CDMA2000® incl. 1xEV-DV Digital Standard for R&S®Signal Generators
Operating Manual

ROHDE&SCHWARZ

This document describes the following software options:

- R&S®AMU-K46/-K246
  1402.6506.02, 1402.8109.02

- R&S®SMATE-K46
  1404.5507.02

- R&S®SMBV-K46/-K246
  1415.8083.xx, 1415.8283.xx

- R&S®SMJ-K46/-K246
  1409.1016.02

- R&S®SMU-K46/-K246
  1160.9876.02, 1408.6014.02

- R&S®AFQ-K246
  1401.6554.02

- R&S®CMW-KW800
  1203.1506.02

- R&S®SFU-K246
  2115.2289.02

The following abbreviations are used throughout this manual: R&S®AMU is abbreviated as R&S AMU, R&S®SMATE is abbreviated as R&S SMATE, R&S®SMBV is abbreviated as R&S SMBV, R&S®SMJ is abbreviated as R&S SMJ, R&S®SMU is abbreviated as R&S SMU, R&S®WinIQSIM2 is abbreviated as R&S WinIQSIM2

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Symbols and safety labels

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

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

Tags and their meaning

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

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

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

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

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

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

Operating states and operating positions

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

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

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

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

Electrical safety

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Operation

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

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

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

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

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

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

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

1. Cells must not be taken apart or crushed.

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

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

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

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

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

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

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

Transport

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

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

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

Waste disposal

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

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

Informaciones elementales de seguridad

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

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

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

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

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

Símbolos y definiciones de seguridad

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

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

Palabras de señal y su significado

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

⚠ PELIGRO

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

⚠ ADVERTENCIA

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

⚠ ATENCIÓN

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

AVISO

AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo.
En la documentación del producto se emplea de forma sinónima el término CUIDADO.

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

Estados operativos y posiciones de funcionamiento

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

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

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

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

Seguridad eléctrica

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Funcionamiento

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

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

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

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

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

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

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

Reparación y mantenimiento

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

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

Baterías y acumuladores o celdas

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

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

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

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

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

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

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

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

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

Transporte

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

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

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

Eliminación

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

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

Contents

1 Preface

1.1 Documentation Overview

The user documentation for the R&S Signal Generator consists of the following parts:

- Online Help system on the instrument,
- "Quick Start Guide" printed manual,
- Documentation CD-ROM with:
  - Online help system (*.chm) as a standalone help,
  - Operating Manuals for base unit and options,
  - Service Manual,
  - Data sheet and specifications,
  - Links to useful sites on the R&S internet.

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive access to the complete information needed for operation and programming. The online help contains help on operating the R&S Signal Generator and all available options.

Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and an example of setup are described. The manual includes also general information, e.g., Safety Instructions.

Operating Manuals

The Operating Manuals are a supplement to the Quick Start Guide. Operating Manuals are provided for the base unit and each additional (software) option.

These manuals are available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In the Operating Manual for the base unit, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

In the individual option manuals, the specific instrument functions of the option are described in detail. For additional information on default settings and parameters, refer to the data sheets. Basic information on operating the R&S Signal Generator is not included in the option manuals.

These manuals can also be orderd in printed form (see ordering information in the data sheet).

Service Manual

This Service Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. It describes how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the instrument by the replacement of modules.

This manual can also be orderd in printed form (see ordering information in the data sheet).

Release Notes

The release notes describe new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided in the Internet.

1.2 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
`File names, commands, program code`	File names, commands, coding samples and screen output are distinguished by their font.
Input	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

2 Introduction

The R&S Signal Generator provides you with the ability to generate signals in accordance with the standard CDMA2000. CDMA2000 is the North American standard for the third mobile radio generation (3G). It is a further development of the North American mobile radio system of the second generation IS95 (CDMA). The R&S Signal Generator supports the CDMA2000 standard 3GPP2 C.S0002-C, version 1.0, may 2002 (release C). CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA –USA).

The R&S Signal Generator generates the CDMA2000 signals with a chip rate of 1,2288 Mcps, corresponding to the so-called "Spreading Rate 1".

The CDMA2000 signals of the base station are generated in a combination of realtime mode (real time channels) and arbitrary waveform mode. Simulation of bit and block errors can be activated for the channels generated in realtime. In arbitrary waveform mode, the signal is first calculated and then output.

The CDMA2000 signals of mobile station 1 (MS1) are always generated in realtime mode, the signals of the three remaining mobile stations always in arbitrary waveform mode.

The R&S Signal Generator simulates CDMA2000 at the physical channel level. The following list gives an overview of the options provided by the R&S Signal Generator for generating a CDMA2000 signal:

- Configuration of up to 4 base stations or 4 mobile stations
- Real time generation of one traffic channel and the SYNC channel on the downlink
- All special channels and up to 78 channels on the downlink (depending on the radio configuration)
- Packet channel according to 1xEV-DV on the downlink
- Operating modes "Traffic", "Access", "Enhanced Access" and "Common Control" on the uplink
- "Misuse For Output Power Control" parameter for varying the original normal transmit power over time
- Simulation of up to 64 additional mobile stations
- Clipping for reducing the crest factor
- All channel coding modes included in IS-2000 (Frame Quality Indicator, Convolutional Encoder, Turbo Encoder, Symbol Puncture, Interleaver, etc)
- Feeding through of bit errors (to test a BER tester) and block errors (to test a BLER tester)

Parameter	Value
Spreading rate	1.2288 MHz
Channel types	Downlink: • Forward Pilot (F-PICH) • Sync (F-SYNC) • Paging (F-PCH) • Transmit Diversity Pilot (F-TDPICH) • Auxiliary Pilot (F-APICH) • Auxiliary Transmit Diversity Pilot (F-ATDPCH) • Broadcast (F-BCH) • Quick Paging (F-QPCH) • Common Power Control (F-CPCCH) • Common Assignment (F-CACH) • Forward Common Control (F-CCCH) • Packet Channels • Forward Packet Data Control (F-PDCCH) • Forward Packet Data (F-PDCH) • Traffic Channels • Forward Dedicated Control (F-DCCH) • Forward Fundamental (F-FCH) • Forward Supplemental (F-SCH) Uplink: • Reverse Pilot (R-PICH) • Access (R-ACH) • Enhanced Access (R-EACH) • Reverse Common Control (R-CCCH) • Traffic Channel • Reverse Dedicated Control (R-DCCH) • Reverse Fundamental (R-FCH) • Reverse Supplemental Code (R-SCCH) • Reverse Supplemental (R-SCH)
Channel count	In downlink 4 base stations each with up to 78 code channels (depending on the radio configuration). In uplink 4 mobile stations with up to 8 code channels (depending on the radio configuration).
Radio configuration	RC 1 – RC 5 & RC10
Frame length	Radio frame: 5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 160 ms (depending on the channel type and the radio configuration)
PN offset	0 ... 511
Quasi Orthogonal Walsh Set	set 1 – set 3
Channel coding	All channel coding modes included in IS-2000 (Frame Quality Indicator, Convolutional Encoder, Turbo Encoder, Symbol Puncture, Interleaver, etc)
Long Code Mask	0 ... 3FF FFFF FFFF hex

3 Modulation System CDMA2000

The following simplified diagram is used to explain the system principle of CDMA200 in the forward (down) and reverse (up) link. The exact system configuration depends on parameters like link direction, spreading rate, mode, radio configuration and channel type. A detailed description cannot be given in this manual. For further information refer to the IS2000 standard.

3.1 Modulation System CDMA2000 in the Downlink (Forward)

The following block diagram shows the components of the CDMA2000 transmission system in the downlink.
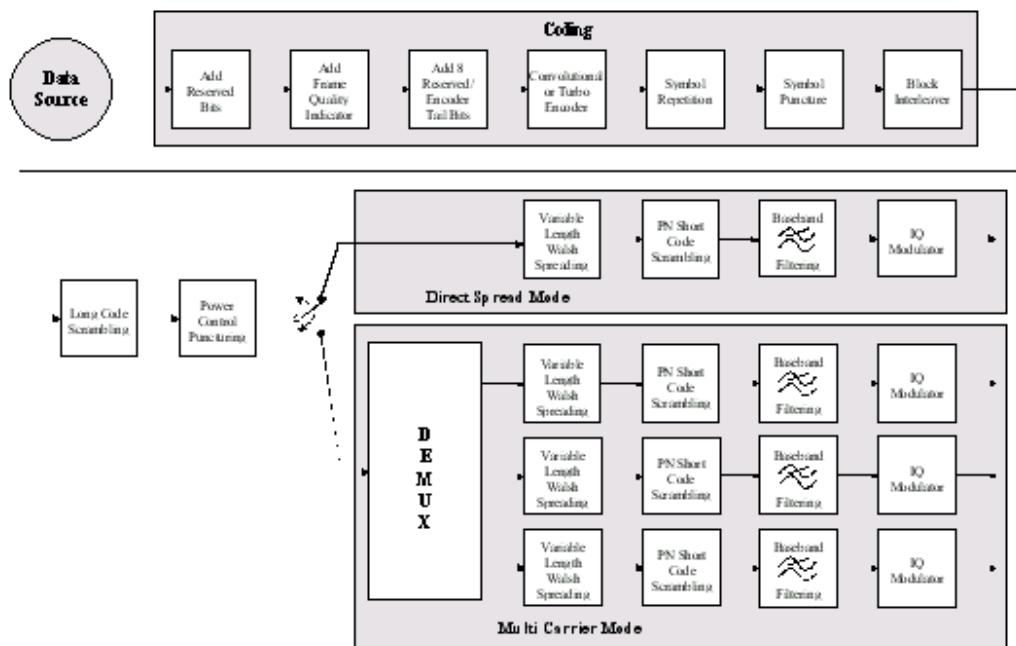

Fig. 3-1: Components of the CDMA2000 transmission system in the downlink (forward)

3.2 Modulation System CDMA2000 in the Uplink (Reverse)

The following block diagram shows the components of the CDMA2000 transmission system in the uplink.
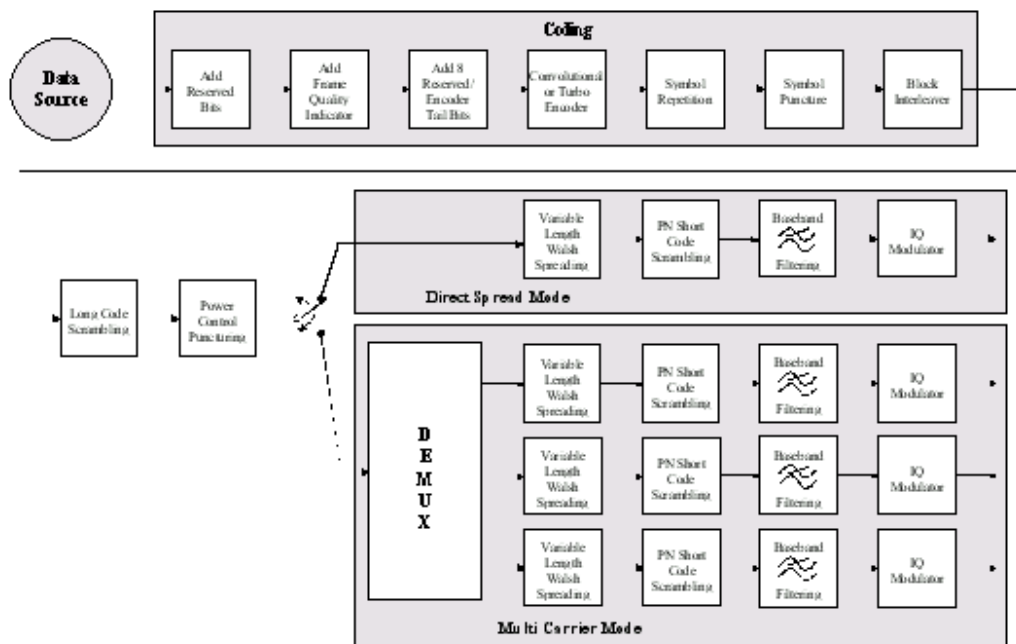
Fig. 3-2: Components of the CDMA2000 transmission system in the uplink (reverse)

3.3 Data Source - Uplink and Downlink

The data fields of all channels can be filled from all possible data sources of the R&S Signal Generator: pattern (all1, all0, user-defined up to 64 bits), PRBS data, data lists and external data.

3.4 Channel Coding - Uplink and Downlink

In contrast to 3GPP FDD, channel coding with CDMA2000 is part of the physical layer. The channel coding procedure may slightly vary depending on channel type, frame length and data rate. The basic coding procedure is illustrated by the coding block in the diagram above. Blocks like 'Add reserved bits' or 'Symbol puncture' are not used in all coding scenarios. For a more exact definition refer to the standard.

