREAMBLE* and *DATA* softkeys are a 1-out-of-4 selection and define the corresponding channel type. Since the four channel types subdivide 1xEV-DO slot with regard to time, the majority of the analyses of the code domain analyzers are available for each channel type. Refer to Table 6-15. The default value is *PILOT*.

IEC/IEEE bus command: : [SENS:]CDP:CTYP PIL | MAC | PReamble | DATA



The *CODE DOM OVERVIEW* softkey is available for the code domain power and code domain error-power and can be enabled. If Overview mode is activated, screen A will display the I branch and screen B the Q branch of the CDP and CDEP analysis as a general rule. The *MAPPING AUTO*, *MAPPING COMPLEX*, *MAPPING I OR Q* and *SELECT I/Q* softkeys are not available when Code Domain Overview mode is active. The default setting is OFF.

IEC/IEEE bus command: : [SENS:]CDP:OVER ON | OFF

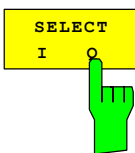


The *MAPPING AUTO*, *MAPPING COMPLEX* and *MAPPING I OR Q* softkeys are a 1-out-of-3 selection. Mapping mode determines whether the I or Q branch or the complex signal is analyzed. Mapping is selected automatically with the *MAPPING AUTO* softkey, depending on the channel type:

Channel type	Mapping
PILOT	I OR Q
MAC	I OR Q
PREAMBLE	I OR Q
DATA	COMPLEX

In order to obtain the option of examining every channel type individually as either complex, or the I and Q branch on their own, mapping can be permanently set by means of the *MAPPING COMPLEX* and *MAPPING I OR Q* softkeys. It is then valid for all channel types. The default value is *MAPPING AUTO*.

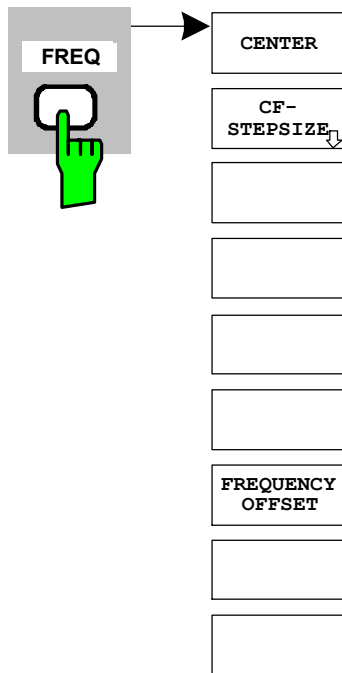
IEC/IEEE bus command: : [SENS:]CDP:MMOD AUTO | IOQ | COMPL



The I or Q branch to be analyzed is selected with the *SELECT I/Q* softkey. The softkey is not available for *MAPPING COMPLEX*. The I branch is selected after a Preset.

IEC/IEEE bus command: : [SENS:]CDP:MAPP I | Q

Frequency settings – *FREQ* key



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

The *CENTER* softkey opens the input window for manually entering the center frequency.

The permissible input range of the center frequency is

$$\text{Minspan}/2 \leq f_{\text{center}} \leq f_{\text{max}} - \text{Minspan}/2$$

f_{center} center frequency

Minspan smallest selectable span >0 Hz (10 Hz)

f_{max} maximum frequency

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

CF-STEP SIZE softkey opens a submenu for setting the step size of the center frequency change. There is an option of entering the step size manually (*MANUAL* softkey) or using the current measurement frequency (*CENTER* softkey). The softkeys are described in the manual for the basic device.

IEC/IEEE bus command: :*FREQ*:*CENT*:*STEP* <numeric_value>

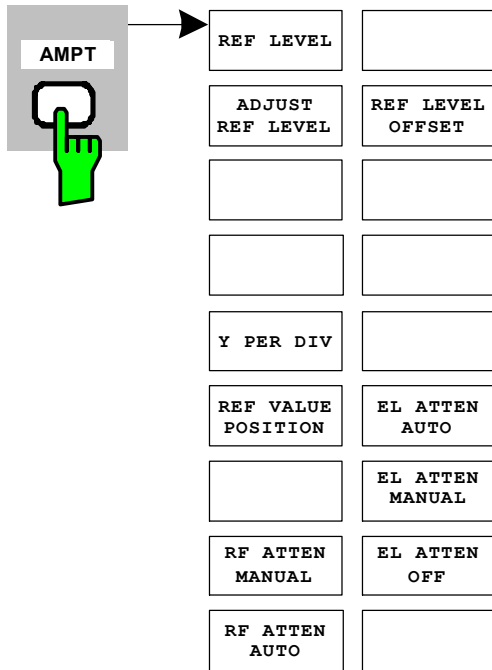
The *FREQUENCY OFFSET* softkey enables entry of an arithmetic frequency offset which is added to the frequency axis labelling. The range for the offset is –100 GHz to 100 GHz. The default setting is 0 Hz.

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

Span settings – *SPAN* key

The *SPAN* key is disabled for measurements in the code domain analyzer. For all other measurements (refer to the *MEAS* key), the permissible span settings are explained for the measurement concerned. The associated menu corresponds to that of the measurement in the basic device and is described in the manual for the basic device.

Level settings – AMPT key



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

The *REF LEVEL* softkey enables entry of the reference level. The entry is performed in dBm.

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

ADJUST REF LEVEL executes a routine for optimum adaptation of the reference level to the signal.

IEC/IEEE bus command:
:[SENS<1|2>:]CDP:LEV:ADJ

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

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

Y PER DIV sets the grid spacing on the y axis for all diagrams in which this is possible.

IEC/IEEE bus command:
:DISP [:WIND<1|2>]:TRAC<1..3>:Y[:SCAL]:PDIV

REF VALUE POSITION supports entry of the position of the y-axis reference value on the axis (0 to 100%).

IEC/IEEE bus command:
:DISP [:WIND<1|2>]:TRAC<1..3>:Y[:SCAL]:RPOS

The *RF ATTEN MANUAL* softkey enables entry of the attenuation, irrespective of the reference level. If the required reference level can no longer be set for the given RF attenuation, it will be adjusted and the message "Limit reached" will be issued.

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

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

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

The *EL ATTEN MANUAL* softkey enables the electronic step attenuator enables entry of the attenuation, which is set on the electronic step attenuator.

The attenuation can be modified in steps of 5 dB between 0 and 30 dB. Other entries will be rounded down to the next lower integer value.

```
IEC/IEEE bus command: :INP:EATT:AUTO OFF;  
                       INP:EATT 10 DB
```

The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

The *EL ATTEN AUTO* softkey enables the electronic step attenuator and sets its attenuation to 0 dB.

The permissible range of the reference level extends from the current reference level on enabling the electronic step attenuator to 30 dB beyond that value. If a reference level outside the permissible 30 dB range is set, the setting is performed with the mechanical step attenuator. Starting from this new reference level up to 30 dB above it, the setting is again performed with this electronic step attenuator.

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

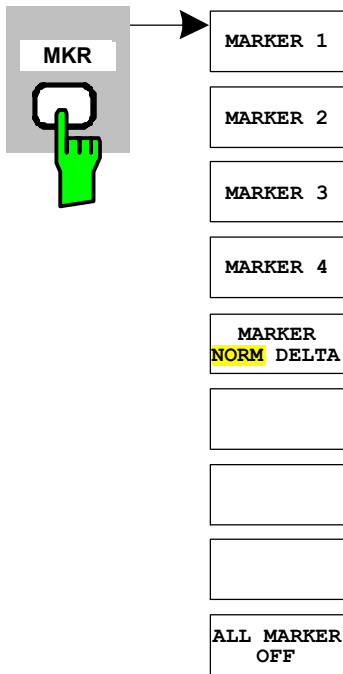
The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

The *EL ATTEN OFF*

```
IEC/IEEE bus command:INP:EATT:STAT OFF
```

The softkey is only available with the *ELECTRONIC ATTENUATOR* R&S FSP-B25, R&S FSU-B25 and R&S FSQ-B25 option.

Marker settings – MKR key



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

Markers are not available for the *GENERAL RESULTS*, *CHANNEL RESULTS* and *CHANNEL TABLE* analyses. Up to four markers can be enabled in all other analyses and defined as marker or delta marker with the help of the *MARKER NORM/DELTA* softkey.

The *MARKER 1/2/3/4* softkeys select the marker concerned and enable it simultaneously.

Marker 1 is always the normal marker after it has been enabled, while markers 2 to 4 are delta referring to marker 1 after they have been enabled. The *MARKER NORM DELTA* softkey can be used to transform these markers into markers with absolute measure value display. If marker 1 is the active marker, *MARKER NORM DELTA* is enabled as an additional delta marker.

Pressing the *MARKER 1* to *MARKER 4* softkeys disables the selected marker.

```
IEC/IEEE bus command: :CALC:MARK ON;
                        :CALC:MARK:X <value>;
                        :CALC:MARK:Y?
                        :CALC:DELT ON;
                        :CALC:DELT:MODE ABS|REL
                        :CALC:DELT:X <value>;
                        :CALC:DELT:X:REL?
                        :CALC:DELT:Y?
```

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

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

The parameters relating to an enabled marker are read out above the diagrams:

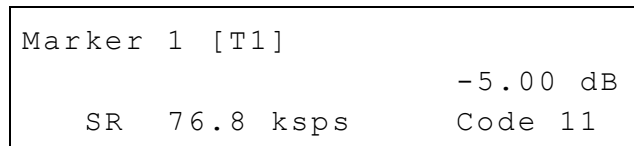


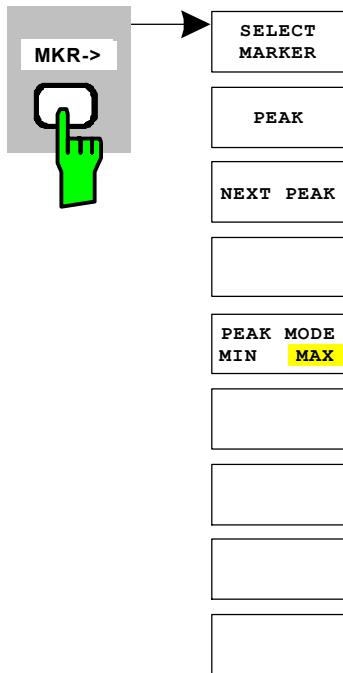
Fig. 6–32 Diagram marker field

Apart from the channel power, which is displayed relative to the total power in the channel type, the parameters of the channel are specified. The meanings are as follows (for the channel assigned to the marker):

- SR 76.8 ksps: Symbol rate of the channel
- Code 11: Walsh code number of the channel

For all other measurements not belonging to the code domain analyzer the marker functions of the basic device apply.

Changing instrument settings – MKR→ key



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

The *SELECT MARKER* softkey selects the desired marker in a data input field. If the marker is disabled, it is enabled and can then be moved. You enter a number. Delta marker 1 is selected by entering '0'.

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

The *PEAK* softkey sets the active marker or delta marker to the maximum/minimum of the associated trace.

If no marker had been active before the *MKR*→ menu was opened, marker 1 is automatically enabled and the Peak function is executed.

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

The *NEXT PEAK* softkey sets the active marker or delta marker to the next lower maximum/minimum value of the associated trace. The search direction is specified by the setting in the *NEXT MODE LEFT/RIGHT* submenu.

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

The *PEAK MODE MIN/MAX* softkey sets whether the peak search should determine the maximum or minimum value of the trace. The parameter affects the behavior of the *PEAK* and *NEXT PEAK* softkeys.

IEC/IEEE bus command:--

IEC/IEEE bus command: :CALC<1|2>:MARK<1>:Y?

Marker functions – MKR FCTN key

The *MKR FCTN* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K84, the softkeys are described in the manual for the basic device.

Bandwidth setting – BW key

The *BW* key is disabled for all measurements of the code domain analyzer. For all other measurements of the R&S FS-K84, the softkeys associated with the menu are described in the manual for the basic device.

Measurement control – SWEEP key

The menu of the *SWEEP* key contains options for switching between single measurement and continuous measurement, and also control of single measurements. For measurements in the spectral range, the measurement time for a sweep and the number of sweep points can also be set. All the softkeys associated with the menu are described in the manual for the basic device.

Measurement selection – MEAS key

The menu of the *MEAS* key contains all the measurements that can be selected on the R&S FS-K84 by pressing a key. The menu and its submenus are described in Chapter 6.

Trigger settings – TRIG key

The selectable trigger options depend on the measurement selected. For the code domain power analyzer, a free-run mode and a mode with the external even second clock trigger called for by the 1xEV-DO Standard are possible. The trigger options for all other measurements are identical to those of the corresponding measurement in the basic device. The associated softkeys are described in the manual for the basic device.