Add Reserved Bits:	filled with "0" bits
Add Frame Quality Indicator:	calculation and insertion of a CRC (cyclic redundancy code) checksum for error identification.
Add 8 Reserved/Encoder	
Tail Bits:	reserved, tail bits which set the subsequent coder to a defined final state.
Convolutional or Turbo Encoder:	error correction code, depending on data rate and other parameters either by convolutional coding or turbo codes.

Symbol Repetition:	symbol repetition is used together with bock symbol puncture for adapting the convolutional or turbo coder output data rate to the required input data rate of the interleaver.
Symbol Puncture:	symbol puncturing (elimination) is used together with bock symbol repetition for adapting the convolutional or turbo coder output data rate to the required input data rate of the interleaver.
Block Interleaver:	blockwise permutation of input data sequence of interleaver to reduce bit errors.

3.5 Long-Code Scrambling Generator - Downlink

The long-code generator is also referred to as scrambling code generator since it scrambles the chip sequence in a user-specific way (long-code mask).
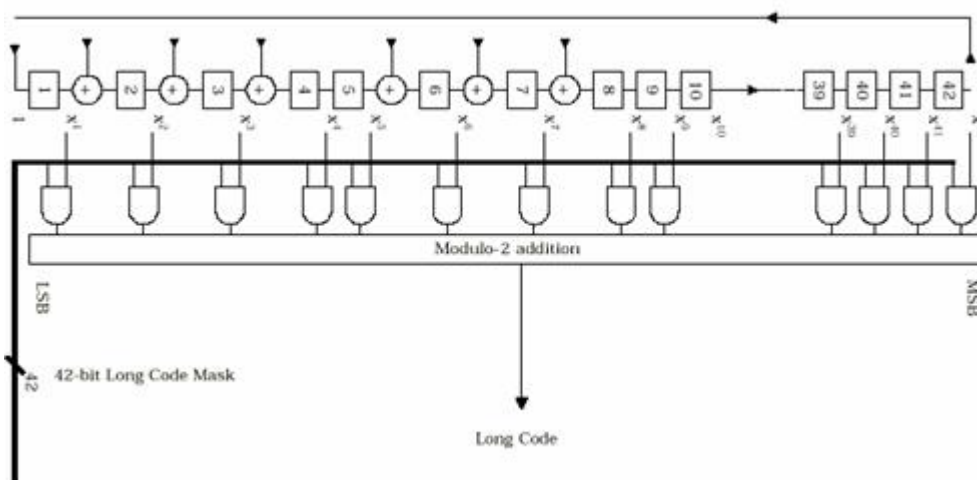

Fig. 3-3: Long-code generator CDMA2000

The long-code generator is a feedback 42-bit shift register with its status vector linked to a user-specific long-code mask to form the specific long-code sequence.

The generator polynomial of the shift-register section of the long-code generator is:

$$p(x) = x^{42}+x^{35}+x^{33}+x^{31}+x^{27}+x^{26}+x^{25}+x^{22}+x^{21}+x^{19}+x^{18}+x^{17}+x^{16}+x^{10}+x^{7}+x^{6}+x^{5}+x^{3}+x^{2}+x^{1}+1$$

A real long code is used in the forward link. In the reverse link a complex long code with I and Q component is required. The long code for the I component is derived directly from the 1X generator, that for the Q component corresponds to the I long code delayed by one chip.

3.6 Power Control Puncturing - Downlink

To control the output power of the mobile station, the base station sends power control bits in the traffic channel at an 800 Hz rate instead of the scrambled data bits. Depending on the power control bits, the mobile station increases or reduces its output power.

3.7 Variable-Length Walsh Spreading - Downlink

Spreading of the CDMA2000 signal is performed in this block. Walsh codes with a variable spreading factor are used. The spreading factor and the Walsh code depend on the spreading rate, channel type, frame length and data rate. To extend the base-station capacity, so-called 'quasi-orthogonal Walsh sets' can be used in addition to the Walsh codes. The input data stream of the spreading unit is already complex (I + jQ). If a standard Walsh code is used, spreading is performed by multiplying the input symbol (modulo 2 multiplication) with the real Walsh code. The quasi-orthogonal Walsh code results in complex spreading through an additional rotation of the output phase (the spreading code then consists of a real and an imaginary part).

3.8 PN Short-Code Scrambling - Downlink

The (complex) input data stream of the PN short-code scrambler is multiplied by a complex PN sequence (I_{PN} + j Q_{PN}). This is also called 'quadrature spreading'. With channels of the radio configurations 1 and 2, whose generation is comparable with that of IS-95 systems, this block splits up the input stream in I and Q components.

The base-station-specific parameter PN offset determines the start phase of these PN short-code sequences. This permits signals of different base stations to be distinguished.

Generator polynomial for I and Q components of the PN short code:

$P_I(x) = x^{15}+x^{13}+x^9+x^8+x^7+x^5+1$

$P_Q(x) = X^{15}+x^{12}+x^{11}+x^{10}+x^6+x^5+x^4+x^3+1$

The period of a PN short-code sequence is 26.666 ms.

3.9 Spreading - Uplink

Increasing the data rate or spreading in the reverse link is performed in different ways depending on the radio configuration and the channel type.

3.9.1 Variable Length Walsh Spreading

Walsh codes with a variable spread factor are used for spreading. The spreading factor and the Walsh code depend on the spreading rate, channel type, frame length and the data rate. Spreading is obtained by multiplication of the input symbol (modulo 2 multiplication) by the real Walsh code.

3.9.2 64-ary Orthogonal Modulator

Groups of 6 input bits are used for addressing a line of the Walsh code table with the spread code length of 64. This 'modulator' increases the data rate by a factor of 64/6.

This type of rate increase comes from IS-95 and is mainly used in the radio configurations 1 and 2.

3.10   Scrambling - Uplink

In the scrambling block of the uplink system the spread data stream is scrambled by means of the long code and the PN short code. Different methods are used for the radio configurations 1, 2 and RC3 to RC5.

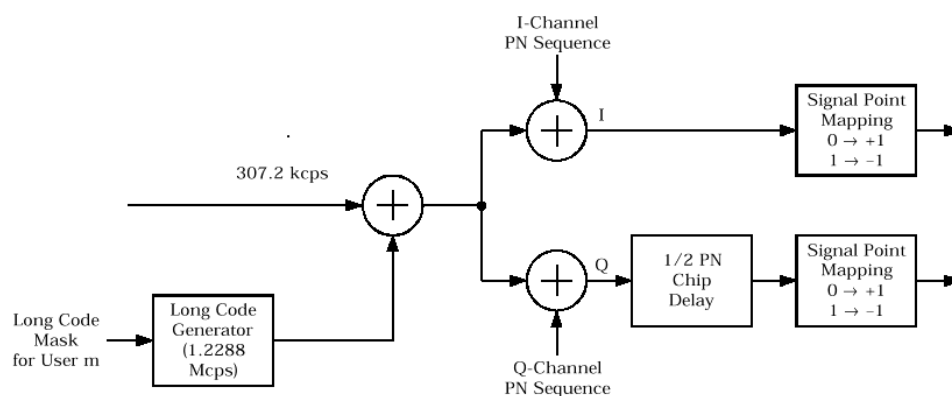### 3.10.1   Scrambling for Radio Configuration 1 and 2

Fig. 3-4: Scrambling in the uplink RC 1 and RC2

The output data stream of the spreading block is scrambled with the **long code**. The rate is increased in addition by a factor of four. The long-code generator is also referred to as scrambling code generator since it scrambles the chip sequence in a user-specific way (long-code mask). This generator exactly corresponds to that described in chapter 3.5, "Long-Code Scrambling Generator - Downlink", on page 13 for the downlink.

The real input data stream of the **PN short-code** scrambler is multiplied by a complex PN sequence (I_{PN} + j Q_{PN}). This procedure is also called 'quadrature spreading'. With channels of the radio configurations 1 and 2, whose generation is comparable with that of IS-95 systems, this block splits up the input stream in I and Q components.

In contrast to the downlink, no variable PN offset parameter is available for the PN short code in the reverse link. The PN offset is always 0.

Different generation rules are used for the PN short codes depending on the mode and spreading rate. The generator polynomials of the PN short codes correspond to those in the downlink (see chapter 3.8, "PN Short-Code Scrambling - Downlink", on page 14). The I and Q data streams consisting of {0, 1} sequences are then mapped to {+1, -1} in the **signal point mapping** block.

Because of the delay of the Q component, offset QPSK constellation known from the reverse link of IS-95 is obtained from the QPSK constellation. Due to the Q delay, the transfer of the I and Q signal components from one chip to the next is never synchronous.

For this reason there are no zero crossings in the transfer from one chip to the next. This behavior can be seen in the vector diagram below.
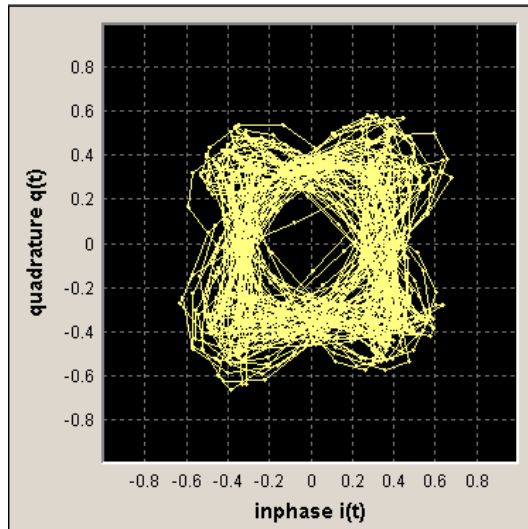

Fig. 3-5: Scrambling in the uplink RC 1 and RC2

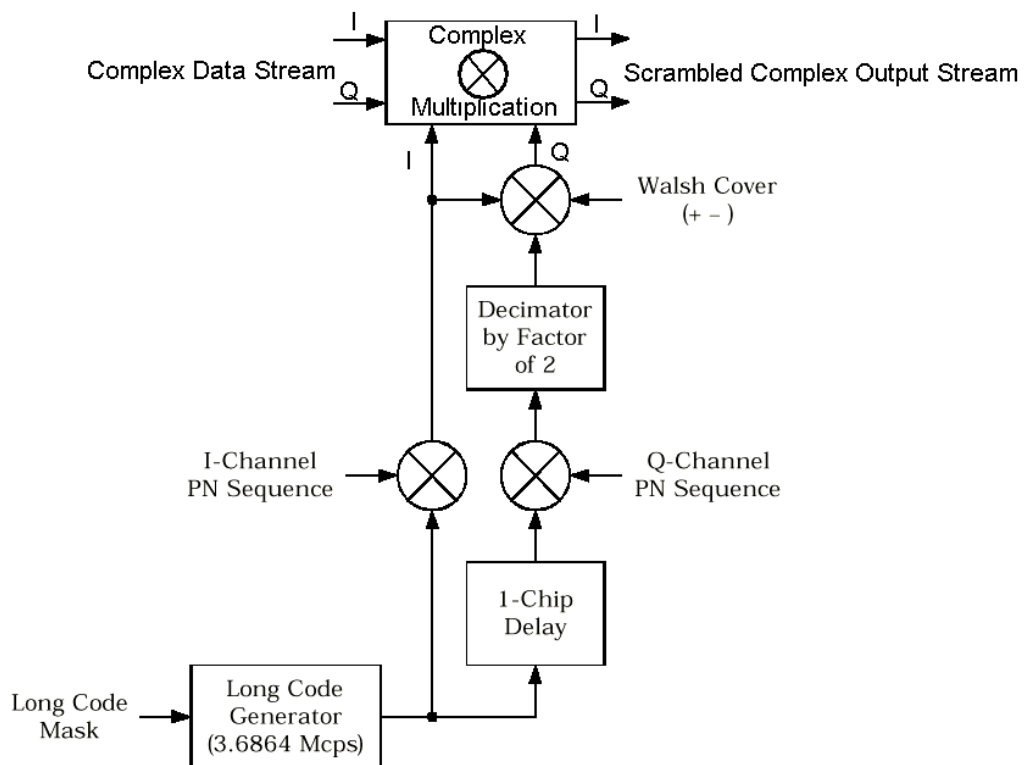### 3.10.2   Scrambling for Radio Configuration 3, 4 and 5

Fig. 3-6: Scrambling in the uplink RC3, RC4 and RC5

Here too, the long-code generator defined in chapter 3.5, "Long-Code Scrambling Generator - Downlink", on page 13 for the downlink is used. A complex long-code sequence is required. For this purpose, the output sequence of the generator is used as the I component and the sequence delayed by one chip as the Q component.

The I component of the long code is then multiplied by the I component of the PN short code, the Q component with the corresponding Q component of the PN short code. The definition of the PN short code is given in chapter 3.8, "PN Short-Code Scrambling - Downlink", on page 14.

The subsequent operations decimation by factor of 2 and linking the Q component to the Walsh sequence (+-) and the I component serve for reducing the zero crossings of the I/Q signal at the end of the whole scrambling process. Thus a behavior similar to that in the uplink of 3GPP is obtained. It is also known as **HPSK** (hybrid phase shift keying).

The resulting I/Q output stream is obtained by complex multiplication (modulo 2) of the I/Q input sequence of the scrambler by the complex scramble sequence obtained from the long code and the PN short code. The constellation obtained is a combination of QPSK and offset QPSK.

In this mode, the traffic data streams of a channel are mapped either to the I or to the Q path of the complex data stream shown in the diagram above. With these so-called BPSK channels, the channel component at the scrambler input consists of a real or an imaginary component. As can be seen in the table below, the constellation after complex scrambling is again at the angle bisector.

Table 3-1: Output combinations with BPSK channels

d(n) \ S-Code(n)	-1-j	-1+j	+1-j	+1+j
-1	+1+j	+1-j	-1+j	-1-j
+1	-1-j	-1+j	+1-j	+1+j
-j	-1+j	+1+j	-1-j	+1-j
+j	+1-j	-1-j	+1+j	-1+j

3.11   Baseband Filtering - Uplink and Downlink

This block performs baseband filtering (pulse shaping and band limiting) of the I/Q signal. In addition to the filters specified in the standard, the signal generator also provides equalizer filters with a better adjacent-channel leakage ratio.

3.12   I/Q Modulator - Uplink and Downlink

The IQ modulator defined in the IS2000 standard differs from the definition in the R&S Signal Generator. The definition on which the R&S Signal Generator is based is used by virtually all digital communication standards (except IS95 and IS2000).

In the final step, the filtered IQ signal is modulated to the desired RF in a different way in the IQ modulator:
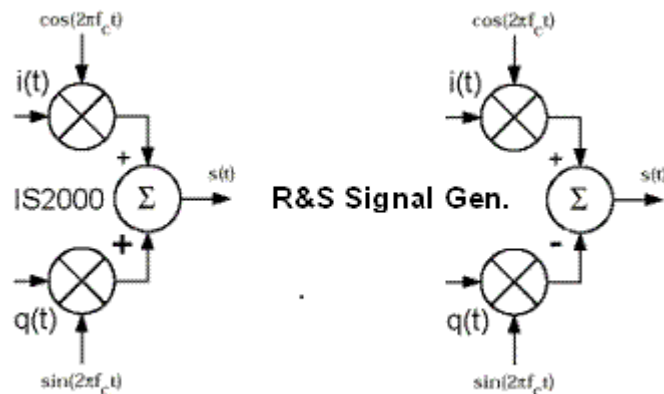
Fig. 3-7: Definition of IQ modulator in IS2000 and the R&S Signal Generator

According to IS2000, the RF signal s(t) is derived from the baseband I/Q signal as follows:

$$s(t) = i(t)\cos(2\pi f_c t) + q(t)\sin(2\pi f_c t)$$

The R&S Signal Generator is based on the following definition:

$$s(t) = i(t)\cos(2\pi f_c t) + q(t)\sin(2\pi f_c t)$$

The R&S Signal Generator enables baseband signals to be generated according to IS2000 (cdma2000 standard) by inverting the Q-part of the signal.

So that this baseband signal can be used to generate an RF signal which also conforms to the standard, the "I/Q Modulator" menu contains the "I/Q Swap" function for swapping the I/Q control of the I/Q modulator.

3.13 Constellation of I/Q Signals - Downlink

Depending on radio configuration and channel type, the signal components in the different channels create different sub-constellations.

3.13.1 BPSK channels

With some channel types (particularly in RC1 and 2 but always in the pilot channel, for instance) the data stream is split up in I and Q components in the **PN Short Code Scrambling** block. The input data stream of this block is a real +/-1 sequence similar to BPSK. The complex output data sequence is then as follows:

$S_{out}(n) = d_{in}(n) (PN_I(n) + j\, PN_Q(n))$, with $d_{in}(n)$, $PN_I(n)$, $PN_Q(n) \in \{-1, +1\}$.

This yields four different output combinations for S_{out}:

(-1 –j), (-1 +j), (+1 –j), (+1 +j),

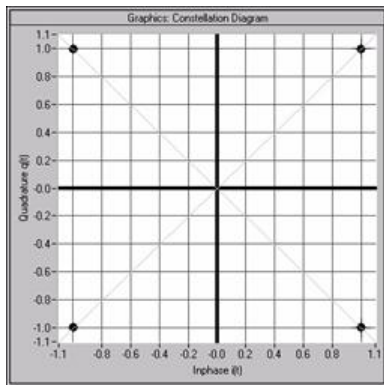ie. all points are on one of the two angle bisectors at the I/Q level.

Fig. 3-8: Constellation diagram of a BPSK channel with 0 dB power

3.13.2 QPSK channels

With other channel types, the input data stream of the **PN Short Code Scrambling** block is a complex ±1 ±j sequence similar to QPSK. The complex output data sequence is then as follows:

$S_{out}(n) = (d_I(n) + jd_Q(n)) (PN_I(n) + j\, PN_Q(n))$, with $d_I(n), d_Q(n), PN_I(n), PN_Q(n) \in \{-1, +1\}$.

Table 3-2: Output combinations with QPSK channels

PN(n) \ d(n)	-1-j	-1+j	+1-j	+1+j
-1-j	+2j	+2	-2	-2j
-1+j	+2	-2j	+2j	-2
+1-j	-2	+2j	-2j	+2
+1+j	-2j	-2	+2	+2j

This again yields four different output combinations for S_{out}:

-2j, 2j, -2, 2,

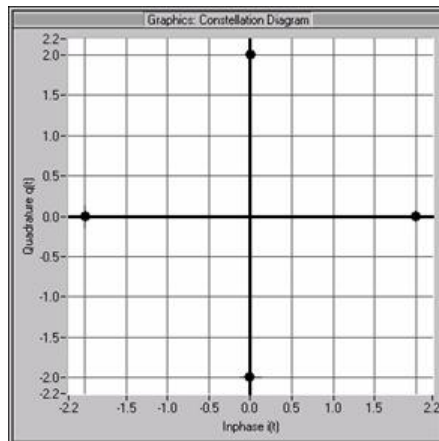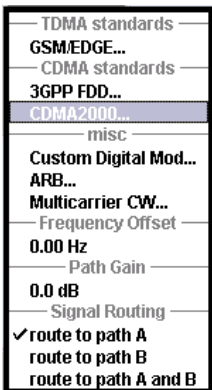i.e. all points are on one of the two axes at the I/Q level.

Fig. 3-9: Constellation diagram of a QPSK channel with 0 dB power

3.14 Power Control - Downlink and Uplink

After spreading and scrambling, a channel-specific power factor p is applied to the signal. For example, a value of -6 dB therefore results in half the level (or ¼ power).

4 User Interface

The menu for setting the CDMA2000 digital standard is either called from the baseband block or from the menu tree under Baseband.

The menu is split into several sections for configuring the standard. The choice of transmission direction determines which displays and parameters are made available in the lower section.

The upper section of the menu is where the CDMA2000 digital standard is enabled, the default settings are called and the transmission direction selected.

The valid CDMA2000 version and the spreading rate in use are displayed.

Many of the buttons lead to submenus for loading and saving the CDMA2000 configuration and for setting the filter, trigger and clock parameters.

The lower menu section is where either the base station signal or the mobile station signal is configured, depending on the transmission direction selected.
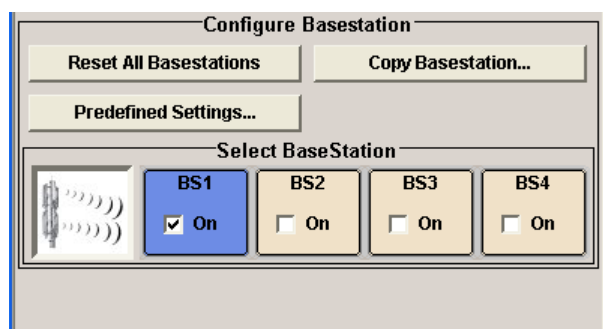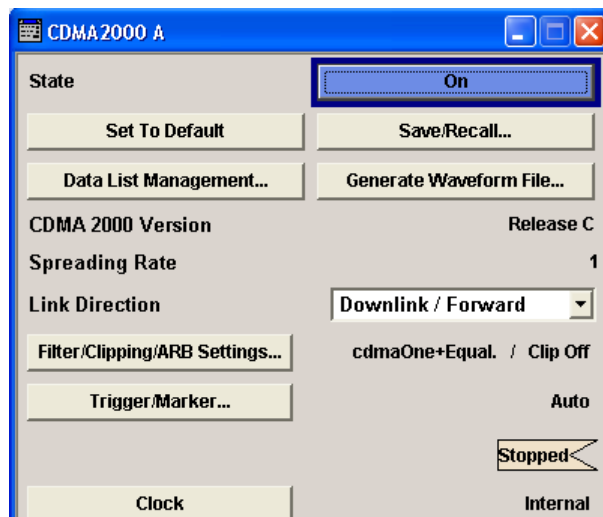
4.1 General Settings for CDMA2000 Signals

The upper menu section is where the CDMA2000 digital standard is enabled and reset and where all the settings valid for the signal in both transmission directions are made.

State

Enables/disables the CDMA2000 standard.

Enabling this standard disables all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

The CDMA2000 signal is generated by a combination of realtime mode (real time channels) and arbitrary waveform mode (all the other channels).

On the downlink, one traffic channel and the SYNC channel of base station 1 are generated in realtime. All the other channels are generated in arbitrary waveform mode and added.

In the uplink, all the channels of mobile station 1 are generated in realtime, the other mobile stations are generated in arbitrary waveform mode and added to the realtime signal.

SCPI command:

[:SOURce<hw>]:BB:C2K:STATe on page 90

Set to Default

Calls the default settings. The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Parameter	Value
State	Not affected by Set to default
Link Direction	Downlink
Filter	CdmaOne + Equalizer
Clipping	Off
Trigger	Auto
Clock	Internal
Base Station Configuration	
State	Off
Radio Configuration Traffic Channels 1 and 2	RC3
Radio Configuration other Traffic Channels	RC1
Time Delay	0 chips
PN Offset	0
Transmit Diversity	Off
Quasi Orthogonal Walsh Set	1
Mobile Station Configuration	
State	Off

Parameter	Value
Mode	Traffic
Radio Configuration	RC3
Channel Coding	Complete
LC Mask (hex)	0
State (all Channels)	Off
Power Control	Off

SCPI command:

[:SOURce<hw>]:BB:C2K:PRESet on page 88

Save/Recall ...

Calls the "Save/Recall" menu.

From the "Save/Recall" menu the "File Select" windows for saving and recalling CDMA2000 configurations and the "File Manager" can be called.

CDMA2000 configurations are stored as files with the predefined file extension *.cdma2k. The file name and the directory they are stored in are user-definable.

The complete settings in the "CDMA2000" menu are saved and recalled.

"Recall CDMA2000 Setting"	Opens the File Select window for loading a saved CDMA2000 configuration. The configuration of the selected (highlighted) file is loaded by pressing the "Select" button.
"Save CDMA2000 Setting"	Opens the "File Select" window for saving the current CDMA2000 signal configuration. The name of the file is specified in the File name entry field, the directory selected in the save into field. The file is saved by pressing the "Save" button.
"File Manager"	Calls the "File Manager". The "File Manager" is used to copy, delete and rename files and to create new directories.

SCPI command:

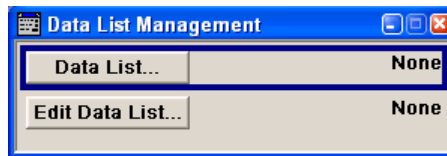[:SOURce<hw>]:BB:C2K:SETTing:CATalog on page 89

[:SOURce<hw>]:BB:C2K:SETTing:LOAD on page 89

[:SOURce<hw>]:BB:C2K:SETTing:STORe on page 90

[:SOURce<hw>]:BB:C2K:SETTing:DELete on page 89

Data List Management

Calls the "Data List Management" menu. This menu is used to create and edit a data list.

All data lists are stored as files with the predefined file extension `*.dm_iqd`. The file name and the directory they are stored in are user-definable.

The data lists must be selected as a data source from the submenus under the individual function, e.g. in the channel table of the base stations.

Note: All data lists are generated and edited by means of the `SOURce:BB:DM` subsystem commands. Files containing data lists usually end with `*.dm_iqd`. The data lists are selected as a data source for a specific function in the individual subsystems of the digital standard.