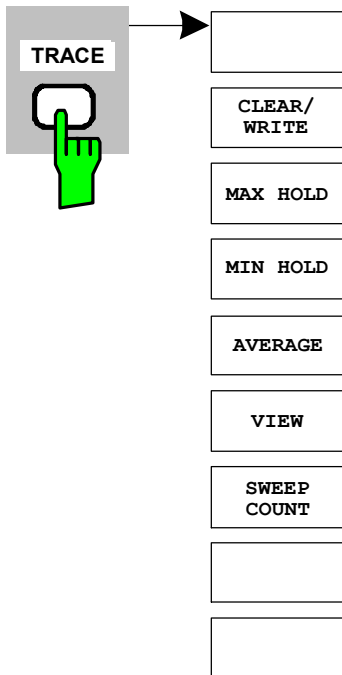
The *GATED TRIGGER* can be used with *POWER*, *ADJACENT CHANNEL LEAKAGE RATION*, *SPECTRUM EMISSION MASK* and *OCCUPIED BANDWIDTH* measurements to measure idle slots as well (only *PILOT* and *MAC* channel types active). To do this, set the power range with *GATE DELAY* and *GATE LENGTH* after selecting a trigger source in the *GATED TRIGGER SETTINGS* and then connect the *GATED TRIGGER* on the Trigger menu.



With the softkey *EXTERN* the external trigger source can be selected. From firmware V2.60/3.60 on also the external trigger level can be adjusted in the range from 0.5V to 3.5V. The default value is 1.4V.

```
IEC-Bus-command: :TRIG [:SEQ]:LEV[:EXT]  
                  <numeric_value>
```


Trace settings – TRACE key



The *TRACE* key opens the following submenu:

The *CLEAR/WRITE* softkey enables Overwrite mode for the acquired measured values, i.e. the trace is rewritten for each sweep. After the *CLEAR/WRITE* softkey has been operated, the device deletes the selected trace memory and restarts the measurement.

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

The *MAX HOLD* softkey activates the peak value detector. The analyzer only accepts the new measured value into the saved trace data if it is larger than the previous one.

Pressing the *MAX HOLD* softkey a second time deletes the trace memory and starts peak value detection from the beginning again.

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

The *MIN HOLD* softkey activates the minimum value detector. The analyzer only accepts the new measured value into the saved trace data if it is smaller than the previous one.

Pressing the *MIN HOLD* softkey a second time deletes the trace memory and starts minimum peak detection from the beginning again.

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

The *AVERAGE* softkey enables the trace averaging function. The average is formed from several sweeps. Averaging is performed irrespective of the AVG MODE LOG / LIN setting on the logarithmic level values or on the measured power/voltage values. Averaging is restarted every time the *AVERAGE* softkey is pressed. The trace memory is always cleared.

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

For the measurements in the code domain analyzer, an *AVERAGE/ MAX HOLD* or *MIN HOLD* is possible.

With the Channel Occupancy Table analysis, the channel configuration measured on the first sweep is retained for the trace statistics.

If the signal is reconfigured, the *SINGLE SWEEP* softkey (and *CONTINUOUS SWEEP* if necessary) must be pressed.

The GENERAL RESULT, CHANNEL RESULT, BITSTREAM analyses and the CONSTELLATION diagrams support only CLEAR WRITE mode as a general rule.

The *SWEEP COUNT* softkey sets the number of sweeps over which the average value is formed. The permissible range is 0 to 30000, though the following should be noted:

Sweep Count = 0 means running averaging with averaging length of 10

Sweep Count = 1 means no averaging

Sweep Count > 1 averaging over the specified number of sweeps; in continuous sweep mode averaging changes over to running averaging once this number has been reached.

The default setting is running averaging (Sweep Count = 0). The number of sweeps used for averaging is always equal to the averaging length of 10 for all active traces in the selected diagram.

IEC/IEEE bus command::SWE:COUN 64

Display lines – *LINES* key

The *LINES* key is disabled for all measurements of the code domain analyzer. The menu setting options for all other measurements are equivalent to those of the corresponding measurement in the basic device. The respective softkeys are described in the manual for the basic device.

Measurement screen settings – *DISP* key

The menu of the *DISP* key contains softkeys for configuring the measurement screen. The menus and the softkey properties are described in the manual for the basic device.

Storing and loading of device data – *FILE* key

The *FILE* menu is the same as that of the basic device. All softkeys are described in the manual for the basic device.

Preset of device – *PRESET* key

The *PRESET* key presets the device. The behaviour is the same as of the basic unit and is described in the manual for the basic unit.

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.

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.

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

This chapter describes the remote control commands for the application firmware. An alphabetical list following the description provides a quick overview of the commands.

The commands, which also apply to the basic device in SPECTRUM mode, and the system settings are described in the operating manual for the analyzer.

CALCulate:FEED subsystem

The type of analysis can be selected with the CALCulate:FEED subsystem. This corresponds to the result display selection in manual operation.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1 2> :FEED	<string>		No query

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

This command selects the measured data that will be displayed.

Parameters: <string>::= 'XPOW:CDP' |
 'XPOW:CDP:RAT' |
 'XPOW:CDEP' |
 'XTIM:CDP:MACCuracy' |
 'XTIM:CDP:PVCHip' |
 'XTIM:CDP:PVSYmbol' |
 'XTIM:CDP:BSTReam' |
 'XTIM:CDP:ERR:SUMM' |
 'XTIM:CDP:ERR:CTABLE' |
 'XTIM:CDP:ERR:PCDomain' |
 'XTIM:CDP:SYMB:CONST' |
 'XTIM:CDP:SYMB:EVM' |
 'XTIM:CDP:COMP:CONST'

The meanings of the string parameters are as follows:

'XPOW:CDP'	Result display of the code domain power absolute in the bar chart (CALCulate<1>)
'XPOW:CDP:RAT'	Result display of the code domain power ratio (relative) in the bar chart (CALCulate<1>)
'XPOW:CDEP'	Result display of the code domain error power in the bar chart (CALCulate<1>)
'XTIM:CDP:ERR:SUMM'	Tabular analysis of results (CALCulate2)
'XTIM:CDP:ERR:CTABLE'	Display of the channel occupancy table (CALCulate<1>)
'XTIM:CDP:ERR:PCDomain'	Result display of the peak code domain error (CALCulate2)
'XTIM:CDP:MACCuracy'	Result display of the COMPOSITE EVM (CALCulate2)
'XTIM:CDP:PVCHip'	Result display of power versus chip (CALCulate2)
'XTIM:CDP:PVSYmbol'	Result display of power versus symbol (CALCulate2)
'XTIM:CDP:BSTReam'	Result display of bit stream (CALCulate2)
'XTIM:CDP:SYMB:CONST'	Result display of symbol constellation (CALCulate2)
'XTIM:CDP:SYMB:EVM'	Result display of error vector magnitude (CALCulate2)
'XTIM:CDP:COMP:CONST'	Result display of composite constellation (CALCulate2)

Example:	"INST:SEL BDO"	'Activate 1xEV-DO BTS
	"INIT:CONT OFF"	'Select single sweep
	"CALC2:FEED 'XTIM:CDP:MACC'"	'Select COMP EVM analysis
	"INIT;*WAI"	'Start measurement with sync
	"TRAC? TRACE2"	'Query COMP EVM data

Characteristics: *RST value: 'XPOW:CDP:RAT' (CALCulate<1>)
 'XTIM:CDP:ERR:SUMM'(CALCulate<2>)
 SCPI: conforms

Note: *The code domain power measurements are always shown in split screen mode and the allocation of the analysis to the measurement window is fixed. Therefore, specify for every analysis in brackets the numerical suffix that is necessary or allowed at CALCulate.*

To activate the Overview mode for Code Domain Power and Code Domain Error-Power, you must use the CDP:OVER ON command. If you then switch to an analysis different from these two, (such as the Channel Occupancy table), you leave Overview mode and the analysis you used last on the other screen is restored.

CALCulate:LIMit:SPECtrum subsystem

The CALCulate:LIMit:SPECtrum subsystem defines the limit check for spectral measurements.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1 2> :LIMit<1...8> :ESPectrum :MODE :VALue :RESTore :CHECK :X? :Y? :TRANsition	AUTO MANual USER <numeric_value> <numeric_value>	DBM Hz	No query Query only Query only

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

This command automatically enables and disables automatic selection of the limit line in the spectrum emission mask measurement.

The limit lines normally depend on the selected band class.

(Command CONF:CDP:BCL)

Parameters:

- AUTO The limit line depends on the measured channel power
- MANUAL One of the three default limit lines is set. The selection is made with the command CALC:LIM:ESP:VAL
- USER Query only, user-defined limit lines are enabled (refer to the description of limit lines in the manual for the device)

Example:

```
"INST:SEL BDO" 'Activate 1xEV-DO BTS
"INIT:CONT OFF" 'Select single sweep
"CONF:CDP:BCL 1" 'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP" 'Measure spectrum emission mask
"CALC:LIM:ESP:MODE AUTO" 'Activates automatic selection of
'limit line
"INIT;*WAI" 'Start measurement with sync
"CALC:LIM:FAIL?" 'Query result of the limit check
```

Characteristics:

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

:CALCulate:LIMit:ESpectrum:VALue <numeric_value>

This command switches to manual limit line selection. The limit line is selected by specifying the expected power as a value. One of the four possible limit lines is selected depending on the value entered:

Specified value in dBm	Selected limit line	Value when queried
Value \geq 33	"P \geq 33"	33
$28 \leq$ value < 33	"28 \leq P < 33"	28
Value < 28	"P < 28"	0

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:BCL 1"	'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP"	'Measure spectrum emission mask
"CALC:LIM:ESP:VALue 33"	'Activates manual selection of the 'limit line and selects the one for P \geq 33
"INIT;*WAI"	'Start measurement with sync
"CALC:LIM:FAIL?"	'Query result of the limit check

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

:CALCulate:LIMit:ESpectrum:REStore

This command restores the standard limit lines for the spectrum emission mask measurement. All changes made to the standard limit lines are lost and the state of these limit lines as they left the factory is restored .

Example:

"INST BDO"	'Activate 1xEV-DO BTS
"CALC:LIM:ESP:REST"	'Resets the spectrum emission mask 'limit lines to their default setting

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

This command is an event and therefore has neither a query function nor a *RST value.

:CALCulate:LIMit:ESpectrum:CHECK:X?;Y?

These commands query the worst fail position.

Example:

"INST BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:BCL 1"	'Select band class 1, 1900 MHz
"CONF:CDP:MEAS ESP"	'Select spectrum emission mask 'measurement
"CALC:LIM:ESP:VALue 33"	'Activates manual selection of the 'limit line and selects the one for P \geq 33
"INIT;*WAI"	'Start measurement with 'synchronization
"CALC:LIM:ESP:CHECK:X?;Y?"	'Query result of worst fail position

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

:CALCulate:LIMit:ESpectrum:TRANSition 0..1 GHz

specifies the offset frequency at which the resolution bandwidth is changed between 30k and 1MHz.

Example:	"INST BDO"	'Activate 1xEV-DO BTS
	"INIT:CONT OFF"	'Select single sweep
	"CONF:CDP:BCL 1"	'Select band class 1, 1900 MHz
	"CONF:CDP:MEAS ESP"	'Select spectrum emission mask
		'measurement
	"CALC:LIM:ESP:TRAN 10MHZ"	'Defines the transition frequency to
		'10 MHz
	"INIT;*WAI"	'Start measurement with synchronization
	"CALC:LIM:ESP:CHEC:X?;Y?"	'Query result of worst fail position

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

CALCulate:LIMit:PVTime Subsystem

The CALCulate:LIMit:PVTime subsystem defines the limit check for Power vs. Measurement

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1 2> :LIMit<1...8> :PVTime :REFerence :RVALue :RESTore	AUTO MANual ONCE <numeric_value>	— DBM —	No query

:CALCulate:LIMit:PVTime:REFerence AUTO | MANual | ONCE

The standard asks for the sequence to first measure the FULL slot with the limit line relative to the mean power of the averaged time response. Therefore the parameter AUTO in a FULL slot measurement should be selected. In this mode the mean power is calculated and the limit lines are relative to that mean power value. This value should be used also as the reference for the IDLE slot measurement. With the parameter ONCE the current mean power value of the averaged time response is used to set as the fixedreference value for the limit lines. The mode is switched from AUTO to MANUAL. Now the IDLE slot can be selected and the measurement sequence can be finished.

The manual mode can also be selected via the parameter MANUAL. Then a user defined value can be entered via the command :CALC:LIM:PVT:RVAL <value> in dBm as the reference value for the limits.

Example:

```

"INST:SEL BDO"           'Activate 1xEV-DO BTS
"INIT:CONT OFF"         'Select single sweep
"CONF:CDP:MEAS PVT"     'Measure Power vs Time
"SENS:SWE:COUN 50"      'Only 50 halfslots averaging
"CONF:CDP:RFSL FULL"    'Limit lines for FULL Slot,
                        'use FULL slot signal at input
"CALC:LIM:PVT:REF AUTO" 'Automatic reference value
                        'for limit lines
"INIT:IMM;*WAI"         'Start measurement with sync
"CALC:MARK:FUNC:SUMM:MEAN:RES?"
                        'Read out mean power
"CALCulate1:LIMit1:FAIL?" 'Upper line failed?
"CALCulate1:LIMit2:FAIL?" 'Lower line failed?
"CALC:LIM:PVT:REF ONCE" 'Use the FULL slot results as manual
                        'reference value for IDLE slot
                        'measurement
"CONF:CDP:RFSL IDLE"    'Limit lines for FULL Slot,
                        'use FULL slot signal at input
"INIT:IMM;*WAI"         'Start measurement with sync
"TRACe1? TRACe1"        'Read out 512 points
"CALCulate1:LIMit1:FAIL?" 'Upper line failed?
"CALCulate1:LIMit2:FAIL?" 'Lower line failed?
"TRACe1? TRACe1"        'Read out 512 points
"CALC:LIM:PVT:RVAL?"    'Read out reference value
                        '(in this example identical to
                        'the mean power)
"CALC:LIM:PVT:RVAL -33.5" 'Define a new reference value
    
```

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

:CALCulate:LIMit:PVT:RVALue <numeric_value>

With this command the reference level in dBm for calculating the limit lines can be set. Precondition is that the automatic mode of power calculation is switched off via the commands

:CALC:LIM:PVT:REF ONCE or CALC:LIM:PVT:REF:MAN.