Example: Creating and editing the data list

`:SOUR:BB:DM:DLIS:SEL "d_list1"`

`:SOUR:BB:DM:DLIS:DATA #B11110101010000001111....`

`:SOUR:BB:DM:DLIS:DATA:APP #B11110101010000001111....`

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA` on page 123
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:DSELect` on page 124
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA` on page 130
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:DSELect` on page 131
`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA` on page 151
`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:DSELect` on page 151
`[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA` on page 157
`[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:DSELect` on page 158

Generate Waveform File
Opens the submenu for storing the current CDMA2000 signal as ARB signal in a waveform file. This file can be loaded in the ARB menu and processed as multicarrier or multisegment signal.

The file name is entered in the submenu. The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

SCPI command:
`[:SOURce<hw>]:BB:C2K:WAVeform:CREate` on page 91

CDMA 2000 Version
Displays the current version of the CDMA2000 standard.

The default settings and parameters provided are oriented towards the specifications of the version displayed.

SCPI command:

[:SOURce]:BB:C2K:VERSion on page 91

Spreading Rate

Displays the spreading rate.

Mode Spreading Rate 1 ("Direct Spread 1X") is used:

The **Chip Rate** parameter which determines the rate of the spread symbols as is used for signal output, can be varied in the Filter, Clipping, ARB Settings menu (see chapter 4.3, "Filter/Clipping/ARB Settings", on page 30).

SCPI command:

[:SOURce<hw>]:BB:C2K:CRATe on page 87

Link Direction

Selects the transmission direction.

The settings of the base station or the mobile station are provided in the following menu section in accordance with the selection.

"Downlink/ For-ward Link"   The transmission direction selected is base station to mobile station. The signal corresponds to that of a base station.

"Uplink/ Reverse Link"   The transmission direction selected is mobile station to base station. The signal corresponds to that of a mobile station.

SCPI command:

[:SOURce<hw>]:BB:C2K:LINK on page 88

Filtering/Clipping/ARB Settings

Calls the menu for setting baseband filtering, clipping and the sequence length of the arbitrary waveform component. The current setting is displayed next to the button.

The menu is described in chapter 4.3, "Filter/Clipping/ARB Settings", on page 30.

SCPI command:

n.a.

Trigger/Marker

(Trigger for R&S SMx and R&S AMU instruments only)

Calls the menu for selecting the trigger source, for configuring the marker signals and for setting the time delay of an external trigger signal (see chapter 4.4, "Trigger/Marker/Clock Settings", on page 35).

The currently selected trigger source is displayed to the right of the button.

SCPI command:

n.a.

Execute Trigger

(Trigger for R&S SMx and R&S AMU instruments only)

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:EXECute on page 101

Clock
(Trigger for R&S SMx and R&S AMU instruments only)

Calls the menu for selecting the clock source and for setting a delay (see chapter 4.4, "Trigger/Marker/Clock Settings", on page 35).

SCPI command:
n.a.

4.2 Configure Base Station or Mobile Station

Depending on the transmission direction selection, the central section of the menu provides either the "Configure Base Station" section (selection "Downlink/Forward Link") or the "Configure Mobile Station" section (selection "Uplink/Reverse Link").
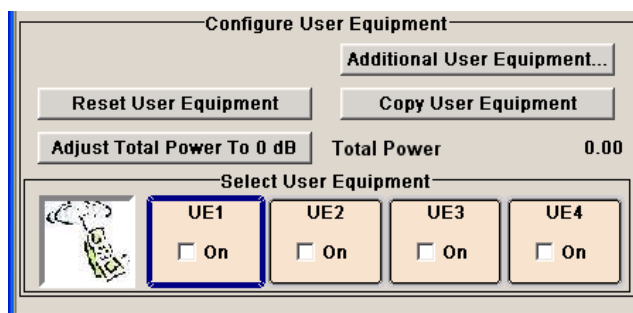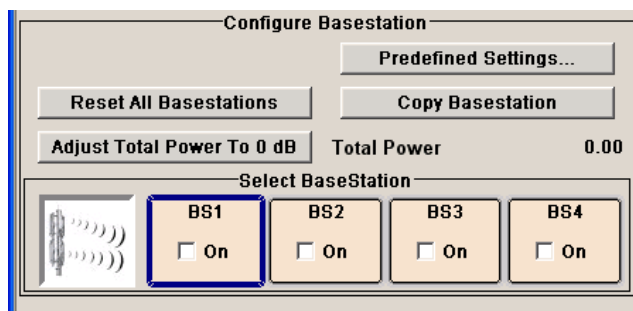
Predefined Settings Downlink
Calls menu for setting predefined configurations.

The menu is described in chapter 4.5, "Predefined Settings - Downlink", on page 44.

Additional Mobile Station
Calls menu for simulating up to 64 additional mobile stations.

The menu is described in chapter 4.6, "Additional Mobile Station - Uplink", on page 47.

Reset All Base Stations

Resets all base stations to the predefined settings. The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Parameter	Value
Base Station Configuration	
State	Off
Time Delay	0 chips
PN Offset	0
Transmit Diversity	Off
Quasi Orthogonal Walsh Set	1
State (all channels)	Off
Frame Length (0-5 / 0-7/ 0-10)	26.6 ms / 40 ms / 5 ms
Frame Length (all other channels)	20 ms
Data Rate (0-6,0-10,0-11,1-1,1-4,2-1,2-4)	9.6 kbps
Data Rate (0-7,0-9,1-2,1-3,2-2,2-3)	19.2 kbps
Data Rate (all other channels)	1.2 kbps
Walsh (0-2 / 0-5)	16 / 32
Walsh (1-1 / 1-2 / 1-3 / 2-1 / 2-2 / 2-3)	8 / 17 /18 /9 / 19 /20
Walsh (all other channels)	0
Power (0-1 / 0-6)	-7 dB / -6.62 dB
Power (0-5 , 1-1, 2-1 / 1-2, 1-3, 2-2, 2-3)	-12.72 dB / -9.72 dB
Power (all other channels)	0 dB
Data Source (0-1, 0-2, 0-3, 0-4)	All0
Data Source (all other channels)	PN9
Channel Coding (all Channels)	Complete

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:PRESet on page 117

Reset All Mobile Stations

Resets all mobile stations to the predefined settings. The following table gives an overview of the settings. The preset value for each parameter is specified in the description of the remote-control commands.

Parameter	Value
Mobile Station Configuration	
State	Off

Parameter	Value
Mode	Traffic
Radio Configuration	3
Channel Coding	Complete
LC Mask (hex)	0
State (all Channels)	Off
Frame Length	20 ms
Data Rate (2 / 3,4,5)	9.6 kbps / 1.5 kbps
Walsh (0 / 8 / 4 / 2 /6)	0 / 8 / 4 / 2 / 6
Spread (2 / 3,4,5)	32 / 16
Power	0 dB
Data Source	PN9

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:PRESet on page 150

Copy ...

Copies the settings of a base or mobile station to a second base or mobile station. A window opens for creating the destination station.

Window for the"Downlink / Forward" transmission direction:
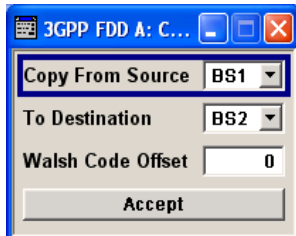
Window for the "Uplink / Reverse" transmission direction:
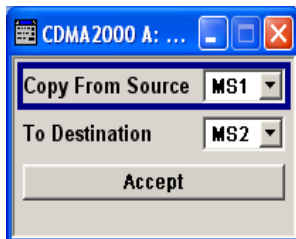
"Copy from Source"   Selects the base station or mobile station whose settings are to be copied.

"To Destination"Selects the base station or mobile station whose settings are to be overwritten.

"Walsh Code Offset (Base Station only)"	Enters the offset to be applied when copying the base station to the Walsh codes of the destination base station. The minimum value is 0 (Walsh codes are identical), the maximum value is 255.
"Accept"	Start the copy process.

SCPI command:

[:SOURce<hw>]:BB:C2K:COPY:SOURce on page 86

[:SOURce<hw>]:BB:C2K:COPY:DESTination on page 85

[:SOURce<hw>]:BB:C2K:COPY:COFFset on page 85

[:SOURce<hw>]:BB:C2K:COPY:EXECute on page 86

Adjust Total Power to 0dB

Sets the power of an enabled channel so that the total power of all the active channels is 0 dB. This will not change the power ratio among the individual channels.

SCPI command:

[:SOURce<hw>]:BB:C2K:POWer:ADJust on page 88

Total Power

Displays the total power of the active channels.

The total power is calculated from the power ratio of the powered up code channels with modulation on. If the value is not equal to 0 dB, the individual code channels (whilst still retaining the power ratios) are internally adapted so that the "Total Power" for achieving the set output level is 0 dB.

SCPI command:

[:SOURce<hw>]:BB:C2K:POWer[:TOTal] on page 88

Select ...

Selects the base or mobile station by pressing the accompanying button. This opens a menu for editing the selected base or mobile station.

The menus are described in sections chapter 4.7, "Base Station Configuration", on page 49 and chapter 4.10, "Mobile Station Configuration (MS)", on page 75.

SCPI command:
(the base station or mobile station is selected by the keyword index BSTation<i> or MSTation<i>.)

Base Station or Mobile Station On

Activates or deactivates the base or mobile station.
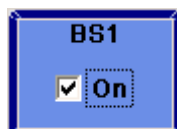
SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:STATe on page 145

[:SOURce<hw>]:BB:C2K:MSTation<st>:STATe on page 157

4.3 Filter/Clipping/ARB Settings

To access this dialog, select "Main Menu > Filter/Clipping".

The baseband filter, sample rate variation and clipping are defined in this menu. Generation of baseband signals according to IS2000 (cdma2000 standard) by inverting the Q-part of the signal is enabled in the "I/Q Settings" section.

4.3.1 Filter Settings

In the "Filter" section, the settings are made for the baseband filter.
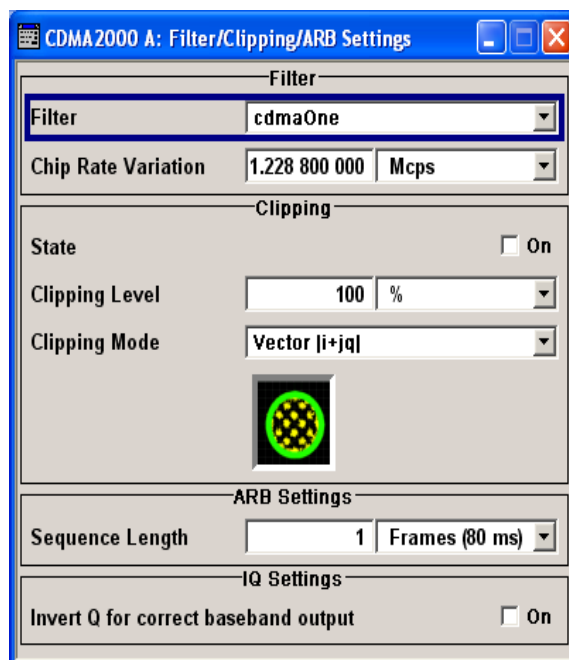
Filter
Sets the baseband filter.

"CdmaOne"   Uplink filter according to standard.

"CdmaOne+   Downlink filter according to standard.
Equalizer "

"CdmaOne   Non-standard filter for the uplink. This filter achieves better adjacent-
705kHz"   channel leakage ratio.

"CdmaOne   Non-standard filter for the downlink. This filter achieves better adjacent-
705kHz+ Equal-channel leakage ratio.
izer "

SCPI command:
[:SOURce<hw>]:BB:C2K:FILTer:TYPe on page 92

Roll Off Factor / BxT
Sets the filter parameter.

The filter parameter offered ("Roll Off Factor" or "BxT") depends on the currently selected filter type. This parameter is preset to the default for each of the predefined filters.

SCPI command:

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:APCO25 on page 93

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:COSine on page 93

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:GAUSs on page 94

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:PGAuss on page 94

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:RCOSine on page 95

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:SPHase on page 95

Cut Off Frequency Factor
(available for filter parameter "Lowpass" only)

Sets the value for the cut off frequency factor. The cut off frequency of the filter can be adjusted to reach spectrum mask requirements.

SCPI command:

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:LPASs on page 94

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:LPASSEVM on page 94

Chip Rate Variation
Enters the chip rate.

The chip rate entry changes the output clock and the modulation bandwidth.

SCPI command:

[:SOURce<hw>]:BB:C2K:CRATe:VARiation on page 87

Impulse Length
(For WinIQSIM2 only)

Displays the number of filter tabs. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

[:SOURce<hw>]:BB:C2K:FILTer:ILENgth:AUTO on page 92

[:SOURce<hw>]:BB:C2K:FILTer:ILENgth on page 92

Oversampling
(For WinIQSIM2 only)

Determines the upsampling factor. If the check box is activated, the most sensible parameter values are selected. The value depends on the coherence check. If the check box is deactivated, the values can be changed manually.

SCPI command:

[:SOURce<hw>]:BB:C2K:FILTer:OSAMpling:AUTO on page 93

[:SOURce<hw>]:BB:C2K:FILTer:OSAMpling on page 92

4.3.2 Clipping Settings

The settings for clipping are collected in the "Clipping" section.

Clipping State

Switches baseband clipping on and off.

Baseband clipping is a very simple and effective way of reducing the crest factor of the signal.

CDMA signals may have very high crest factors particularly with many channels and long sequences. High crest factors entail two basic problems:
● The nonlinearity of the power amplifier (compression) causes intermodulation which expands the spectrum (spectral regrowth).
● Since the level in the D/A converter is relative to the maximum value, the average value is converted with a relatively low resolution. This results in a high quantization noise.

Both effects increase the adjacent-channel power.

With baseband clipping, all the levels are limited to a settable value ("Clipping Level"). This level is specified as a percentage of the highest peak value. Since clipping is done prior to filtering, the procedure does not influence the spectrum. The EVM however increases.

Since clipping the signal not only changes the peak value but also the average value, the effect on the crest factor is unpredictable.

Example:

This example shows the effect of the Clipping on the crest factor for typical scenarios.

The following pictures demonstrate the affect of clipping with vector mode (|i+q|), using a signal configuration with 2 active channels.
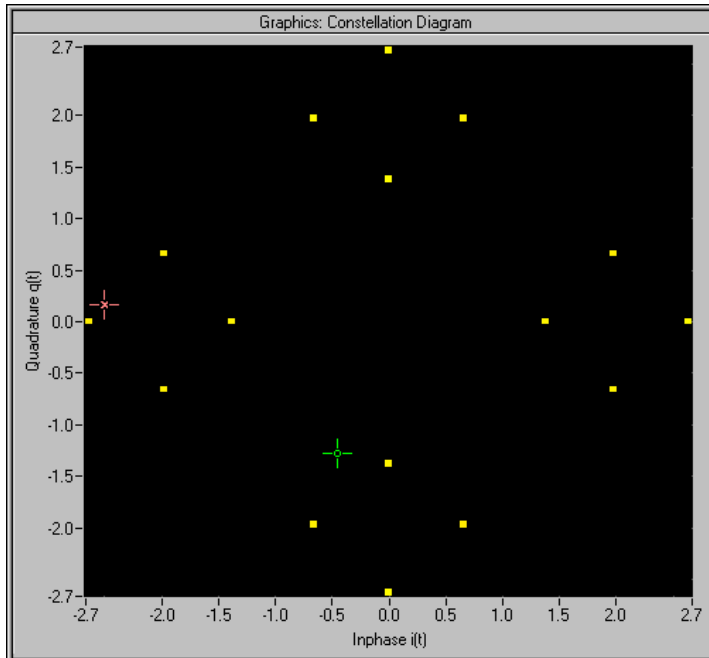

Fig. 4-1: Constellation diagram of the signal without clipping, shows the level mapping .
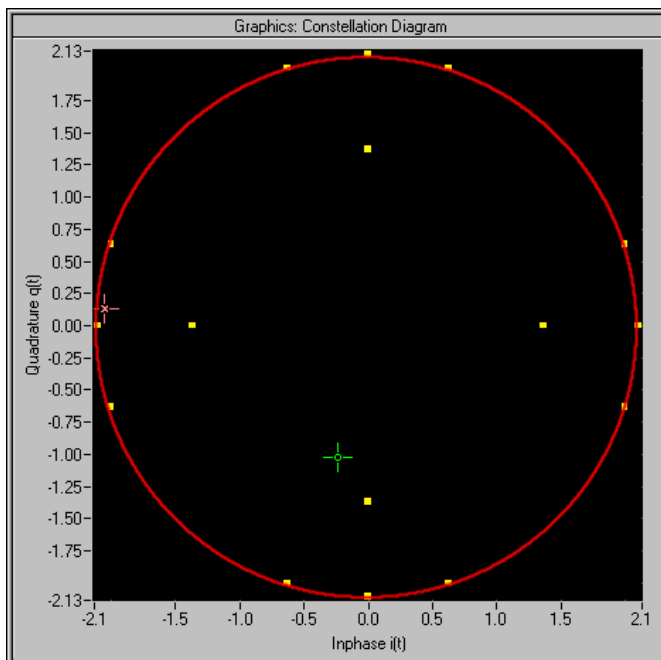
Fig. 4-2: Constellation diagram with clipping level 80 %, vector mode (|i+q|) The circle emphasizes the changed constellation points.

SCPI command:

[:SOURce<hw>]:BB:C2K:CLIPping:STATe on page 96

Clipping Level

Sets the limit for clipping.

This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

SCPI command:

[:SOURce<hw>]:BB:C2K:CLIPping:LEVel on page 95

Clipping Mode

Selects the clipping method. A graphic illustration of the way in which these two methods work is given in the menu.

"Vector | i + q |" The limit is related to the amplitude | i + q |. The I and Q components are mapped together, the angle is retained.

"Scalar | i | + | q The limit is related to the absolute maximum of all the I and Q values | i
|" | + | q | .

The I and Q components are mapped separately, the angle changes.

SCPI command:

[:SOURce<hw>]:BB:C2K:CLIPping:MODE on page 96

4.3.3 ARB Settings

The "ARB Settings" section is where the sequence length of the arbitrary waveform component is defined.

Sequence Length ARB

Changes the sequence length of the arbitrary waveform component of the CDMA signal in the number of frames. This component is calculated in advance and output in the arbitrary waveform generator. It is added to the realtime signal components.

The number of chips is determined from this sequence length (1 Frame = 80 ms) and the chip rate. At 1.2288 MChips/s a frame equals 98.304 chips.

In pure amplifier tests with several channels and no real time channels, it is possible to improve the statistical properties of the signal by increasing the sequence length.

Note: Unlike with 3GPP, in the case of CDMA2000 the length of a frame is not uniformly defined. A frame length of 80ms is used in the R&S Signal Generator. This is the same

frame length that the WinIQSIMsoftware uses for cdma2000 frames. Division into 80 ms frames was chosen because in this time grid the frame lengths for both the SYNC channel, with its cycle duration of 26.67 ms, and all other channels work out to 5 ms, 10 ms, 20 ms or 80 ms.The F-BCH has a frame length of 160 ms. In order to use this channel, an even number of 80 ms frames has to be set.

SCPI command:
[:SOURce<hw>]:BB:C2K:SLENgth on page 90

4.3.4 I/Q Setting

The "I/Q Setting" section is where the baseband signal can be inverted.

Invert Q for Correct Baseband Output
Inverts Q-part of the baseband signal. (see also chapter 3.12, "I/Q Modulator - Uplink and Downlink", on page 17)

"ON"   The signal on the baseband outputs meets the cdma2000 standard. In order to generate an RF signal that conforms to the standard, the I/Q Swap function in the I/Q Modulator menu must be enabled (On).

"OFF"   The signal on the baseband outputs does not meet the cdma2000 standard. It can however be mixed with other signals from the second baseband without any problem. In order to generate the RF signal, the I/Q Swap function in the I/Q Modulator menu must be disabled (Off).

SCPI command:
[:SOURce<hw>]:BB:C2K:IQSWap[:STATe] on page 87

4.4 Trigger/Marker/Clock Settings

The trigger, clock, and marker delay functions are available for R&S SMx and R&S AMU instruments only.

To access this dialog, select "Main Menu > Trigger/Marker".

The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.
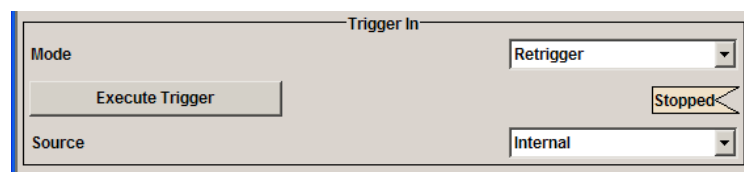
The "Marker Mode" section is where the marker signals at the MARKER output connectors are configured.
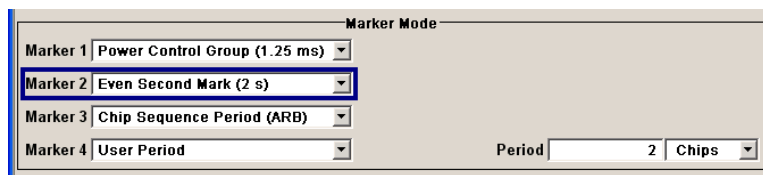
The "Marker Delay" section is where a marker signal delay can be defined, either without restriction or restricted to the dynamic section, i.e., the section in which it is possible to make settings without restarting signal and marker generation.

The "Clock Settings" section is where the clock source is selected and - in the case of an external source - the clock type.

The buttons in the last section lead to submenu for general trigger, clock and mapping settings.

4.4.1 Trigger In

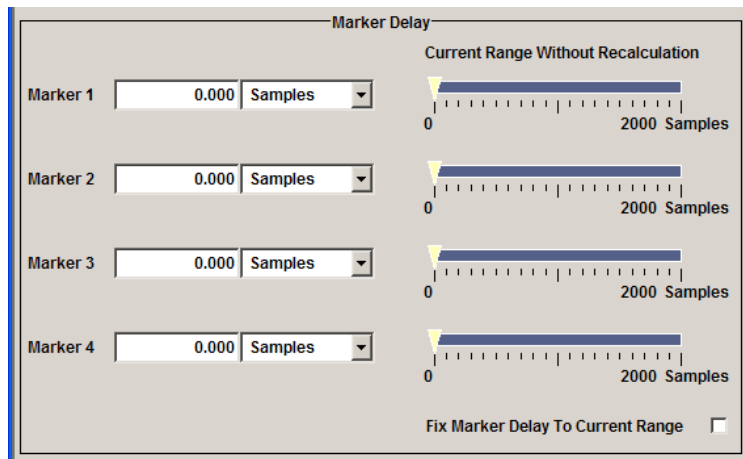The trigger functions are available for R&S SMx and R&S AMU instruments only.

The "Trigger In" section is where the trigger for the signal is set. Various parameters will be provided for the settings, depending on which trigger source - internal or external - is selected. The current status of signal generation ("Running" or "Stopped") is indicated for all trigger modes.
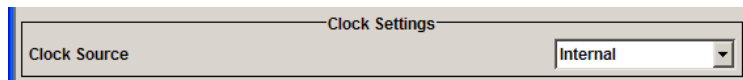
Trigger Mode

Selects trigger mode.

The trigger mode determines the effect of a trigger on the signal generation.

"Auto"   The signal is generated continuously.

"Retrigger"   The signal is generated continuously. A trigger event (internal or exter-
                  nal) causes a restart.

"Armed_Auto"   The signal is generated only when a trigger event occurs. Then the signal
                  is generated continuously.
                  Button "Arm" stops signal generation. A subsequent trigger event (inter-
                  nal with "Execute Trigger" or external) causes a restart.

"Armed_Retrig-   The signal is generated only when a trigger event occurs. Then the signal
ger"   is generated continuously. Every subsequent trigger event causes a
                  restart.
                  Button "Arm" stops signal generation. A subsequent trigger event (inter-
                  nal with "Execute Trigger" or external) causes a restart.

"Single"   The signal is generated only when a trigger event occurs. Then the signal
                  is generated once to the length specified at "Signal Duration".
                  Every subsequent trigger event (internal with "Execute Trigger" or exter-
                  nal) causes a restart.

SCPI command:

[:SOURce<hw>]:BB:C2K[:TRIGger]:SEQuence on page 100

Signal Duration Unit

Defines the unit for the entry of the length of the signal sequence to be output in the Single
trigger mode. Available units are chip sequence length (CLS), chips or frames.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:SLUNit on page 104

Signal Duration

Defines the length of the signal sequence to be output in the "Single" trigger mode.

It is possible to output deliberately just part of the signal, an exact sequence of the signal,
or a defined number of repetitions of the signal.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:SLENgth on page 103

Running/Stopped

Displays the status of signal generation for all trigger modes. This display appears only
when signal generation is enabled ("State" On).

"Running"   The modulation signal is generated; a trigger was (internally or exter-
                  nally) initiated in triggered mode.
                  If "Armed_Auto" and "Armed_Retrigger" have been selected, generation
                  of signals can be stopped with the "Arm" button. A new trigger (internally
                  with "Execute Trigger" or externally) causes a restart.

"Stopped"   The signal is not generated, and the instrument waits for a trigger event
                 (internal or external).

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:RMODe on page 103

Arm

Stops signal generation. This button appears only with "Running" signal generation in the
"Armed_Auto" and "Armed_Retrigger" trigger modes.

Signal generation can be restarted by a new trigger (internally with "Execute Trigger" or
externally).