Example: See example of command :CALC:LIM:PVT:REF

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

:CALCulate:LIMit:PVT:RESTore

This command restores the standard limit lines for the power versus time measurement. All changes made to the standard limit lines are lost and the state of these limit lines as they left the factory is restored .

Example:	":INST BDO"	'Activate 1xEV-DO BTS
	":CALC:LIM:PVT:REST"	'Resets the PVT limit lines to their 'default setting

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

This command is an event and therefore has neither a query function nor a *RST value.

CALCulate:MARKer subsystem

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1 2> :MARKer<1...4> :FUNction :CDPower [:BTS] :RESult?	FERRor RHO FERPpm CERRor TFRame IQOFFset IQIMbalance MACCuracy PCDError SRATe TOFFset CHANnel POFFset SFACTor CDPabsolute CDPRelative EVMRms EVMPeak RHOPilot RHO1 RHO2 PPILot PMAC PDATa PPRamble MACTive DACTive PLENgth MTYPe DMTYPe RHOData RHOMac		Query only

:CALCulate<1|2>:MARKer<1>:FUNction:CDPower[:BTS]:RESult?

RHO | MACCuracy | PCDError | FERRor | FERPpm | CERRor | TFRame | IQOFFset |
IQIMbalance | SRATe | CHANnel | SFACTor | TOFFset | POFFset | CDPabsolute | CDPRelative |
EVMRms | EVMPeak | RHOPilot | RHO1 | RHO2 | PPILot | PMAC | PDATa | PPRamble |
MACTive | DACTive | PLENgth | MTYPe | DMTYPe | RHOData | RHOMac

This command queries the measured and calculated values of the Code Domain Power analysis. The channel type can be set by means of the `CDPower:CTYPe` command, the slot number by means of the `CDPower:SLOT` command and the code number by means of the `CDPower:CODE` command.

Parameters:

Global results for all slots:

FERRor Frequency error in Hz
 FERPpm Frequency error in ppm
 CERRor Chip rate error in ppm
 TFRame Trigger to Frame
 RHOPilot RHO over all slots for the pilot area
 RHO1 RHO_{overall-1} over all slots over all chips with start of averaging
 at the half-slot limit
 RHO2 RHO_{overall-2} over all slots over all chips with start of averaging
 at the quarter-slot limit
 RHOData Read out values from IEC/IEEE bus
 RHOMac Read out values from IEC/IEEE bus

Results for the selected slot:

PPILot Absolute power in the PILOT channel type
 PMAC Absolute power in the MAC channel type
 PDATa Absolute power in the DATA channel type
 PPRamble Absolute power in the PREAMBLE channel type
 MACCuracy Composite EVM in %
 DMTYPe Modulation type of the DATA channel type:
 2 = QPSK
 3 = 8-PSK
 4 = 16-QAM
 MACTive Number of active MAC channels

DACTive	Number of active DATA channels
PLENGth	Length of preamble in chips
RHO	RHO value for the selected channel type/slot

Results for the selected channel type in the selected slot:

PCDError	Peak code domain error in dB
IQIMbalance	IQ imbalance in %
IQOFFset	IQ offset in %

Channel results:

SRATe	Symbol rate in ksps
CHANnel	Channel number
SFACTor	Spreading factor of the channel
TOFFset	Timing offset in s
POFFset	Phase offset in rad
CDPRelative	Channel power, relative, in dB
CDPabsolute	Channel power, absolute, in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector mag. peak in %
MTYPE	Modulation type:
	0 = BPSK-I
	1 = BPSK-Q
	2 = QPSK
	3 = 8-PSK
	4 = 16-QAM
	5 = 2BPSK (if complex analysis selected for PILOT, PREAMBLE or MAC)

Note:

The Trigger to Frame value (TFRame) supplies a '9' if the trigger is at *FREE RUN*.

The Timing/Phase Offset values (TOFFset/POFFset) supply a '9' if timing and phase measurement is disabled (refer to CDP:TPM) or the number of active channels is higher than 50.

Example:	":INST:SEL BDO"	'Activate 1xEV-DO BTS, implicit are 'CDP relative on screen A and 'General results active on screen B
	":INIT:CONT OFF"	'Select single sweep
	":INIT;*WAI"	'Start measurement with sync
	":CALC:MARK:FUNC:CDP:RES? PPIL"	'Read out pilot power
	":CDP:SLOT 2"	'Selects slot 2
	":CDP:CODE 11"	'Select code number 11
	":CALC:MARK:FUNC:CDP:RES? EVMR"	'Read out EVM RMS of the code with 'number 11 in slot 2

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

CALCulate:STATistics subsystem

The CALCulate:STATistics subsystem controls the statistical measurement functions in the device. The measurement functions cannot be selected for these measurement functions. The numerical suffix is ignored accordingly with CALCulate.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate			
:STATistics			
:CCDF			
[:STATe]	<Boolean>		
:APD			
[:STATe]	<Boolean>		
:NSAMples	<numeric_value>		
:SCALe			
:Y			
:UPPer	<numeric_value>		
:LOWer	<numeric_value>		
:RESults?	MEAN PEAK CFACtor ALL		Query only

:CALCulate:STATistics:CCDF[:STATe] ON

This command enables and disables measurement of the complementary cumulated distribution function (CCDF).

Example: ":CALC:STAT:CCDF ON"

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

Hint:

The OFF state is reachable by selecting another measurement with the CONF:CDP:MEAS command.

:CALCulate:STATistics:APD[:STATe] ON

This command enables and disables measurement of the amplitude probability distribution (APD).

Example: ":CALC:STAT:APD ON"

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

Hint:

The OFF state is reachable by selecting another measurement with the CONF:CDP:MEAS command.

:CALCulate:STATistics:NSAMples 100 ... 1E9

This command sets the number of measurement points for the statistical measurement functions.

Example: ":CALC:STAT:NSAM 5000"

Characteristics: *RST value: 100000
 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 plotted on the y axis, the entered numerical values have no units.

Example: ":CALC:STAT:SCAL: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 plotted on the y axis, the entered numerical values have no units.

Example: ":CALC:STAT:SCAL:Y:LOW 0.001"

Characteristics: *RST value: 1E-6
SCPI: device-specific

:CALCulate:STATistics:RESult? MEAN | PEAK | CFACtor | ALL

This command reads out the results of statistical measurements from a recorded trace.

Parameters: The desired result is selected by means of the following parameters:

MEAN Mean (RMS) power measured in the period of analysis in dBm

PEAK Peak power in dBm measured in the period of analysis

CFACtor Determined CREST factor (i.e. ratio of peak power to mean power) in dB

ALL Results of all three named measurements, separated by a comma:

<mean power>,<peak power>,<crest factor>

Example: ":CALC:STAT:RES? ALL" 'Reads out all three measurement results.

Example of reply string:

5.56,19.25,13.69

i.e. Mean power: 5.56 dBm,

Peak power 19.25 dBm,

CREST factor 13.69 dB

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

Operating mode: A

CALCulate:PEAKsearch subsystem

This command, activates a single evaluation of spectrum emission mask. The limit mask is checked against the trace. It is recommended to use single sweep.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1 2> :PEAKsearch :MARGin :SUBRanges	<numeric_value> <numeric_value>	dB --	

:CALCulate:PEAKsearch :SUBRanges 1 .. 50

This command defines how many peaks are searched for within one range.

Example: ":CALC:PEAK:SUBR 25"

Characteristics: *RST value: 25
 SCPI: device-specific

:CALCulate:PEAKsearch :MARGin

This command defines an overall margin which is subtracted from the limit line to make the peak search more stronger.

Example: ":CALC:PEAK:MARG 100dB"

Characteristics: *RST value: 6dB
 SCPI: device-specific

CONFigure:CDPower subsystem

This subsystem contains the commands for the selection and configuration of measurement in the 1xEV-DO BTS application firmware. The numerical suffix 1 is allowed with CONFigure. You will find more examples of the Code Domain Power analysis under the:[SENSe]:CDPower command. Further settings for the spectrum emission mask measurement can be found under the CALCulate:LIMit:ESpectrum command.

COMMAND	PARAMETER	UNIT	COMMENT
CONFigure			
:CDPower			
[:BTS]			FS-K84 option
:MEASurement	POWer ACLR MCAClr ESPectrum OBANdwidth OBWidth CDPower CCDF PVTime		
:CTABLE			
[:STATe]	<Boolean>		
:SElect	<file_name>		
:NAME	<file_name>		
:DATA	<numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>		
	...		
:COMment	<string>		
:COpy	<file_name>		
:DElete			
:CATalog?			
:REStore			
:BClass	<numeric_value>		
:RFSLot	FULL IDLE		
:PVTime			
:BURSt	ON OFF		
:MCARier			
[:STATe]	<Boolean>		
:FILTer			
[:STATe]	<Boolean>		
:COFREquency	<numeric_value>	Hz	
:ROFF	<numeric_value>		
:TYPE	LPASs RRC		
:MALGo	<Boolean>		
:REVision	0 A		

CONFigure<1>:CDPower[:BTS]:MEASurement POWer | ACLR | ESPectrum | OBANdwith | OBWidth | CDPower | CCDF

This command selects the measurement of Application FS-K84, 1xEV-DO base station tests. The predefined settings of the different measurements are described at length in Chapter 6.

Parameters:

POWER	Power channel measurement (Standard 1xEV-DO Forward) with predefined settings
ACLR	Adjacent channel power measurements (Standard 1xEV-DO forward) with predefined settings
ESPectrum	Check on signal power (Spectrum Emission Mask)
OBANdwith OBWidth	Measurement of occupied bandwidth
CDPower	Code domain analyzer measurement.
CCDF	Measurement of the Complementary Cumulative Distribution function (signal statistics measurement)
PVTime	Measurement or power versus time, here trace readout delivers 512 points

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:MEAS POW"	'Select Channel Power measurement
"INIT;*WAI"	'Start measurement with sync

Feature:

*RST value:	CDPower
SCPI:	device-specific

:CONFigure<1>:CDPower[:BTS]:CTABLE[:STATe] ON | OFF

This command enables and disables the channel table. Enable results in the measured channel table being saved as "RECENT" and enabled. After the channel table called "RECENT" has been enabled, another channel table can be selected with the `CONF:CDP:CTAB:SElect` command

Note: Always use the `CONF:CDP:CTAB:STAT` command to enable the "RECENT" channel table and then the `CONF:CDP:CTAB:SElect` command to select the required channel table.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS, implicit are
	'CDP Relative active on screen A and
	'General Results on Screen B
"INIT:CONT OFF"	'Select single sweep
"INIT;*WAI"	'Start measurement with sync
	'so that channel table can be
	'enabled
"CONF:CDP:CTAB ON"	'Use predefined channel table
"CONF:CDP:CTAB:SEL 'CTAB_1'"	'Select channel table
"INIT;*WAI"	'Start measurement with sync

Example:

*RST value:	OFF
SCPI:	device-specific

:CONFigure<1>:CDPower[:BTS]:CTABLE:SElect <string>

This command selects a predefined channel table file. Before this command, you must first enable the "RECENT" channel table with the `CONF:CDP:CTAB ON` command.

Example:

<code>"INST:SEL BDO"</code>	'Activate 1xEV-DO BTS, implicit are 'CDP Relative active on screen A and 'General Results on Screen B
<code>"INIT:CONT OFF"</code>	'Select single sweep
<code>"INIT;*WAI"</code>	'Start measurement with sync 'so that channel table can be 'enabled
<code>"CONF:CDP:CTAB ON"</code>	'Use predefined channel table
<code>"CONF:CDP:CTAB:SEL 'CTAB_1'"</code>	'Select channel table
<code>"INIT;*WAI"</code>	'Start measurement with sync

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

:CONFigure:CDPower[:BTS]:CTABLE:NAME <file_name>

This command selects a channel table for editing or creating. It is not used for the analysis. In this respect refer to the commands `CONF:CDP:CTAB:STAT` and `CONF:CDP:CTAB:SEL`.

Example:

<code>"INST:SEL BDO"</code>	'Activate 1xEV-DO BTS
<code>"CONF:CDP:CTAB:NAME 'NEW_TAB'"</code>	'Select table for processing

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

:CONFigure:CDPower[:BTS]:CTABLE:DATA 0..7, 4..6, 0..63, 0..4, 0, 0, 0 | 1, <numeric_value>...