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:ARM:EXECute on page 101

Execute Trigger

(Trigger for R&S SMx and R&S AMU instruments only)

Executes trigger manually. A manual trigger can be executed only when an internal trigger source and a trigger mode other than "Auto" have been selected.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:EXECute on page 101

Trigger Source

Selects trigger source. This setting is effective only when a trigger mode other than
"Auto" has been selected.

"Internal"   The trigger event is executed by "Execute Trigger".

"Internal (Base- (two-path instruments only)
band A/B)"   The trigger event is executed by the trigger signal from the second path

"External   The trigger event is executed with the aid of the active edge of an external
(TRIGGER 1 /   trigger signal.
2)"   The trigger signal is supplied via the TRIGGER connector.
                  The polarity, the trigger threshold and the input impedance of the TRIGGER input can be set in the "Global Trigger/Clock Settings" dialog.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:SOURce on page 104

Sync. Output to External Trigger

(enabled for "Trigger Source" External)

Enables/disables output of the signal synchronous to the external trigger event.

For R&S SMBV instruments:

For or two or more R&S SMBVs configured to work in a master-slave mode for synchronous signal generation, configure this parameter depending on the provided system trigger event and the properties of the output signal. See the table below for an overview of the required settings.

Table 4-1: Typical Applications

System Trigger	Application	"Sync. Output to External Trigger"
Common External Trigger event for the master and the slave instruments	All instruments are synchronous to the external trigger event	ON
	All instruments are synchronous among themselves but starting the signal from first symbol is more important than synchronicity with external trigger event	OFF
Internal trigger signal of the master R&S SMBV for the slave instruments	All instruments are synchronous among themselves	OFF

"On"　　　　　　　Corresponds to the default state of this parameter.
　　　　　　　　　　The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.
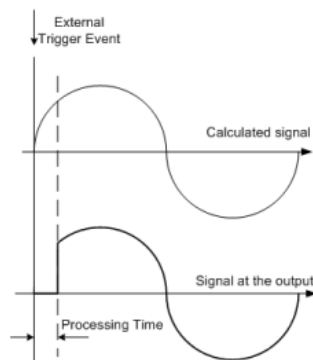
"Off"　　　　　　　The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.
　　　　　　　　　　This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.

SCPI command:
[:SOURce<hw>]:BB:C2K:TRIGger:EXTernal:SYNChronize:OUTPut

Trigger Delay

Sets the trigger signal delay in samples on external triggering or on internal triggering via the second path.

Sets the trigger signal delay in samples on external triggering.

This enables the R&S Signal Generator to be synchronized with the device under test or other external devices.

For two-path instruments, the delay can be set separately for each of the two paths.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger[:EXTernal<ch>]:DELay on page 105

[:SOURce<hw>]:BB:C2K:TRIGger:OBASeband:DELay on page 102

Trigger Inhibit

Sets the duration for inhibiting a new trigger event subsequent to triggering. The input is to be expressed in samples.

In the "Retrigger" mode, every trigger signal causes signal generation to restart. This restart is inhibited for the specified number of samples.

This parameter is only available on external triggering or on internal triggering via the second path.

For two-path instruments, the trigger inhibit can be set separately for each of the two paths.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger[:EXTernal<ch>]:INHibit on page 105

[:SOURce<hw>]:BB:C2K:TRIGger:OBASeband:INHibit on page 102

4.4.2 Marker Mode

The marker output signal for synchronizing external instruments is configured in the "Marker Settings" section "Marker Mode".

The R&S SMBV supports only two markers.

Marker Mode

Selects a marker signal for the associated "MARKER" output.

"Power Control Group (1.25 ms)"
A marker signal is generated at the start of each Power Control Group (every 1,25 ms).

"Radio Frame (20 ms)"
A marker signal is generated every 20 ms (traffic channel frame clock).

"Sync Channel Frame (26.6 ms)"	A marker signal is generated at the beginning of each Sync Channel Frame (every 26,6 ms).
"Superframe (80 ms)"	A marker signal is generated every 80 ms (super frame clock).
"Even Second Mark (2 s)"	A marker signal is generated every 2 seconds.
"Chip Sequence Period (ARB)"	A marker signal is generated at the beginning of every Arbitrary Waveform sequence (depending on the set sequence length). The marker signal is generated regardless of whether or not an ARB component is actually used.
"ON/OFF Period"	A regular marker signal that is defined by an ON/OFF ratio is generated. A period lasts one ON and OFF cycle.
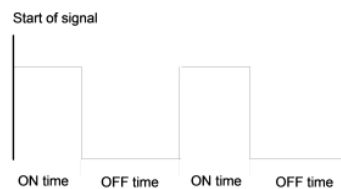
The "ON Time" and "OFF Time" are each expressed as a number of samples and are set in an input field which opens when ON/OFF ratio is selected.

SCPI command:
`[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:ONTime` on page 109
`[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:OFFTime` on page 109

"User Period"	A marker signal is generated at the beginning of every user-defined period. The period is defined in "Period".

SCPI command:
`[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:PERiod` on page 109

SCPI command:
`[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:MODE` on page 108

4.4.3 Marker Delay

The delay of the signals on the MARKER outputs is set in the"Marker Delay" section.

The marker delay functions are available for R&S SMx and R&S AMU instruments only.

The R&S SMBV supports only two markers.

Marker x Delay
Enters the delay between the marker signal at the marker outputs and the start of the frame or slot.

The input is expressed as a number of symbols/samples.

If the setting "Fix marker delay to dynamic range" is enabled, the setting range is restricted to the dynamic range. In this range the delay of the marker signals can be set without restarting the marker and signal.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:DELay on page 107

Current Range without Recalculation
Displays the dynamic range within which the delay of the marker signals can be set without restarting the marker and signal.

The delay can be defined by moving the setting mark.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:DELay:MINimum on page 107
[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:DELay:MAXimum on page 107

Fix marker delay to current range
Restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal.

SCPI command:

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut:DELay:FIXed on page 106

4.4.4 Clock Settings

The "Clock Settings" is used to set the clock source and a delay if required.

The clock functions are available for R&S SMx and R&S AMU instruments only.

Sync. Mode
(for R&S SMBV only)

Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type.
Avoid unnecessary cable length and branching points.

"None"   The instrument is working in stand-alone mode.

"Sync. Master"   The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.
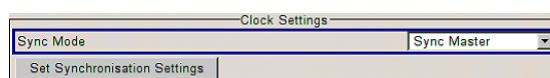
"Sync. Slave"   The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.
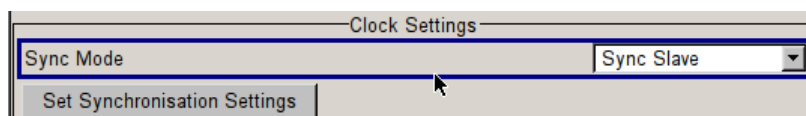
SCPI command:

[:SOURce<hw>]:BB:C2K:CLOCk:SYNChronization:MODE on page 99

Set Synchronization Settings
(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchronization mode, selected with the parameter "Synchronization Mode".

SCPI command:

[:SOURce<hw>]:BB:C2K:CLOCk:SYNChronization:EXECute on page 98

Clock Source
Selects the clock source.

"Internal"   The internal clock reference is used to generate the symbol clock.

"External"   The external clock reference is fed in as the symbol clock or multiple thereof via the CLOCK connector.
The symbol rate must be correctly set to an accuracy of +/-2 % (see data sheet).
The polarity of the clock input can be changed with the aid of "Global Trigger/Clock Settings".
In the case of two-path instruments this selection applies to path A.

SCPI command:

[:SOURce<hw>]:BB:C2K:CLOCk:SOURce on page 98

Clock Mode
Enters the type of externally supplied clock.

"Chip"   A chip clock is supplied via the CLOCK connector.

"Multiple"   A multiple of the chip clock is supplied via the CLOCK connector; the chip clock is derived internally from this.
The "Multiplier" window provided allows the multiplication factor to be entered.

SCPI command:

[:SOURce<hw>]:BB:C2K:CLOCk:MODE on page 97

Clock Multiplier
Enters the multiplication factor for clock type "Multiple".

SCPI command:

[:SOURce<hw>]:BB:C2K:CLOCk:MULTiplier on page 97

Measured External Clock

Indicates the measured frequency of the external clock signal. This enables the user to permanently monitor the frequency of the externally introduced clock.

This information is displayed only if the external clock source has been selected.

SCPI command:
`CLOC:INP:FREQ?`

4.4.5 Global Settings

The buttons in this section lead to submenu for general trigger, clock and mapping settings.

Global Trigger/Clock Settings

Calls the "Global Trigger/Clock/Input Settings" dialog.

This dialog is used among other things for setting the trigger threshold, the input impedance and the polarity of the clock and trigger inputs.

In the case of two-path instruments, these settings are valid for both paths.

The parameters in this menu affect all digital modulations and standards, and are described in chapter "Global Trigger/Clock/Input Settings" in the Operating Manual.

User Marker / AUX I/O Settings

Calls the "User Marker AUX I/O Settings" menu, used used to map the connector on the rear of the instruments.

See also "User Marker / AUX I/O Settings" in the Operating Manual.

4.5 Predefined Settings - Downlink

The "Predefined Settings" can be reached via the "CDMA2000" main menu. It is only available when the Downlink transmission direction is selected. The channel table of base station 1 is filled (preset) with the set parameters.

With the "Predefined Settings" function, it is possible to create highly complex scenarios with just a few keystrokes. This function is of use if, say, just the envelope of the signal is of interest.

In the top section of the menu, the radio configuration of the test scenario and the used special channels are selected.

A separate set of settings of all predefined parameters is provided for each radio configuration. If the radio configuration is changed, the set of traffic channel settings belonging to this RC is automatically indicated.
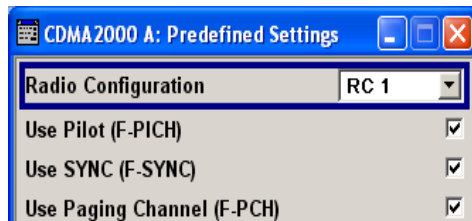
In the "Traffic Channel Settings" section, the number and the structure of the traffic channels used in the test scenario is set. The selected structure is valid for all activated traffic channels.

The indicated parameters depend on the radio configuration. Their settings are specific for the selected radio configuration.
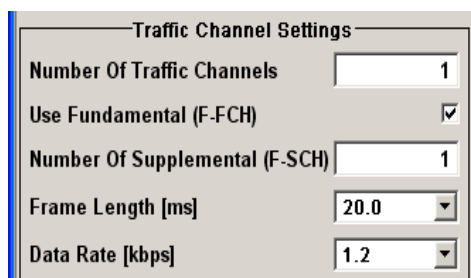
In the bottom section of the menu, the desired range for the crest factor is selected. Button "Accept" presets the channel table of base station 1 with the predefined parameters.
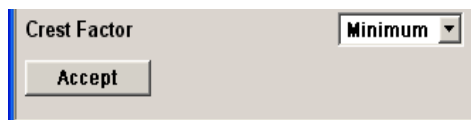
Radio Configuration - Predefined Settings
Selects the radio configuration (RC).

The R&S Signal Generator provides a separate set of settings of all predefined traffic channel parameters for each radio configuration. If the radio configuration is changed, the set of traffic channel table values belonging to this RC is automatically activated.

SCPI command:
[:SOURce<hw>]:BB:C2K:PPARameter:RCONfiguration on page 111

Use Pilot (F-PICH) - Predefined Settings
Selects if pilot channel F-PICH is used in the scenario or not.

SCPI command:
[:SOURce<hw>]:BB:C2K:PPARameter:PICHannel[:STATe] on page 111

Use Sync (F-Sync) - Predefined Settings
Selects if sync channel F-SYNC is used in the scenario or not.

SCPI command:
[:SOURce<hw>]:BB:C2K:PPARameter:SCHannel[:STATe] on page 112

Use Paging Channel (F-PCH) - Predefined Settings

Selects if paging channel F-PCH is used in the scenario or not.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:PCHannel[:STATe] on page 111

Number of Traffic Channels - Predefined Settings

Sets the number of activated traffic channels. Channels F-DCCH, F-FCH, and F-SCH
form a traffic channel.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:COUNt on page 112

Use Dedicated Control (F-DCCH) - Predefined Settings

Selects if the dedicated control channel F-DCCH is activated for the traffic channel or not.
PN9 is used as data source for F-DCCH.

The set state is specific for the selected radio configuration.

F-DCCH cannot be activated for radio configuration RC1 and RC2.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:DCCHannel[:STATe]
on page 113

Use Fundamental (F-FCH) - Predefined Settings

Selects if the fundamental channel F-FCH is activated for the traffic channel or not. PN9
is used as data source for F-FCH. The set value is specific for the selected radio config-
uration.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:FCHannel[:STATe]
on page 113

Number of Supplemental (F-SCH) - Predefined Settings

Sets the number of activated supplemental channels F-SCH. PN9 is used as data source
for F-SCH. The set value is specific for the selected radio configuration.

The maximum number depends on the selected radio configuration:
● RC1 and RC2: 0 ... 7
● RC3, RC4, and RC5: 0 ... 2

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:SCHannel:COUNt
on page 114

Frame Length - Predefined Settings

Sets the frame length of the traffic channel. The set value is specific for the selected radio
configuration.

The value range for the frame length depends on the selected radio configuration:
● RC1 and RC2: 20 ms
● RC3 to RC5: 5, 20, 40 and 80 ms

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:FLENgth on page 113

Data Rate - Predefined Settings

Sets the data rate for F-FCH and all F-SCH. The set value is specific for the selected radio configuration.

The value range depends on the set frame length.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:DATA:RATE on page 112

Crest Factor - Predefined Settings

Selects desired range for the crest factor of the test scenario. The crest factor of the signal is kept in the desired range by automatically setting appropriate Walsh Code Numbers.

"Minimum"	The crest factor is minimized by assigning Walsh codes which are chosen as close as possible.
"Average"	An average crest factor is set. The Walsh codes are distributed uniformly over the code domain.
"Worst"	The crest factor is set to an unfavorable value (i.e. maximum) by assigning Walsh codes which are separated as widely as possible.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:CRESt on page 110

Accept - Predefined Settings

Presets the channel table of base station 1 with the parameters defined in the "Predefined Settings" menu. Base station one is switched on, the other base stations are switched off.

SCPI command:

[:SOURce<hw>]:BB:C2K:PPARameter:EXECute on page 110

4.6 Additional Mobile Station - Uplink

Submenu "Additional User Equipment" can be reached via the "CDMA2000" main menu. It is only available when the Uplink transmission direction is selected.

The menu makes it possible to simulate up to 64 additional mobile stations and thus to generate a signal that corresponds to the received signal for a base station with high capacity utilization.

The fourth mobile station (MS4) serves as a template for all other stations. The following parameters are the only ones modified for the additional mobile stations:

● LC Mask Step (different for all stations)
● Power (different to MS4, but identical among themselves)
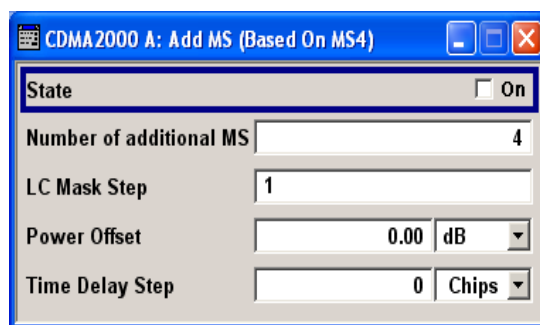
State - Additional MS

Activates additional mobile stations. At "State Off", all the additional mobile stations are switched off.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:STATe on page 149

Number of Additional MS

Sets the number of additional mobile stations. As many as 64 additional mobile stations can be simulated.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:COUNt on page 148

LC Mask Step - Additional MS

Enters the step width for increasing the LC mask of the additional mobile stations. The start value is the scrambling code of MS4.

The Long Code generator mask serves for channel-specific and user-specific scrambling of the code channel.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:LCMask:STEP on page 149

Power Offset - Additional MS

Sets the power offset of the active channels of the additional mobile stations to the power outputs of the active channels of MS4.

The resultant power must fall within the range 0 ... - 80 dB. If the value is above or below this range, it is limited automatically.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:POWer:OFFSet on page 149

Time Delay Step - Additional MS

Enters the step width for the time delay of the additional mobile stations to one another. The start value returns the time delay of MS4. Entry is made in chips and can be a maximum of 1 frame.

The time delay allows mobile stations to be simulated even if the arrival of their signals is not synchronized at the base station.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:TDELay:STEP on page 149

4.7 Base Station Configuration

The "Base Station Configuration" menu is called by selecting base station "BS1" ... "BS4" in the "CDMA2000" menu. Base stations can be configured independently of one another. Base station 1 (BS1) also includes real time channels.

The menu comprises the "Common Settings" section, in which the general parameters of the base station are set, a row containing the buttons "Code Domain..." and "Channel Graph...", which call the appropriate graphics and the most important part, the channel table.

CDMA2000 A: Basestation1

Common Settings

State	Off		Transmit Diversity	Off
Time Delay	0 Chips		Diversity Mode	OTD
PN Offset	0		Quasi orth. Walsh Set	1

Code Domain...   Channel Graph...

	Channel Type	Real Time	RC	Frame Length [ms]	Data Rate [kbps]	Walsh	Q. Orth.	Power [dB]	Data	Dlist Pattern	More Params	State	Dom Conf
0-1	F-PICH			20.0	NotUsd	0		-7.00	All 0		Config..	On	
0-2	F-TDPICH			20.0	NotUsd	16		0.00	All 0		Config..	Off	
0-3	F-APICH			20.0	NotUsd	0		0.00	All 0		Config..	Off	
0-4	F-ATDPICH			20.0	NotUsd	0		0.00	All 0		Config..	Off	
0-5	F-SYNC	Off		26.6	1.2	32		-12.72	PN 9		Config..	On	
0-6	F-PCH			20.0	9.6	1		-6.72	PN 9		Config..	On	
0-7	F-BCH			40.0	19.2	0		0.00	PN 9		Config..	Off	
0-8	F-QPCH			20.0	4.8	0		0.00	PN 9		Config..	Off	
0-9	F-CPCCH			20.0	19.2	0		0.00	PN 9		Config..	Off	
0-10	F-CACH			5.0	9.6	0		0.00	PN 9		Config..	Off	
0-11	F-CCCH			20.0	9.6	0		0.00	PN 9		Config..	Off	
0-12	F-PDCCH		10			0		0.00	PN 9		Config..	Off	
0-13	F-PDCCH		10			0		0.00	PN 9		Config..	Off	
0-14	F-PDCH		10					0.00	PN 9		Config..	Off	
1-1	F-FCH	Off	3	20.0	9.6	8	Off	-12.72	PN 9		Config..	On	
1-2	F-SCH1	Off	3	20.0	19.2	17	Off	-9.72	PN 9		Config..	On	
1-3	F-SCH2	Off	3	20.0	19.2	18	Off	-9.72	PN 9		Config..	On	
1-4	F-DCCH	Off	3	20.0	9.6	0	Off	0.00	PN 9		Config..	Off	
2-1	F-FCH		3	20.0	9.6	9	Off	-12.72	PN 9		Config..	On	
2-2	F-SCH1		3	20.0	19.2	19	Off	-9.72	PN 9		Config..	On	

4.7.1 Common Settings

The general parameters of the base station are set in the "Common Settings" section.

State - BS
Activates or deactivates the selected base station.

SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:STATe on page 145

Transmit Diversity - BS
Switches transmit diversity on and off.

The signal can be sent simultaneously on several antennas. Various forms of transmit diversity are described in the CDMA2000 standard. Different coding is used to divide the signal between the two antennas. As a result, the receiver can decode the traffic signal from the two input signals and is less liable to fading and other interference. The R&S Signal Generator can simulate the signal of one of the two antennas.

To activate transmit diversity, the antennas whose signals are to be simulated must be specified. The signal is generated differently depending on the selected antenna

Two diversity schemes for the calculation of the signals are available for selection at "Diversity Mode".

"Off"   No transmit diversity

"Antenna 1"   Calculate and apply the output signal for antenna 1. The diversity scheme is selected at "Diversity Mode".

"Antenna 2"   Calculate and apply the output signal for antenna 2. The diversity scheme is selected at "Diversity Mode".

SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:TDIVersity on page 146

Diversity Mode - BS
Selects the diversity scheme for "Transmit Diversity".

The diversity scheme defines the calculation mode of the signal for the selected antenna (at Transmit Diversity).

"OTD"   Orthogonal Transmit Diversity Mode. A forward link transmission method which distributes forward link channel symbols among multiple antennas and spreads the symbols with a unique Walsh or quasi-orthogonal function associated with each antenna.

"STS"   Space Time Spreading Mode. A forward link transmission method which transmits all forward link channel symbols on multiple antennas and spreads the symbols with complementary Walsh or quasi-orthogonal functions.

SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:TDIVersity:MODE on page 147

Time Delay - BS
Enters the time delay of the signal of the selected base station compared to the signal of base station 1.

Note: For base station 1, this value is always 0 and read-only.

SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:TDELay on page 146

PN Offset - BS
Enters the PN offset (short code).

The PN offset determines the start phase of these PN short-code sequences (see chapter 3.8, "PN Short-Code Scrambling - Downlink", on page 14).

This permits signals of different base stations to be distinguished.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:PNOFfset` on page 145

Quasi orth Walsh Set - BS

Selects the Quasi Orthogonalen Walsh Set. The standard defines three different sets.

The so-called 'quasi-orthogonal Walsh sets' can be used in addition to the Walsh codes. They increase the number of possible channels and thus extend the base-station capacity. When the quasi-orthogonal Walsh code is used, spreading the data stream results in complex spreading also through an additional rotation of the output phase (the spreading code then consists of a real and an imaginary part).

In the channel table, a decision can be made for each channel whether the Walsh code of the standard set or of the quasi-orthogonal set should be used. The quasi-orthogonal Walsh codes are used if "On" is activated in column "Q. Orth".

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:QWSet` on page 145

Code Domain Graph - BS

Opens the code domain display to visually check the signal (see chapter 4.7.2, "Code Domain and Channel Graphs", on page 51).

SCPI command:
n.a.

4.7.2 Code Domain and Channel Graphs

The Walsh codes of variable length used by CDMA2000 are the so-called Hadamard codes.

The structure of these codes is explained below. The code matrix of the order N+1 is obtained from the matrix N by extending the latter to the right and downwards through copying and downwards to the right by copying and inversion.
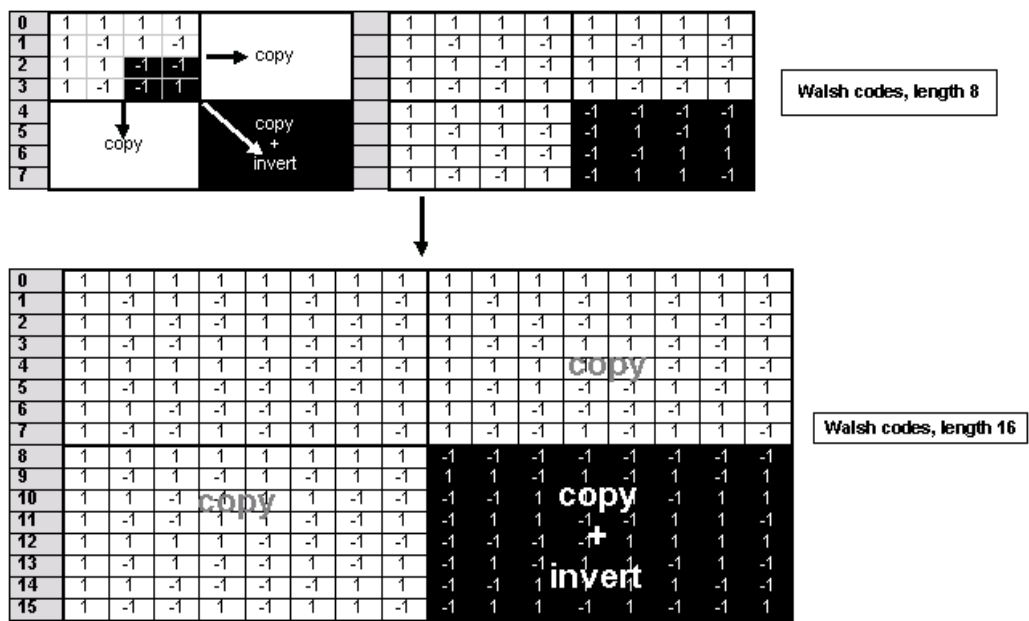
Fig. 4-3: Generation scheme of Walsh code

Walsh codes of the lengths 4, 8, 16, 32, 64, and 128 are used in CDMA2000 with spreading rate 1. The greater the spreading factor / Walsh code length, the smaller the useful symbol rate prior to spreading and vice versa.