This command defines a channel table. The whole table is defined in one go. The inactive channels (INACTIVE) do not have to be defined. Eight values are specified for a line of table.

<Channel type>, <Code class>, <Code number>, <Modulation>, <Reserved1>, <Reserved2>, <Status>, <CDP Relative [dB]>, etc.

- Channel type: The channel type is numerically coded as follows:
 - 0 = PILOT
 - 1 = MAC
 - 2 = PREAMBLE with 64 chip length
 - 3 = PREAMBLE with 128 chip length
 - 4 = PREAMBLE with 256 chip length
 - 5 = PREAMBLE with 512 chip length
 - 6 = PREAMBLE with 1024 chip length
 - 7 = DATA
- Code class: Depending on channel type, fixed: PILOT: 5, MAC: 6, PREAMBLE: 5 and DATA: 4 (spreading factor = 2^code class)
- Code number: 0...spreading factor-1
- Modulation: Modulation type including mapping:
 - 0 = BPSK-I
 - 1 = BPSK-Q
 - 2 = QPSK
 - 3 = 8-PSK
 - 4 = 16-QAM
- Reserved1: Always 0 (reserved)
- Reserved2: Always 0 (reserved)
- Status: 0: inactive, 1:active
Can be used in a setting command to disable a channel temporarily
- CDP relative: Any with setting command, relative with CDP query

Before using this command, you must set the name of the channel table using the **CONF:CDP:CTAB:NAME** command.

Example:

```
"INST:SEL BDO" 'Activate 1xEV-DO BTS'
"CONF:CDP:CTAB:NAME 'NEW_TAB'" 'Select table for processing'
"CONF:CDP:CTAB:DATA 0,5,0,0,0,0,0,1,0.0,
1,6,35,1,0,0,1,0.0"
'Selects PILOT 0.32 BPSK-I and
'MAC 35.64 BPSK-Q..
```

Characteristics:

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

:CONFigure:CDPower[:BTS]:CTABLE:COMMeNt <string>

This command defines a comment on the selected channel table.

Before using this command, you must set the name of the channel table using the `CONF:CDP:CTAB:NAME` command and enter a valid channel table by means of `CONF:CDP:CTAB:DATA`.

Example:

```
"INST:SEL BDO"           'Activate 1xEV-DO BTS
"CONF:CDP:CTAB:NAME 'NEW_TAB'" 'Select table for processing
"CONF:CDP:CTAB:COMM 'Comment for NEW_TAB'"
```

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

:CONFigure:CDPower[:BTS]:CTABLE:COpy <file_name>

This command copies one channel table to another. You select the channel table you want to copy by means of the `CONF:CDP:CTAB:NAME` command.

Parameters: <file_name> ::= name of the new channel table

Example:

```
"INST:SEL BDO"           'Activate 1xEV-DO BTS
"CONF:CDP:CTAB:NAME 'CTAB_1'" 'Select table for processing
"CONF:CDP:CTAB:COpy 'CTAB_2'" 'Copies CTAB_1 to C_TAB2
```

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

The name of the channel table may contain up to 8 characters. This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:CTABLE:DELeTe

This command deletes the selected channel table. You select the channel table you want to delete by means of the `CONF:C2KP:CTAB:NAME` command.

Example:

```
"INST:SEL BDO"           'Activate 1xEV-DO BTS
"CONF:CDP:CTAB:NAME 'CTAB_2TAB'" 'Select table for processing
"CONF:CDP:CTAB:DEL"       'Deletes CTAB_2
```

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

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:CTABLE:CATalog?

This command retrieves the names of all the channel tables for 1xEV-DO BTS stored on the hard disk.

The syntax of this output format is as follows:

<Sum of file sizes of all subsequent files>,<spare storage space on fixed disk>,
<1st file name>,<1st file size>,<2nd file name>,,<2nd file size>,,...,<nth file name>,,
<nth file size>,,

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS
 "CONF:CDP:CTAB:CAT?" 'Query catalog

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

:CONFigure:CDPower[:BTS]:CTABLE:RESTore

This command restores the supplied channel table. Any channel tables delivered with the instrument modified by the customer are thus returned to their initial state.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS
 "CONF:CDP:CTAB:REST" 'Restore table

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

This command is an "event" and therefore has neither a *RST value nor a query function.

:CONFigure:CDPower[:BTS]:BCLass 0...15

This command selects the band class.

Band class	Name
0	800 MHz band
1	1900 MHz band
2	TACS band
3	JTACS band
4	Korean PCS band
5	450 MHz band
6	2 GHz band
7	700 MHz band
8	1800 MHz band
9	900 MHz band
10	Secondary 800 MHz band
11	400 MHz European PAMR band
12	800 MHz PAMR band
14	US PCS 1.9GHz Band
15	AWS Band

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS
 "INIT:CONT OFF" 'Select single sweep
 "CONF:CDP:BCL 1" 'Select Band Class 1, 1900 MHz

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

:CONFigure:CDPower[:BTS]:RFSLot FULL | IDLE

This command defines the expected signal: FULL slot or IDLE slot. Accordingly the limit lines and the borders for calculating the mean power are set. The lower and upper limit line are called DOPVTFL/DOPVTFU for FULL and DOPVTIL/DOPVTIU for IDLE mode. It is possible to change these lines with the standard limit line editor.

Beispiel:	"INST:SEL BDO"	'Activate 1xEV-DO BTS
	"INIT:CONT OFF"	'Select single sweep
	"CONF:CDP:MEAS PVT"	'Select power vs time
	"SENS:SWE:COUN 50"	'50 half slots averaging
	"CONF:CDP:RFSL FULL"	'Use limit line for FULL slot
		'Connect FULL slot signal
	"CALC:LIM:PVT:REF AUTO"	'Automatic reference value
		'for limit lines
	"INIT:IMM;*WAI"	'Start measurement with sync
	"CALC:MARK:FUNC:SUMM:MEAN:RES?"	
		'Read out mean level
	"CALCulate1:LIMit1:FAIL?"	'Upper line failed?
	"CALCulate1:LIMit2:FAIL?"	'Lower line failed?
	"CALC:LIM:PVT:REF ONCE"	'Take over FULL slot result as manual
		'value for IDLE measurement
	"CONF:CDP:RFSL IDLE"	'Use limit line for IDLE slot
		'Connect IDLE slot signal
	"INIT:IMM;*WAI"	'Start measurement with sync
	"CALC:LIMit1:FAIL?"	'Upper line failed?
	"CALC:LIMit2:FAIL?"	'Lower line failed?

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

:CONFigure:CDPower[:BTS]:PVTimer:BURSt ON | OFF

This command activates an automatic burst alignment to the center of the diagram.

Example: "CONF:CDP:PVT:BURS ON" 'Activates the automatic alignment

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

:CONFigure:CDPower[:BTS]:PVTimer:FREStart ON | OFF

If switched on, this command evaluates the limit line over all results at the end of a single sweep. The sweep is restarted if this result is FAILED.

Example: "CONF:CDP:PVT:FRES ON" 'Restarts a single sweep if the result evaluation is failed.

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

:CONFigure:CDPower[:BTS]:PVTimer:LIST[:STATe] ON | OFF

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

Example: "CONF:CDP:PVT:LIST[:STATe] ON"

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

:CONFigure:CDPower[:BTS]:PVTimer:LIST:RESult

With this command the list evaluation results are queried in a defined order.

Example: "CONF:CDP:PVT:LIST:RES"

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

:CONFigure:CDPower[:BTS]:MCARier[:STATe] ON | OFF

This command defines whether the multi carrier mode is ON or OFF.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS
"INIT:CONT OFF" 'Select single sweep
"CONF:CDP:MCAR ON" 'Switch on the multi carrier mode

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

:CONFigure:CDPower[:BTS]:MCARier:FILTer[:STATe] ON | OFF

This command defines in multi carrier mode whether the additional multi carrier filter is used (ON) or not (OFF). If the multi carrier mode is activated the additional multi carrier filter is switched on.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS
"INIT:CONT OFF" 'Select single sweep
"CONF:CDP:MCAR ON" 'Switch on the multi carrier mode
"CONF:CDP:MCAR:FILT OFF" 'Switch off the MC filter

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

:CONFigure:CDPower[:BTS]:MCARier:FILTer:COFRequency <numeric_value>

This command defines in multi carrier mode with the multi carrier filter on the value of the cut off frequency of the RRC filter.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:MCAR ON"	'Switch on the multi carrier mode
"CONF:CDP:MCAR:FILT ON"	'Switch on the MC filter
"CONF:CDP:MCAR:FILT:TYPE RRC"	'Select RRC MC filter
"CONF:CDP:MCAR:FILT:COFR 1.2MHz"	'Select 1.2 MHz cut off frequency

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

:CONFigure:CDPower[:BTS]:MCARier:FILTer:TYPE LPASs | RRC

This command defines in multi carrier mode with the multi carrier filter on the type of the filter. By default a fix low pass filter is used. It is also possible to choose a definable RRC filter.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:MCAR ON"	'Switch on the multi carrier mode
"CONF:CDP:MCAR:FILT ON"	'Switch on the MC filter
"CONF:CDP:MCAR:FILT:TYPE RRC"	'Select RRC MC filter
"CONF:CDP:MCAR:FILT:ROFF 0.03"	'Defines 0.03 as roll off

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

:CONFigure:CDPower[:BTS]:MCARier:MALGo ON | OFF

This command defines in multi carrier mode whether the enhanced multi carrier algorithm is used (ON) or not (OFF). If the multi carrier mode is activated the enhanced algorithm is switched on.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS
"INIT:CONT OFF"	'Select single sweep
"CONF:CDP:MCAR ON"	'Switch on the multi carrier mode
"CONF:CDP:MCAR:MALgo OFF"	'Switch off the enhanced multi carrier algorithm

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

:CONFigure:CDPower[:BTS]:REVision 0 | A

With this command whether a revision 0 (subtype 0/1) signal or a revision A (subtype 2) signal is analyzed.

Example: "CONF:CDP:REV 0" 'revision 0 signal is analyzed

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

INSTrument subsystem

The INSTrument subsystem selects the operating mode of the device either by means of text parameters or by means of permanently assigned numbers.

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument [:SElect] :NSElect	SANalyzer BC2K BDO <numeric_value>		

:INSTrument[:SElect] SANalyzer | BC2K | BDO

This command switches from one operating mode to another by means of text parameters.

Selecting 1xEV-DO BTS (BDO = base station 1xEV-DO) sets the device to a defined state. The preset values are described in Chapter 2, in the section entitled "Default settings in".

Example: "INST BDO" 'Activate 1xEV-DO BTS

Characteristics: *RST value: SANalyzer
SCPI: Conforms

Switching to BC2K presupposes the option CDMA2000 FWD (BTS) R&S FS-K82.

Switching to BDO presupposes the option 1xEV-DO FWD (BTS) R&S FS-K84.

:INSTrument:NSElect 1 | 10 | 14

This command switches from one operating mode to another by means of numbers.

Parameters: 1: Spectral analysis mode
10: CDMA2000 FWD (BTS) mode
14: 1xEV-DO FWD (BTS) mode

Example: "INST:NSEL 14" 'Activate 1xEV-DO BTS.

Characteristics: *RST value: 1
SCPI: Conforms

Switching to 10 presupposes the option cdma2000 FWD (BTS) R&S FS-K82.

Switching to 14 presupposes the option 1xEV-DO FWD (BTS) R&S FS-K84.

SENSe:CDPower subsystem

This subsystem sets the parameters for the code domain measurements mode. The numerical suffix for SENSe<1|2> is meaningless for this subsystem.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe<1 2>] :CDPower			
:ICTReshold	<numeric_value>	DB	
:SBANd	NORMal INVerse		
:LEVel			
:ADJust			
:CODE	<numeric_value>	—	
:SLOT	<numeric_value>	—	
:MMODE	AUTO IOQ COMPLex	—	
:MAPPING	I Q	—	
:NORMalize	<Boolean>	—	
:QINVert	<Boolean>	—	
:PNOffset	<numeric_value>	—	
:IQLength	<numeric_value>	—	
:TPMeas	<Boolean>	—	
:CTYPe	PILot MAC PREamble DATA	—	
:OVERview	<Boolean>	—	
:AVERage	<Boolean>	—	
:SET			
:COUNT	<numeric_value>	—	
[:VALue]	<numeric_value>	—	

:[SENSe:]CDPower:ICTReshold -100 dB ...0 dB

This command sets the threshold value from which a channel is regarded as active. The level refers to the signal total power.

Example:

```
"INST:SEL BDO" 'Activate 1xEV-DO BTS, implicit are
'CDP Relative active on screen A and
'General Results on screen B
"INIT:CONT OFF" 'Select single sweep
"CDP:ICTR -10DB" 'Threshold value to -10dB
"INIT;*WAI" 'Start measurement with sync
```

Characteristics: *RST value: -40 dB
SCPI: device-specific

:[SENSe:]CDPower:SBANd NORMal | INVers

This command is used to swap the left and right sideband.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS, implicit are
	'CDP Relative active on screen A and
	'General Results on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:SBAN INV"	'Swap sidebands
"INIT;*WAI"	'Start measurement with sync

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

:[SENSe:]CDPower:LEVel:ADJust

This command initiates automatic setting of the RF attenuation and IF gain to the level of the applied signal. The device is placed in the *ATTEN MANUAL* mode to set RF attenuation and IF gain independently of each other to optimum values. This mode is retained even after the mode has changed from 1xEV-DO BTS to SPECTRUM.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS, implicit are
	'CDP Relative active on screen A and
	'General Results on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:LEV:ADJ"	'Start automatic level setting
"INIT;*WAI"	'Start measurement with sync

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

This command is an "event" and therefore has neither a *RST value nor a query function.

:[SENSe:]CDPower:CODE <numeric value>

This command selects the code number. The maximum value depends on the spreading factor of the channel type. PILOT/PREAMBLE: 0..31, DATA: 0..15, MAC: 0..63.

Example:

"INST:SEL BDO"	'Activate 1xEV-DO BTS, implicit are
	'CDP Relative active on screen A and
	'General Results on screen B
"INIT:CONT OFF"	'Select single sweep
"CDP:CODE 11"	'Select code number 11
"INIT;*WAI"	'Start measurement with sync

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

:[SENSe:]CDPower:SLOT 0 ...IQLength-1

This command selects the slot.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:SLOT 2" "INIT;*WAI"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP Relative active on screen A and 'General Results on screen B 'Select single sweep 'Selects slot 2 'Start measurement with sync</pre>
Characteristics:	<pre>*RST value: 0 SCPI: device-specific</pre>	

:[SENSe:]CDPower:MMODE AUTO | IOQ | COMPlEx

This command defines the mapping mode. With AUTO, internal working takes place in "Complex" mapping mode for the DATA channel type and "I or Q" for the PILOT, MAC and PREAMBLE channel types. With this command, each mapping mode can be determined personally for all channel types, or it is possible to return to AUTO.

Example:	<pre>"INST:SEL BDO" 'branch are "INIT:CONT OFF" "CDP:MMODE COMP" "INIT;*WAI"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'The PILOT channel type and the I 'selected 'Select single sweep 'The pilot channel type is analyzed 'Complex 'Start measurement with sync</pre>
Characteristics:	<pre>*RST value: AUTO SCPI: device-specific</pre>	

:[SENSe:]CDPower:MAPPING I | Q

This command selects, when the mapping mode is not Complex, whether the I or Q branch should be analyzed.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:MAPP Q" "INIT;*WAI"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'The PILOT channel type, mapping 'mode IORQ and the I branch are 'selected 'Select single sweep 'Selects the Q branch 'Start measurement with sync</pre>
Characteristics:	<pre>*RST value: I SCPI: device-specific</pre>	

:[SENSe:]CDPower:NORMalize ON | OFF

This command enables and disables elimination of the IQ offset.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS, implicit are
 "INIT:CONT OFF" 'CDP Relative active on screen A and
 "CDP:NORM OFF" 'General Results on screen B
 "INIT;*WAI" 'Select single sweep
 'Elimination of IQ Offset off
 'Start measurement with sync

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

:[SENSe:]CDPower:QINVert ON | OFF

This command inserts the sign of the signal Q component.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS, implicit are
 "INIT:CONT OFF" 'CDP Relative active on screen A and
 "CDP:QINV ON" 'General Results on screen B
 "INIT;*WAI" 'Select single sweep
 'Enable Invert Q component
 'Start measurement with sync

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

:[SENSe:]CDPower:PNOffset 0..511

This command sets the PN offset of the base station in multiples of 64 chips.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS, implicit are
 "INIT:CONT OFF" 'CDP Relative active on screen A and
 "CDP:PNOF 45" 'General Results on screen B
 "INIT;*WAI" 'Select single sweep
 'Set PN Offset
 'Start measurement with sync

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

:[SENSe:]CDPower:IQLength R&S FSU/R&S FSQ: 2..36, R&S FSP: 2..12

This command sets the capture length (IQ Capture Length) in multiples of the slot. The range is between 2 and 36 for the Analyzer R&S FSU/R&S FSQ and from 2 to 12 for the Analyzer R&S FSP.

Example: "INST:SEL BDO" 'Activate 1xEV-DO BTS, implicit are
 "INIT:CONT OFF" 'CDP Relative active on screen A and
 "CDP:IQL 8" 'General Results on screen B
 "INIT;*WAI" 'Select single sweep
 '8 slots capture length
 'Start measurement with sync

Characteristics: *RST value: 3
 SCPI: device-specific

:[SENSe:]CDPower:TPMeas ON | OFF

This command supports the specific enabling and disabling of the timing and phase offset analysis of the channels for the first active channel in the channel type. If the value is OFF or if more than 50 channels are active, the command `TRACe? TRACe1` and `CALC:MARK:FUNC:CDP:RES?` returns a value of '9' for the timing and phase offset as the result. If the value is ON, the timing and phase offsets are calculated and returned.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:TPM ON" "INIT;*WAI" "CDP:SLOT 2" "CDP:CODE 11" "CALC:MARK:FUNC:CDP:RES? TOFF" "CALC:MARK:FUNC:CDP:RES? POFF"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP Relative active on screen A and 'General Results on screen B 'Select single sweep 'Enable Analyze Timing and Phase 'Offset 'Start measurement with sync 'Selects slot 2 'Select code number 11 'Read out timing offset of the code with 'number 11 in slot 2 'Read out phase offset of code with 'number 11 in slot 2</pre>
-----------------	---	---

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

:[SENSe:]CDPower:CTYPe PILOT | MAC | PREamble | DATA

This command is used to select the channel type. The number of results then changes in most analyses, such as code domain power, symbol EVM, and bit stream, because either a different spreading factor or a different number of symbols is available for the analysis.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:CTYP MAC" "INIT;*WAI"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'The PILOT channel type is selected 'Select single sweep 'MAC channel type is selected 'Start measurement with sync</pre>
-----------------	--	--

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

:[SENSe:]CDPower:OVERview ON | OFF

This command can be precisely enabled by means of ON when either the Code Domain Power or the Code Domain Error Power analysis is active. (Refer to the command `CALC1:FEED`). In Overview mode, the I branch of the signal is normally displayed on screen A and the Q branch of the signal on screen B with the CDP/CDEP. The branches can be read out separately by means of `TRAC:DATA? TRACE1` and `TRAC:DATA? TRACE2`.

The previous analyses become active again when you exit Overview mode.

If an analysis other than Code Domain Power or Code Domain Error Power is selected when Overview mode is active, you exit Overview mode and the previous analysis is reset on the other screen.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "INIT;*WAI" "CDP:OVER ON" "TRAC? TRACE1" "TRAC? TRACE2" "CDP:OVER OFF"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP Relative active on screen A and 'General Results on screen B 'Select single sweep 'Start measurement with sync 'Activate Overview mode 'CDP Relative on screen A I branch 'CDP Relative on screen B Q branch 'Read out CDP Relative of I branch 'Read out CDP Relative of Q branch 'Disable Overview mode: 'CDP Relative active on screen A and 'General Results on screen B</pre>
-----------------	---	--

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

:[SENSe:]CDPower:AVERage ON | OFF

This command can be precisely enabled by means of ON when the Code Domain Power analysis is active. (Refer to the command `CALC1:FEED`). If averaging is active, the CDP is calculated over all slots and displayed as called for by the 1xEV-DO Standard.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "INIT;*WAI" "CDP:AVER ON"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP Relative active on screen A and 'General Results on screen B 'Select single sweep 'Start measurement with sync 'Activate averaging 'CDP Relative over all slots 'active on screen A</pre>
-----------------	---	---

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

:[SENSe:]CDPower:SET:COUNT 1 ... 57

If the SET COUNT is set to 1 (default value), the device behaves as normal and with the command `CDPower:IQLength` (IQ-Capture-Length) the number of slots can be set.

For R&S FSQ the *SET COUNT* can be adjusted in the range of 1...57. Is the *SET COUNT* greater than 1 the IQ-Capture-Length will be implicitly set to 32 Slots and become unavailable. The *SET COUNT* defines then how many SETS of 32 Slots shall be captured consecutively into the IQ RAM of the R&S FSQ.

This command is only available on R&S FSQ.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:SET:COUN 12" "INIT;*WAI" "CDP:SET 2" "TRAC? TRACE1"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP relative on screen A and 'result summary active on screen B 'Select single sweep 'Select 12 Sets of 32 slots on 'R&S FSQ 'Start measurement with 'synchronization 'Select results from SET 2 'Read out CDP</pre>
Characteristics:	<pre>*RST value: 1 SCPI: device-specific</pre>	

:[SENSe:]CDPower:SET[:VALue] 0 ... (SET COUNT-1)

With this command the SET is selected for which the results are evaluated. Beforehand with `CDP:SET:COUN` a *SET COUNT* value greater than 1 must be set.

This command is only available on R&S FSQ.

Example:	<pre>"INST:SEL BDO" "INIT:CONT OFF" "CDP:SET:COUN 12" "INIT;*WAI" "CDP:SET 2" "TRAC? TRACE1"</pre>	<pre>'Activate 1xEV-DO BTS, implicit are 'CDP relative on screen A and 'result summary active on screen B 'Select single sweep 'Select 12 Sets of 32 Slots on 'R&S FSQ 'Start measurement with 'synchronization 'Select results from SET 2 'Read out CDP</pre>
Characteristics:	<pre>*RST value: 0 SCPI: device-specific</pre>	

MMEMory subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings. The various drives can be addressed via the "mass storage unit specifier" <msus> using the conventional DOS syntax. The internal hard disk is addressed by "D:", the floppy disk drive by "A:".

COMMAND	PARAMETER	UNIT	COMMENT
MMEMory :STORe :FINal	<file name>		

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

With this command the peak list is exported to a file in ASCII format.

Example: "MMEM:STOR:FIN 'A:\final.dat' "

Characteristics: *RST value:
SCPI: device-specific

TRACe subsystem

:TRACe[:DATA] TRACE1 | TRACE2

The command transfers trace data from the controller to the device, and the query command reads trace data from the device

TRACE1, TRACE2 can be read out, depending on the display.

The trace data (TRACE1 | TRACE2) are formatted for the different displays as shown in the following. The number of values refers to the table below:

Channel type	Spreading factor		Symbol rate	Modulation type	Chips per slot	Symbols per slot and code	Bits per slot and code		
							Mapping I or Q	Mapping complex	
PILOT	32		38.4 ksps	BPSK-I or BPSK-Q	96*2 = 192	6	6	6	12
MAC	Rev. 0	64	19.2 ksps	BPSK-I or BPSK-Q	64*4 = 256	4	4	4	8
	Rev. A	128	9.6 ksps						
PRE-AMBLE	Rev. 0	32	38.4 ksps	BPSK-I or BPSK-Q	Preamble length				
					64:	2	2	4	
					128:	4	4	8	8
					256:	8	8	16	16
					512:	16	16	32	32
					1024:	32	32	64	64
	Rev. A	64	19.2 ksps	BPSK-I or BPSK-Q	64:	1	1	2	2
					128:	2	2	4	4
					256:	4	4	8	8
					512:	8	8	16	16
					1024:	16	16	32	32
DATA	16		76.8 ksps	QPSK, 8-PSK, 16-QAM	400*4- PreambleChips= DataNettoChips	Mapping always complex Modulation type:			
						QPSK	8-PSK	16-QAM	
					1600-0 = 1600	100	200	300	400
					1600-64 = 1536	96	192	288	384
					1600-128 = 1472	92	184	276	368
					1600-256 = 1344	84	168	252	336
					1600-512 = 1088	68	136	204	272
					1600-1024 = 576	36	72	104	144

CODE DOMAIN POWER ABSOLUT/CODE DOMAIN POWER RELATIVE (TRACE1/TRACE2):

The following is output for each channel of the selected channel type:

Code number Code number of the channel, values between 0 to 31/15/63
 depending on the channel type

Level – For CODE DOMAIN POWER ABSOLUTE in unit dBm
 – For CODE DOMAIN POWER RELATIVE in unit dB

Power ID 0 – inactive channel
 1 – active channel

Three values are thus transferred for all channels:

<Code number>, <Level>, <Power ID>, etc.

The number of output codes corresponds to the spreading factor, which depends on the channel type: PILOT/PREAMBLE: 32, DATA: 16, MAC: 64. (See table above.)

Depending on the mapping settings, the I or Q branch or the complex signal is returned. With Code Domain Overview, the I branch in TRACE1 and the Q branch in TRACE2 are always returned.

Example:

The example shows the results of the query for the PILOT channel type, in which only code 0.32 at BPSK-I with 0 dB power is active:

```

"INST:SEL BDO"
"INIT:CONT OFF"
"INIT;*WAI"
"TRAC? TRACE1"
0, 0.0,1, 1,-57.3,0,
2,-54.6,0, 3,-55.3,0,
.... 31,-54.7,0
"CDP:OVER ON"
"TRAC? TRACE1"
0, 0.0,1, 1,-57.3,0,
2,-54.6,0, 3,-55.3,0,
.... 31,-54.7,0
"TRAC? TRACE2"
0,-53.1,0, 1,-54.2,0,
2,-53.3,0, 3,-56.0,0,
.... 31,-52.1,0

```

'Activate 1xEV-DO BTS, implicit are
'CDP Relative active on screen A and
'General Results on screen B
'and PILOT channel type, mapping
'mode
'IORQ and I branch selected
'Select single sweep
'Start measurement with sync
'Read out CDP Relative of the I branch

'Activate Overview mode
'Read out CDP Relative of the I branch
'Same values as above

'Read out CDP Relative of the
'Q branch
'Code 0 has no component at Q!

CODE DOMAIN ERROR POWER (TRACE1/TRACE2):

The following is output for each channel of the selected channel type:

Code number Code number of the channel, values between 0 to 31/15/63
 depending on the channel type

Error power In unit dB

Power ID 0 – inactive channel
 1 – active channel

Three values are thus transferred for all channels: <Code number>, <Level>, <Power ID>, etc.

The number of output codes corresponds to the spreading factor, which depends on the channel type: PILOT/PREAMBLE: 32, DATA: 16, MAC: 64. (See table above.)

Depending on the mapping settings, the I or Q branch or the complex signal is returned. With Code Domain Overview, the I branch in TRACE1 and the Q branch in TRACE2 are always returned.

Example:

The example shows the results of the query for the PILOT channel type, in which only code 0.32 at BPSK-I with 0 dB power is active:

```
"INST:SEL BDO"                            'Activate 1xEV-DO BTS, implicit are
'CDP Relative active on screen A and
'General Results on screen B'and
PILOT channel type, mapping mode
'IORQ and I branch selected

"INIT:CONT OFF"                            'Select single sweep
"CALC1:FEED 'XPOW:CDEP'"                'Code Domain Error Power analysis
"INIT;*WAI"                                'Start measurement with sync
"TRAC? TRACE1"                            'Read out CDEP Relative of the
'I branch

0,-52.0,1,                                1,-51.5,0,
2,-56.2,0,                                3,-53.9,0,
....                                        31,-55.3,0

"CDP:OVER ON"                             'Activate Overview mode
"TRAC? TRACE1"                            'Read out CDEP Relative of the
'I branch

0,-52.0,1,                                1,-51.5,0,
2,-56.2,0,                                3,-53.9,0,
....                                        31,-55.3,0

"TRAC? TRACE2"                            'Read out CDEP Relative of the
'Q branch

0,-54.2,0,                                1,-51.8,0,
2,-51.4,0,                                3,-54.3,0,
....                                        31,-54.3,0
```

CHANNEL TABLE (TRACE1):

The following is output for each active channel:

Channel type	The channel type is numerically coded as follows:
	0 = PILOT
	1 = MAC
	2 = PREAMBLE with 64 chip length
	3 = PREAMBLE with 128 chip length
	4 = PREAMBLE with 256 chip length
	5 = PREAMBLE with 512 chip length
	6 = PREAMBLE with 1024 chip length
	7 = DATA
Code class	Fixed, depending on channel type: PILOT: 5, MAC: 6, PREAMBLE: 5 and DATA: 4 (spreading factor = 2 ^{code class})
Code number	Code number of channel, values between 0 and spreading factor 1
Modulation:	Modulation type including mapping:
	0 = BPSK-I
	1 = BPSK-Q
	2 = QPSK
	3 = 8-PSK
	4 = 16-QAM
	Modulation types QPSK/8-PSK/16-QAM have complex values.
Absolute level	In unit dBm
Relative level	In unit dB, referred to the total power in the channel type
Timing offset	Referred to the first active channel in seconds
Phase offset	Referred to the first active channel in rad
	If the analysis of the timing and phase offsets is not active (refer to <code>CDPower:TPMeas</code>) or if there are more than 50 active channels in the signal, a value of 9 is returned
	A value of 9 is generally returned for inactive channels.

This means that 8 values are transmitted for all active channels:

<Channel type>, <Code class>, <Code number>, <Modulation>, <Absolute level>, <Relative level>, <Timing offset>, <Phase offset>, etc.

The channels are listed in the following channel type order: PILOT, MAC, PREAMBLE, DATA. Within the channel types, the channels are sorted in ascending code number order.

Example: The example shows the results of the query for the following configuration:

PILOT	0.32	(CC 5)	BPSK-I	0.0dB
MAC	2.64	(CC 6)	BPSK-I	-7.0dB
MAC	3.64	(CC 6)	BPSK-I	-6.9dB
MAC	4.64	(CC 6)	BPSK-I	-7.1dB
MAC	34.64	(CC 6)	BPSK-Q	-7.1dB
MAC	35.64	(CC 6)	BPSK-Q	-7.0dB
PRE64	2.32	(CC 5)	BPSK-I	0.0dB
DATA	0.16	(CC 4)	16-QAM	-12.1dB
DATA	1.16	(CC 4)	16-QAM	-12.0dB
DATA	2.16	(CC 4)	16-QAM	-12.2dB
...
DATA	13.16	(CC 4)	16-QAM	-12.1dB
DATA	14.16	(CC 4)	16-QAM	-12.2dB
DATA	15.16	(CC 4)	16-QAM	-12.3dB

```

"INST:SEL BDO"           'Activate 1xEV-DO BTS, implicit are
                          'CDP Relative active on screen A and
                          'General Results on screen B
"INIT:CONT OFF"         'Select single sweep
"CALC1:FEED 'XTIM:CDP:ERR:CTAB'" 'Analyze channel tables
"INIT;*WAI"             'Start measurement with sync
"TRAC? TRACE1"         'Read out channel table
0 , 5, 0, 0, 15.0, 0.0, 9, 9, 'PILOT
1 , 6, 2, 0, 8.0, -7.0, 9, 9, 'MAC
1 , 6, 3, 0, 8.1, -6.9, 9, 9,
1 , 6, 4, 0, 7.9, -7.1, 9, 9,
1 , 6, 34, 1, 7.9, -7.1, 9, 9,
1 , 6, 35, 1, 8.0, -7.0, 9, 9,
2 , 5, 0, 0, 14.9, 0.0, 9, 9, 'PREAMBLE
7 , 4, 0, 4, 2.8, -12.1, 9, 9, 'DATA
7 , 4, 1, 4, 2.9, -12.0, 9, 9,
7 , 4, 2, 4, 2.7, -12.2, 9, 9,
7 , 4, 3, 4, 2.8, -12.1, 9, 9,
.. .. .. .. ... ..
7 , 4, 13, 4, 2.8, -12.1, 9, 9,
7 , 4, 14, 4, 2.7, -12.2, 9, 9,
7 , 4, 15, 4, 2.6, -12.3, 9, 9

```

CHANNEL TABLE (CTABLE):

In addition to the results of the channel table which are output using the TRACE1 command, active timing and phase offset measurement (refer to `CDPower:TPMeas`) also has the CTABLE query command which displays the maximum values of the TIMING and PHASE OFFSET together with the associated channel type and channel.

The following values are output:

<Max. time offset in s>, <Channel Type>, <Code number for max. time>, <Code class for max. time>,

<Max. phase offset in rad>, <Channe type>, <Code number for max. phase>, <Code class for max. phase>, <Reserved 1>, ..., <Reserved 4>

The channel type is 1 for MAC and 7 for DATA.

Example:

```

"INST:SEL BDO"           'Activate 1xEV-DO BTS, implicit are
                          'CDP relative on Screen A and
                          'Result Summary active on Screen B
"INIT:CONT OFF"         'Select single sweep
"CALC2:FEED 'XTIM:CDP:ERR:CTAB'" 'Analyze channel tables
"CDP:TPM ON"           'Activate timing and phase offset measurement
"INIT;*WAI"           'Start measurement with synchronization
"TRAC? CTAB"          'Read out maximum timing and phase offsets
-1.55E-009,1,5,6,      'Max. time offset with channel type code number and
                          'code class of associated channel
3.37E-003,1,37,6,     'Max. phase offset with channel type code number
                          'and code class of associated channel
0,0,0,0              '4 reserved values

```

GENERAL RESULTS/CHANNEL RESULTS (TRACE2):

The results included in GENERAL RESULTS and CHANNEL RESULTS are read out in the following order:

<FERRor>, <FERPpm>, <CERRor>, <TFRame>, <RHOPilot>, <RHO1>, <RHO2>, <PPILot>, <PMAC>, <PDATa>, <PPReamble>, <MACCuracy>, <DMTYpe>, <MACTive>, <DACTive>, <PLENGth>, <RHO>, <PCDerror>, <IQIMbalance>, <IQOFFset>, <SRATe>, <CHANnel>, <SFACtor>, <TOFFset>, <POFFset>, <CDPRelative>, <CDPabsolute>, <EVMRms>, <EVMPeak>, <MTYPE>

In this instance the results have the following meaning and units:

Global results for all slots:

FERRor	Frequency error in Hz
FERPpm	Frequency error in ppm
CERRor	Chip rate error in ppm
TFRame	Trigger to Frame
RHOPilot	RHO over all slots for the pilot area
RHO1	RHOoverall-1 over all slots over all chips with start of averaging at the half-slot limit
RHO2	RHOoverall-2 over all slots over all chips with start of averaging at the quarter-slot limit

Results for the selected slot:

PPILot	Absolute power in the PILOT channel type
PMAC	Absolute power in the MAC channel type
PDATa	Absolute power in the DATA channel type
PPReamble	Absolute power in the PREAMBLE channel type
MACCuracy	Composite EVM in %
DMTYpe	Modulation type in the DATA channel type: 2 = QPSK 3 = 8-PSK 4 = 16-QAM
MACTive	Number of active MAC channels
DACTive	Number of active DATA channels
PLENGth	Length of preamble in chips
RHO	RHO value for the selected channel type/slot

Results for the selected channel type in the selected slot:

PCDerror	Peak code domain error in dB
IQIMbalance	IQ imbalance in %
IQOFFset	IQ offset in %

Channel results:

SRATe	Symbol rate in ksp/s
CHANnel	Channel number
SFACtor	Spreading factor of the channel
TOFFset	Timing offset in s
POFFset	Phase offset in rad
CDPRelative	Channel power, relative, in dB
CDPabsolute	Channel power, absolute, in dBm
EVMRms	Error vector magnitude RMS in %
EVMPeak	Error vector mag. peak in %
MTYPE	Modulation type: 0 = BPSK-I 1 = BPSK-Q 2 = QPSK

3 = 8-PSK
 4 = 16-QAM
 5 = 2BPSK (if complex analysis selected for PILOT, PREAMBLE
 or MAC)

Note: The Trigger to Frame value (TFR_{Frame}) supplies a '9' if the trigger is at FREE RUN. The Timing/Phase Offset values ($TOFF_{set}/POFF_{set}$) supply a '9' if timing and phase measurement is disabled (refer to $CDP:TPM$) or the number of active channels is higher than 50.

POWER VS CHIP

The number of returned values is 2048, since one level value is available per chip.
 POWER VS CHIP: <Level value in dBm>, <Level value in dBm>, etc.;

PEAK CODE DOMAIN ERR and COMPOSITE EVM (TRACE2):

The number of returned value pairs corresponds to the IQ capture length.
 (Refer to the command $CDPower:IQLength$).

PEAK CODE DOMAIN ERROR: <Slot number>, <Level value in dB>,;
 COMPOSITE EVM: <Slot number>, <Value in %>,;

SYMBOL EVM (TRACE2):

The number of values depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

<Value in % symbol 0>, <Value in % symbol 1>,.....;

POWER VS SYMBOL (TRACE2):

The number of values depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

<Value in dBm symbol 0>, <Value in dBm symbol 1>,.....;

SYMBOL CONST (TRACE2):

The number of value pairs depends on the number of symbols and is between 2 and 100. Refer in this respect to the table above in the column 'Number of symbols per slot and code'.

Real and imaginary parts are transferred as value pairs.

<re 0>,<im 0>,<re 1>,<im 1>,.....<re n>, <im n>

COMPOSITE CONST (TRACe2):

The number of value pairs corresponds to the number of chips for the channel type. The value is between 64 and 1600 chips per slot. Refer in this respect to the table above in the column 'Chips per slot'.

<re Chip 0>, <in Chip 0>, <re Chip 1>, <in Chip 1>,.....;

BITSTREAM (TRACE2):

The bit stream of a slot is output. A value is read out for each bit (range 0,1), each symbol consists of 1 bit for BPSK-I/BPSK-Q, 2 bits for QPSK and 2BPSK (Complex BPSK-I/BPSK-Q analysis), 3 bits for 8-PSK and 4 bits for 16-QAM. The bit stream per slot is accordingly of different lengths. Refer in this respect to the table above in the column 'Bits per slot and code'. The number of bits is between 2 and 400.

Example of bit stream trace: 0, 0, 1, 0, 1, 1, 0

STATus-QUEStionable:SYNC-Register

This register contains information about the error situation in the Code Domain Power analysis of the FS-K84 option.

It can be queried with the commands "STATus:QUEStionable:SYNC:CONDition?" and "STATus:QUEStionable:SYNC[:EVENT]?" .

Table 7-1 Significance of bits in STATus:QUEStionable:SYNC-Register

Bit No.	Explanation
0	Not used in the FS-K84 application
1	<p>K84 Frame Sync failed</p> <p>This bit is set when synchronization is not possible within the application. Possible reasons for this are:</p> <ul style="list-style-type: none"> Wrongly set frequency Wrongly set level Wrongly set PN OFFSET Wrongly set values for Q-INVERT or SIDE BAND INVERT Invalid signal at Input
2 to 3	Not used in the FS-K84 application
4	<p>K84 Preamble Current Slot missing</p> <p>This bit is set when the Preamble channel type is being investigated within the FS-K84 application, and there is no preamble in the current slot. The measurement results that can be read out for the Preamble channel type are not valid!</p>
5	<p>K84 Preamble Overall missing</p> <p>This bit is set when the Preamble channel type is being investigated within the FS-K84 application, and there is no preamble in at least one of the slots being examined. The measurement results that can be read out for the Preamble channel type are not valid if the analysis takes all slots into account. (CDP with Average, Peak Code Domain Error, Composite EVM)</p>
6 to 14	Not used in the FS-K84 application
15	This bit is always 0.

Table of Softkeys with Assignment of IEC/IEEE bus Commands

MEAS key and MEAS hotkey

POWER	:CONF<1>:CDP:MEAS POW Result query:CALC<1>:MARK<1>:FUNC:POW:RES? CPOW
ACLR	:CONF<1>:CDP:MEAS ACLR Result query: :CALC<1>:MARKer<1>:FUNction:POWer:RESult? ACPower
NO. OF ADJ CHAN	:SENS:POW:ACH:ACP 2
ADJUST SETTINGS	:SENS:POW:ACH:PRES ACP CPOW OBW
SWEEP TIME	:SWE:TIM 1 s
NOISE CORR ON OFF	:SENS:POW:NCORR ON
FAST ACLR ON OFF	:SENS:POW:HSP ON
DIAGRAM FULL SIZE	-
ADJUST REV LVL	:SENS:POW:ACH:PRES:RLEV
ACLR LIMIT CHECK	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH:RES? :CALC:LIM:ACP:ALT:RES?
EDIT ACLR LIMIT	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH 0dB,0dB :CALC:LIM:ACP:ACH:STAT ON :CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm :CALC:LIM:ACP:ACH:ABS:STAT ON :CALC:LIM:ACP:ALT1 0dB,0dB :CALC:LIM:ACP:ALT1:STAT ON :CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT1:ABS:STAT ON :CALC:LIM:ACP:ALT2..11 0dB,0dB :CALC:LIM:ACP:ALT2..11:STAT ON :CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT2..11:ABS:STAT ON
CHANNEL BANDWIDTH	:SENS:POW:ACH:BWID 1.2288MHz
ADJ CHAN BANDWIDTH	:SENS:POW:ACH:BWID:ACH 30kHz :SENS:POW:ACH:BWID:ALT1 30kHz :SENS:POW:ACH:BWID:ALT2..11 30kHz
ADJ CHAN SPACING	:SENS:POW:ACH:SPAC:ACH 750kHz :SENS:POW:ACH:SPAC:ALT1 1.98MHz :SENS:POW:ACH:SPAC:ALT2..11 4MHz
ACLR ABS REL	:SENS:POW:ACH:MODE ABS
CHAN PWR / HZ	:CALC:MARK:FUNC:POW:RES:PHZ ON OFF

POWER MODE	
CLEAR/ WRITE	
MAX HOLD	:CALC:MARK:FUNC:POW:MODE WRIT MAXH
MULT CARR ACLR	:CONF<1>:CDP:MEAS MCAClr Result query: :CALC<1>:MARK<1>:FUNC:POW:RES? MCAC
CP/ACP CONFIG	
NO. OF ADJ CHAN	:SENS:POW:ACH:ACP 2
NO. OF TX CHAN	:SENS:POW:ACH:TXCH:COUN 4
CHANNEL BANDWITH	:SENS:POW:ACH:BWID 1.2288MHz
CHANNEL SPACING	:SENS:POW:ACH:SPAC:ACH 750kHz :SENS:POW:ACH:SPAC:ALT1 1.98MHz :SENS:POW:ACH:SPAC:ALT2..11 4MHz
ACP REF SETTING	:POW:ACH:REF:TXCH:MAN 1 :POW:ACH:REF:TXCH:AUTO MIN :POW:ACH:REF:TXCH:AUTO MAX :POW:ACH:REF:TXCH:AUTO LHIG
CP/ACP ABS REL	:POW:ACH:MODE ABS
CHAN PWR / HZ	:CALC:MARK:FUNC:POW:RES:PHZ ON OFF
POWER MODE	
CLEAR/ WRITE	
MAX HOLD	:CALC:MARK:FUNC:POW:MODE WRIT MAXH
ADJUST SETTINGS	:SENS:POW:ACH:PRES MCAC
ACP LIMIT CHECK	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH:RES? :CALC:LIM:ACP:ALT:RES?
EDIT ACP LIMIT	:CALC:LIM:ACP ON :CALC:LIM:ACP:ACH 0dB,0dB :CALC:LIM:ACP:ACH:STAT ON :CALC:LIM:ACP:ACH:ABS -10dBm,-10dBm :CALC:LIM:ACP:ACH:ABS:STAT ON :CALC:LIM:ACP:ALT1 0dB,0dB :CALC:LIM:ACP:ALT1:STAT ON :CALC:LIM:ACP:ALT1:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT1:ABS:STAT ON :CALC:LIM:ACP:ALT2..11 0dB,0dB :CALC:LIM:ACP:ALT2..11:STAT ON :CALC:LIM:ACP:ALT2..11:ABS -10dBm,-10dBm :CALC:LIM:ACP:ALT2..11:ABS:STAT ON

SWEEP TIME	:SWE:TIM 1 s
NOISE CORR ON OFF	:SENS:POW:NCORR ON
FAST ACP ON OFF	:SENS:POW:HSP ON
DIAGRAM FULL SIZE	-
ADJUST REV LVL	:SENS:POW:ACH:PRES:RLEV
SPECTRUM EM MASK	:CONF:CDP:MEAS ESpectrum Result query: :CALC<1>:LIMit<1>:FAIL? :CALC:LIM:ESP:CHEC:X?;Y?
LIMIT LINE AUTO	:CALC:LIM:ESP:MODE AUTO
LIMIT LINE MANUAL	:CALC:LIM:ESP:MODE MANual :CALCul:LIM:ESP:VAL <numeric_value>
LIMIT LINE USER	:CALC:LIMit<1>:NAME <string> :CALC:LIMit<1>:UNIT DBM :CALC:LIMit<1>:CONT[:DATA] <num_value>, <num_value>, ... :CALC:LIMit<1>:CONT:DOMain FREQuency :CALC:LIMit<1>:CONT:TRACe 1 :CALC:LIMit<1>:CONT:OFFset <num_value> :CALC:LIMit<1>:CONT:MODE RELative :CALC:LIM<1>:UPPer[:DATA] <num_value>, <num_value>.. :CALC:LIM<1>:UPPer:STATe ON OFF :CALC:LIM<1>:UPPer:OFFset <num_value> :CALC:LIM<1>:UPPer:MARGin <num_value> :CALC:LIM<1>:UPPer:MODE ABSolute :CALC:LIM<1>:UPPer:SPACing LINear
	Hint: - If the y values are entered with the command :CALC:LIMit<1>:LOWer[:DATA] the limit check is "failed", if the values are below the limit line - If a user defined limit line is switched on this one has priority over the limit lines selected via AUTO or MANUAL
RESTORE STD LINES	:CALC:LIM:ESP:RESTore
LIST EVALUATION	:CALC1:PEAKsearch:AUTO ON OFF With this command the list evaluation which is by default for backwards compatibility reasons off can be turned on. TRACe1:DATA? LIST With this command the list evaluation results are queried in the following order: <no>, <start>, <stop>, <rbw>, <freq>, <power abs>, <power rel>, <delta>, <limit check>, <unused1>, <unused2>
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV
30kHz/1MHz TRANSITION	:CALC:LIM:ESP:TRAN <numeric value>
PEAK SEARCH	:CALC:PEAK
PEAK PER RANGE	:CALC:PEAK:SUBR 1...50
MARGIN	:CALC:PEAK:MARG -200dB...200dB

VIEW PEAK LIST	:TRAC? FINall The comma separated values are: <freq1>, <level1>, <delta level 1>, <freq2>, <level2>, <delta level 2>, ...
SORT BY FREQUENCY	--
SORT BY DELTA LIM	--
ASCII FILE EXPORT	<trace no 1>, <freq1>, <level1>, <delta level 1>, <trace no 2>, <freq2>, <level2>, <delta level 2>, ...
DECIM SEP - ,	:FORM:DEXP:DSEP POIN COMM
OCCUPIED BANDWIDTH	:CONF<1>:CDP:MEAS OBANdwidth Result query: :CALC<1>:MARKer<1>:FUNction:POWer:RESult? OBANdwidth
% POWER BANDWITH	:SENS:POW:BWID 99PCT
ADJUST SETTINGS	:SENS:POW:PRES OBW
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV
STATISTICS	:CONF:CDP:MEAS CCDF or :CALC:STATistics[:BTS]:CCDF[:STATe] ON Result query: CALC:MARKer:X?
APD	:CALC:STAT:APD ON
CCDF	:CALC:STAT:CCDF ON
PERCENT MARKER	:CALC:MARKr:Y:PERC 0...100%
NO OF SAMPLES	CALC:STAT:NSAM <value>
SCALING	
X-AXIS REF LVL	:CALC:STAT:SCAL:X:RLEV <value>
X-AXIS RANGE	:CALC:STAT:SCAL:X:RANG <value>
Y-UNIT % ABS	:CALC:STAT:SCAL:Y:UNIT PCT
Y-AXIS MAX VALUE	:CALC:STAT:SCAL:Y:UPP <value>
Y-AXIS MIN VALUE	:CALC:STAT:SCAL:Y:LOW <value>
ADJUST SETTINGS	:CALC:STAT:SCAL:AUTO ONCE
DEFAULT SETTINGSL	:CALC:STAT:PRES

ADJUST
SETTINGS

:CALC:STAT:SCAL:AUTO ONCE

CONT
MEAS

:INIT:CONT ON;
:INIT:IMM

SINGLE
MEAS

:INIT:CONT OFF;
:INIT:IMM

RESULTS hotkey and CODE DOM ANALYZER softkey

CODE DOM POWER	:CALC<1>:FEED "XPOW:CDP:RAT" (relative) :CALC<1>:FEED "XPOW:CDP" (absolute)
CODE DOM ERROR	:CALC<1>:FEED "XPOW:CDEP"
COMPOSITE EVM	:CALC2:FEED "XTIM:CDP:MACCuracy"
PEAK CODE DOMAIN ERR	:CALC2:FEED "XTIM:CDP:ERR:PCDomain"
POWER VS SLOT	:CALC2:FEED "XTIM:CDP:PVSLot"
GENERAL RESULT	:CALC2:FEED "XTIM:CDP:ERR:SUMM" :CALC<1 2>:MARK<1>:FUNC:CDP[:BTS]:RES? RHO MACC PCD FERR FERP CERR TFR I IQOF IQIM SRAT CHAN SFAC TOFF POFF CDP CDPR EVMR EVMP RHOP RHO1 RHO2 PPIlot PMAC PDATA PPR MACT DACT PLEN MTYP DMTY RHOD RHOM
CHANEL RESULTS	
SYMBOL CONST	:CALC2:FEED "XTIM:CDP:SYMB:CONS"
SYMBOL EVM	:CALC2:FEED "XTIM:CDP:SYMB:EVM"
BITSTEAM	:CALC2:FEED "XTIM:CDP:BSTReam"
COMPOSITE CONST	:CALC2:FEED "XTIM:CDP:COMP:CONS"
POWER VS SYMBOL	:CALC2:FEED "XTIM:CDP:PVSy"
SELECT CODE	:[SENSe:]CDP:CODE 0...(BASE SF-1)
SELECT	
CAPTURE LENGTH	:[SENSe:]CDP:IQLength 2..36
SET COUNT	:[SENSe:]CDP:SET:COUNT 1..57 (nur R&S FSQ)
SET TO ANALYZE	:[SENSe:]CDP:SET:[VALue] 0..(SET COUNT-1) (nur R&S FSQ)
SELECT CODE	:[SENSe:]CDP:CODE 0...(BASE SF-1)
SELECT SLOT	:[SENSe:]CDP:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)
ADJUST REF LVL	:SENS:POW:ACH:PRES:RLEV

CHAN CONF hotkey

CODE CHAN AUTOSEARCH	:CONF:CDP[:BTS]:CTABLE[:STATE] OFF
CODE CHAN PREDEFINED	:CONF:CDP[:BTS]:CTABLE[:STATE] ON :CONF:CDP[:BTS]:CTABLE:SElect <channel table name>
EDIT CHAN CONF TABLE	---
NEW CHAN CONF TABLE	---
HEADER VALUES	:CONF:CDP[:BTS]:CTABLE:NAME "NEW_TAB"
INSERT MAC	---
INSERT PREAMBLE	---
DELETE LINE	---
MEAS CHAN CONF TABLE	---
SAVE TABLE	--
SORT TABLE	---
PAGE UP	---
PAGE UP	---
DEL CHAN CONF TABLE	:CONF:CDP[:BTS]:CTABLE:DELeTe
COPY CHAN CONF TABLE	:CONF:CDP[:BTS]:CTABLE:COpy "CTAB2"
RESTORE STD TABLES	:CONF:CDP[:BTS]:CTABLE:REStore

SETTINGS hotkey

BAND CLASS	:CONF:CCDP:BCL <band_class>
REVISION A 0	:CONF:CDP[:BTS]:REV 0 A
PN OFFSET	:[SENS:]CDP:PNOF 0...511
CAPTURE SETTINGS	
CAPTURE LENGTH	:[SENS:]CDP:IQLength 2..36
SET COUNT	:[SENS:]CDP:SET:COUNT 1..57 (nur R&S FSQ)
SET TO ANALYZE	:[SENS:]CDP:SET:[VALue] 0..(SET COUNT-1) (nur R&S FSQ)
SELECT CODE	:[SENS:]CDP:CODE 0...(BASE SF-1)
SELECT SLOT	:[SENS:]CDP:SLOT 0 ... (IQ_CAPTURE_LENGTH-1)
CAPTURE LENGTH	:[SENS:]CDP:IQL 2..50
HEADER VALUES	---
PILOT	
MAC	:[SENS:]CDP:CTYPe PILOt MAC PREAmble DATA
PREAMBLE	
DATA	
CODE DOM CONF TABLE	:[SENS:]CDP:OVERview ON OFF
MAPPING AUTO	
MAPPING COMPLEX	:[SENS:]CDP:MMODE AUTO IOQ COMPLex
MAPPING I OR Q	
SELECT I Q	:[SENS:]CDP:MAPPING I Q
INACT CHAN THRESHOLD	:[SENS:]CDP:ICTReshold -100 dB ... 0 dB
CODE PWR ABS REL	:CALC<1>:FEED "XPOW:CDP:RAT" (relative) :CALC<1>:FEED "XPOW:CDP" (absolute)
CDP AVG ON OFF	:[SENS:]CDP:AVER ON OFF

TIME PHASE
ON OFF

: [SENS:]CDP:TPM ON | OFF

ANT DIV
ON OFF

: [SENS:]CDP:ANT OFF | 1 | 2

ANT NO.
64 128

INVERT Q
ON OFF

: [SENS:]CDP:QINV ON | OFF

SIDE BAND
NORN INV

: [SENS:]CDP:SBAN NORN|INV

NORMALIZE
ON OFF

: [SENS:]CDP:NORM ON | OFF

8 Checking the Rated Specifications

- Switch off the analyzer before withdrawing or inserting modules.
- Check the position of the mains voltage selector (230 V) before switching on the device.
- Perform measurement of the set characteristics after the device has warmed up for at least 30 minutes and after self-calibration of the analyzer and the SMIQ have been completed. This is the only way to ensure that the guaranteed data are complied with.
- Unless specified to the contrary, all settings will be performed starting from the PRESET setting.
- The following conventions apply to settings on the analyzer during measurement:

- [<TASTE>] Press a key on the front panel such as [SPAN]
- [<SOFTKEY>] Press a softkey such as [MARKER → PEAK]
- [<tbid unit>] Enter a value and terminate by entering the unit such as [12 kHz]
- {<nn>} Enter values specified in the table below.

Successive entries are separated by [:] such as [**SPAN**: 15 kHz]

- The values in the sections that follow are not guaranteed; only the specifications in the data sheet are binding.

Measuring equipment and accessories

Item	Device type	Recommended characteristics	Recommended device	R&S order number	Application
1	Signal generator	Vector signal generator	SMIQ with options: SMIQB20 SMIQB11 SMIQB60 SMIQK17 SMIQ-Z5 PARADATA	1125.5555.xx 1125.5190.02 1085.4502.04 1136.4390.02 1154.7800.02 1104.8555.02	
2	Control computer for signal generation using WinIQSIM PC that is either connected by means of a serial cable to the SMIQ, or has an IEC/IEEE bus card and connected by means of an IEC/IEEE bus cable to the SMIQ. R&S WinIQSIM Software 3.91 is installed on that PC. The software can be downloaded from the Rohde & Schwarz web site on the Internet at http://www.rohde-schwarz.com .				

Test sequence

The performance test refers solely to results of the code domain analyzer.

There is no need to check the measured values of the POWER, ACLR and SPECTRUM measurements, since they are already covered by the performance test of the basic device.

If not done already, the WinIQSIM file with the 1xEV-DO BTS signal must be created first and transferred to the SMIQ as DO_FFULL. This is described at length in the section "Generating a 1xEV-DO forward link signal with WinIQSIM" on page 10.

Default setting on
SMIQ:

```
[PRESET]
[LEVEL:           0 dBm]
[FREQ:           878.49 MHz]
ARB MOD
  SET SMIQ ACCORDING TO WAVEFORM ...
    SET SMIQ ACCORDING TO WAVEFORM      ON
    IQ SWAP (VECTOR MODE)              ON
    TRIGGER OUT MODE                    ON
```

(These three settings are only required once after generator preset and are used to apply, in VECTOR MODE, the IQ SWAP and, in ARB MOD, the trigger setting automatically from the waveform file generated by WinIQSIM. This is particularly present when a switch is made between different waveforms.)

```
SELECT WAVEFORM... select name 'DO_FFULL'
STATE:           ON
```

Default setting on
analyzer:

```
[PRESET]
[CENTER:         878.49 MHz]
[AMPT:           10 dBm]
[1xEVDO BS]
[TRIG             EXTERN]
[SETTINGS        TIME/PHASE: ON]
```

```
[RESULTS         CHANNEL TABLE]
```

Test setup and other
settings


- Connect the RF output of the SMIQ to the RF input of the analyzer
- Connect the external trigger input of the analyzer to the TRIG1 port on the Z5 PARADATA BNC ADAPTER
- Connect the external reference output of the analyzer to the SMIQ.

SMIQ UTILITIES

```
REF OSC
SOURCE: EXT
```

```
Analyzer [SETUP:           REFERENCE INT]
```

The measurement result displayed on the screen of the analyzer should look as follows:

	BS,DO,C0 :CHANNEL TAB		Type	PILOT-I				
	CF 878.49 MHz		Code	0.32	Max T	0.76 ns	@ DATA	13.16
			Slot	0	Max Ph	1.71 mrad	@ DATA	5.16
	Type	Chan.SF	Symb Rate	Modulation	Pwr Abs	Pwr Rel	T Offs	Ph Offs
			ksp/s		dBm	dB	ns	mrad
Ref	PILOT	0.32	38.4	BPSK-I	0.29	-0.00	0.00	0.00
10.0	MAC	2.64	19.2	BPSK-I	0.28	-0.00	0.00	0.00
dBm	PRE64	2.32	38.4	BPSK-I	0.29	-0.00	0.00	0.00
Att	DATA	0.16	76.8	16-QAM	-11.75	-12.12	0.00	0.00
40 dB	DATA	1.16	76.8	16-QAM	-11.75	-12.12	-0.28	0.19
	DATA	2.16	76.8	16-QAM	-11.77	-12.13	0.05	0.55
	DATA	3.16	76.8	16-QAM	-11.77	-12.13	-0.03	0.21
	DATA	4.16	76.8	16-QAM	-11.75	-12.12	0.26	1.24
1	DATA	5.16	76.8	16-QAM	-11.75	-12.11	-0.18	1.71
CLRWR	DATA	6.16	76.8	16-QAM	-11.75	-12.12	0.14	-0.64
	DATA	7.16	76.8	16-QAM	-11.76	-12.12	-0.02	-1.54
	DATA	8.16	76.8	16-QAM	-11.77	-12.13	0.19	0.63

GENERAL RESULTS

Type ALL

CF 878.49 MHz

Global Results				
Ref	Carr Freq Error	2.08 mHz	RHO Pilot	0.99989
10.0	Carr Freq Error	0.00 ppm	RHO overall-1	0.99989
dBm	Chip Rate Error	0.15 ppm	RHO overall-2	0.99989
Att	Trg to Frame	167.017333 ns		
40 dB	Results for Slot: 0			
	Power PILOT	0.29 dBm	Data Modulation Type	16-QAM
	Power MAC	0.28 dBm	Act. MAC Channels	1
1	Power DATA	0.36 dBm	Act. DATA Channels	16
CLRWR	Power PREAMBLE	0.29 dBm	Preamble Length	64 Chips
	Composite EVM	1.02 %	RHO	0.99989

9 Relationship between Mac Index and Walsh Codes

With 1xEV-DO there are "MAC indices" to characterize channels. They are also used in Software R&S WinIQSIM.

The MAC index i can be transformed for the MAC channel type into the corresponding Walsh code for a fixed spreading factor of 64 as follows:

$$\left(\frac{i}{2}\right).64 \quad \text{for } i = 0, 2, \dots, 62 \text{ on I - branch}$$

$$\left(\frac{i-1}{2} + 32\right).64 \quad \text{for } i = 1, 3, \dots, 63 \text{ on Q - branch}$$

The PREAMBLE channel type also uses the MAC index as a criterion for channel calculation. The spreading factor in this instance is 32. Since a constant null sequence is sent for the PREAMBLE channel type in the same way as for the PILOT, it is possible to achieve for the PREAMBLE channel type, by means of bit-by-bit complements of the Walsh code for the odd indices, that the sent symbols are inverted. Instead of the null sequence, ones are received for the odd indices, there being 64 different possibilities.

$$\left(\frac{i}{2}\right).32 \quad \text{for } i = 0, 2, \dots, 62$$

$$\overline{\left(\frac{i-1}{2}\right).32} \quad \text{for } i = 1, 3, \dots, 63$$

Not all indices can be used in the 1xEV-DO system. Indices 0 and 1 are not used. Index 2 is not used with MAC and is reserved for the 76.8 kbps control channel with PREAMBLE. Index 3 is not used with MAC and is reserved for the 38.4 kbps control channel with PREAMBLE. Index 4 is the RA channel with MAC (Forward MAC Reverse Activity Channel) and is not used with Preamble. The indices are flexible from index 5 onward.

The relationships have been calculated as a look-up table in the table below:

Table 9–1 Relationship between an **even** MAC index and Walsh code for MAC and PREAMBLE

	MAC CHANNEL TYPE	PREAMBLE CHANNEL TYPE
Mac index	Walsh code on I branch	Walsh code on I branch
0	0	0
2	1	1
4	2 <i>(RA CHANNEL)</i>	2
6	3	3
8	4	4
10	5	5
12	6	6
14	7	7
16	8	8
18	9	9
20	10	10
22	11	11
24	12	12
26	13	13
28	14	14
30	15	15
32	16	16
34	17	17
36	18	18
38	19	19
40	20	20
42	21	21
44	22	22
46	23	23
48	24	24
50	25	25
52	26	26
54	27	27
56	28	28
58	29	29
60	30	30
62	31	31

Table 9-2 Relationship between an odd MAC index and Walsh code for MAC and PREAMBLE

	MAC CHANNEL TYPE	PREAMBLE CHANNEL TYPE
Mac index	Walsh code on Q branch	Walsh Code (bit-by-bit complements)
1	32	0
3	33	1
5	34	2
7	35	3
9	36	4
11	37	5
13	38	6
15	39	7
17	40	8
19	41	9
21	42	10
23	43	11
25	44	12
27	45	13
29	46	14
31	47	15
33	48	16
35	49	17
37	50	18
39	51	19
41	52	20
43	53	21
45	54	22
47	55	23
49	56	24
51	57	25
53	58	26
55	59	27
57	60	28
59	61	29
61	62	30
63	63	31

10 Glossary

1xEV-DO	First evolution data only. Packet-oriented standard for data services as a development of the CDMA2000 mobile radio system
CDEP	Code domain error power
CDP	Code domain power
Composite EVM	The composite EVM measurement determines the squared error between the real and imaginary components of the test signal and of an ideally generated reference signal (EVM referred to the total signal).
Crest factor	Ratio of peak to mean value of a signal
Inactive channel threshold	Minimum power that a single channel must have compared to the total signal in order to be detected as the active channel
DATA	The DATA channel type is located with a length of up to 400 chips at the beginning and end of each half slot. The useful data proper are transmitted in it.
Channel type	With regard to time, the slot is divided into 4 channel types containing independent cdma signals.
MAC	The Medium Access Control channel type is 64 chips in front of and behind the PILOT. The MAC channel type contains the reverse activity (RA) channel and the MAC reverse power control (RPC) channels with which the power of the active terminals is controlled.
MC1	Multicarrier1 (a carrier system 1X)
PILOT	The PILOT channel type comprises 96 chips and is located in the center of each half-slot. It must be present in the signal for the base station signal to be detected.
PREAMBLE	The first 64 to 1024 chips of the DATA channel type are replaced at the beginning of a data packet by the PREAMBLE channel type. Depending on the transmission speeds being used and whether the start of data of the packet is missed, there are therefore preambles of different length in the slot.

RA	Reverse activity channel. Indicates whether at least one terminal is transmitting to the base station.
RPC	Reverse power control. Power regulation of the data terminal equipment by the base station
SLOT	Term in the 1xEV-DO system for 2048 chips or a period of 1.6625 ms
x.y	Walsh code x.y, where: x is the code number and y the spreading factor of the channel.

11 Index

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