In contrast to the spreading codes of 3GPP, Walsh codes of short lengths (low spreading factor) do not occupy a block area in a Walsh matrix of larger spreading factor. Several lines (ratio of the two spreading factors) are occupied in the matrix with a higher spreading factor, distributed over the whole matrix. This behavior is illustrated in the diagram below. This results from the structuring scheme of the Walsh codes that are obtained by copying and inverting the next smaller matrix.
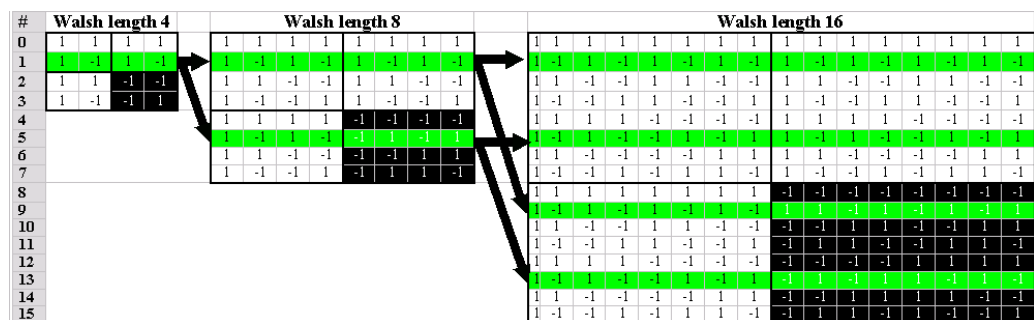
Fig. 4-4: Walsh code tree

If a Walsh code with the length 4 and index 1 is used, codes 1 and 5 are disabled at the length 8, and codes 1, 5, 9 and 13 at the length 16 because codes of greater length contain the output code of shorter length (or its inversion).

When using such conflicting Walsh codes simultaneously, the signals of the associated code channels are mixed so that they can no longer be separated in the receiver. Orthogonality will then be lost.

The matrix range with the highest spreading factor (i.e. 128), which is based on the spreading code selected in the code tree, is then defined as domain of a specific Walsh spreading code. Using a spreading code means that its entire domain is used.

The "Code Domain" graphic shows the assignment of active code channels in the code domain. The upper part shows the code domain of the standard Walsh set, the lower part the code domain of quasi-orthogonal Walsh sets.

The code numbers are plotted on the X axes, the colored bars show the code channels. The legend at the left of the graph indicates the assignment of colors to the spreading factors. An additional color is reserved for the packet channel F-PDCH because this channel may be assigned to more than one code channel. The height of the bars indicates the power of the code channel.
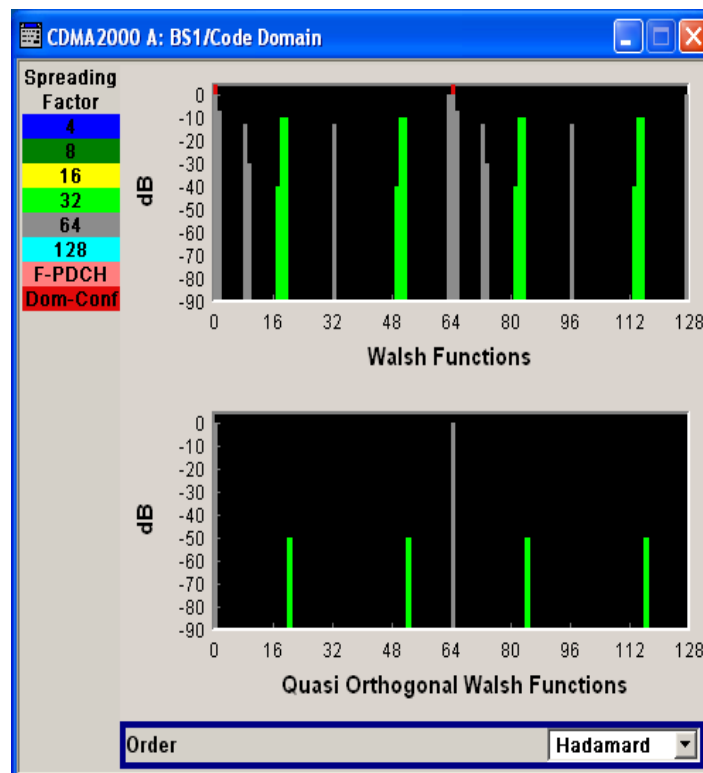
In this display assignment of the domains can be seen at a glance. Compared to 3GPP it is however much more difficult to see whether the code domains of different channels overlap, i.e. whether there is a domain conflict. This is due to the structure of the Walsh codes described above. The reason is that no block areas are occupied in the domain but several areas of minimum width are distributed over the whole domain.

Therefore, the occurrence of a domain conflict is indicated by a red dot marking the involved channels. In addition, in the channel table, a code domain conflict with an is indicated in column "Do Conf" on the far right of the graph by a red dot and the orange-colored column.

	Channel Type	Real Time	RC	Frame Length [ms]	Data Rate [kbps]	Walsh	Q. Orth.	Power [dB]	Data	Dlist Pattern	More Params	State	Dom Conf
14	F-PDCH		10					0.00	PN 9		Config..	Off	
31	F-FCH	Off	4	20.0	9.6	0	Off	0.00	PN 9		Config..	Off	
32	F-SCH31	Off	4	20.0	9.6	0	On	0.00	PN 9		Config..	On	●
33	F-SCH32	Off	4	20.0	9.6	1	Off	0.00	PN 9		Config..	On	●
34	F-DCCH	Off	4	20.0	9.6	2	Off	0.00	PN 9		Config..	On	
41	F-FCH		5	20.0	14.4	3	Off	0.00	PN 9		Config..	On	

ⓘ The graph is calculated from the settings that have been made. A change in the settings results at once in a chance of the graphical display.

Order - Code Domain BS

Switches the order of the spreading codes.

"Hadamard"   The code channels are displayed in the order determined by the Hadamard matrix. The codes are numbered as Walsh codes according to the standard.

"Bit reversed"   The code channels are displayed in the order defined by the Orthogonal Variable Spreading Factor (OVSF) code tree (3GPP code).
The Walsh codes and their generation scheme are closely related to the spreading codes of 3GPP. Basically, the same spreading sequences are used, only the order in the respective code trees is different.
According to 3GPP TS 25.213 the following code tree is used:
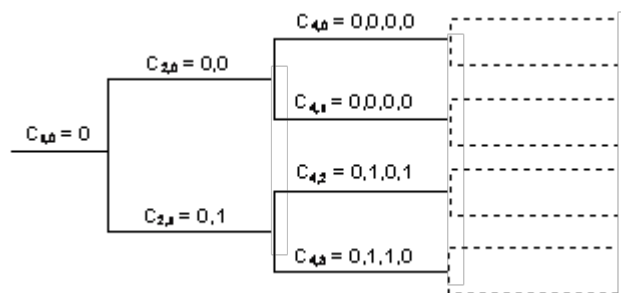
To find a 3GPP code that corresponds to a CDMA2000 code, the bit-inverted line (line index) has to be selected in the 3GPP matrix of identical spreading factor.

Example:

The 3GPP spreading code matching line 10 of the 16-bit Walsh code matrix is searched for. The binary form of the line index 10 (with 4 bits, because of Walsh length $16 = 2^4$) is 1010. The bit-inverted index is 0101, i.e. 5 in decimal notation. This means that the Walsh code No. 10 with the length 16 corresponds to the 3GPP spreading code 5 of the same length (spreading factor).
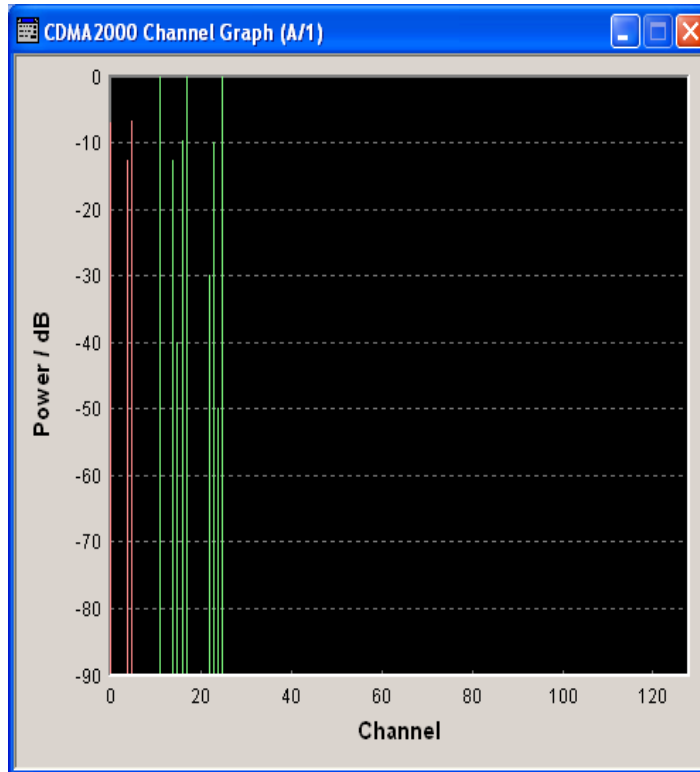
SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict:MODE on page 137

Channel Graph - Base Station
Opens the channel graph display to visually check the configured signal.

The channel graph display shows the active code channels. The channel number is plotted on the X axis. The red bars represent the special channels, the green bars the traffic channels. The channel index is plotted on the X-axes. The height of the bars shows the relative power of the channel.

The graph is calculated from the settings that have been made.

SCPI command:
n.a.

4.7.3 Channel Table - BS

The "channel table" is located in the lower part of the menu. The channel table is where the individual channel parameters are set.

Up to 78 channels are available for each base station. Channels 0-1 to 0-11 are assigned to the special channels which are responsible for the correct communication between base station and mobile station. The packet channels (0-12 to 0-14) and the traffic channels (1-0 and above) transmit the data.

A traffic channel is used for transmitting the radio link information, i.e. for communication with the addressee. The traffic channels consists of a dedicated channel, a fundamental channel and, depending on the radio configuration of up to 7 supplemental channels.

The packet data channel and the packet data control channels are used for transmitting data packets (packet data service) usually at higher data rates than is the case with purely circuit-mode traffic channels. The radio configuration of these channels is defined as 10 in accordance with the cdma2000 standard.

The number of sub channels and the sub channel types of a traffic channel depend on the selected radio configuration. The radio configuration can be set separately for each traffic channel and is the same for all sub channels of this traffic channel. It determines among other things the channel coding types, the frame lengths and the data rates that can be used and the settings of fixed parameter , e.g. CRC length. The R&S Signal Generator provides a separate set of settings of all channel table parameters for each radio configuration. Thus, when the radio configuration is changed, the current set of settings is internally stored for the old radio configuration and the complete set of settings belonging to the new radio configuration is activated and indicated in the channel table.

Channel 0-5 (F-SYNC) and the first traffic channel can be generated in real time.

	Channel Type	Real Time	RC	Frame Length [ms]	Data Rate [kbps]	Walsh	Q. Orth.	Power [dB]	Data	Dlist Pattern	More Params	State	Dom Conf
1	F-PICH			20.0	1.2	0	Off	0	PN 9		Config..	On	
2	F-TDPICH			20.0	1.2	0	Off	0	PN 9		Config..	On	
3	F-APICH			20.0	1.2	0	Off	0	PN 9		Config..	On	
4	F-ATDPICH			20.0	1.2	0	Off	0	PN 9		Config..	On	
5	F-SYNC	On		20.0	2.4	0	Off	0	PN 9		Config..	On	
6	F-PCH			20.0	9.6	0	Off	0	PN 9		Config..	On	
7	F-BCH			20.0	9.6	0	Off	0	All 1		Config..	On	
8	F-QPCH			20.0	1.2	0	Off	0	PN 9		Config..	On	
9	F-CPCCH			20.0	1.2	0	Off	0	PN 9		Config..	On	
10	F-CACH			20.0	1.2	0	Off	0	PN 9		Config..	On	
11	F-CCCH			20.0	1.2	0	Off	0	PN 9		Config..	On	
12	F-PDCCH		10			0	Off	0	PN 9		Config..	Off	
13	F-PDCCH		10			0	Off	0	PN 9		Config..	On	

Channel Number - BS
Displays the channel numbers.

The channel number is made up of 2 numbers. If the first number is 0 it identifies the special channels, i.e. the control channels and packet channels. A first number of 1 to 8 designates the traffic channels. The second number refers consecutively to the special channels or the sub-channels of a traffic channel.

All available channels are always displayed, even those that are inactive. The number of sub-channels per traffic channel 1 (four or eight) depends on the chosen radio configuration.

Each channel is switched on and off by the "On/Off" button in the "State" column.

SCPI command:
During remote control the channel is selected via the suffix to the key-
words `:CGRoup<n>:COFFset<n>`. Then `CGRoup0` selects the special channels group, `CGRoup1 to 8` the traffic channel. `COFFset1 to 14` selects either the special channel or the code channel of a traffic channel. E.g. `:CGRoup0:COFFset14` selects the packet channel F-PDCH, `:CGRoup3:COFFset1` selects the F-FCH of traffic channel 3.

Channel Type - BS
Indication of the channel type (see following table).

Table 4-2: List of supported channel types and their sequence in the CDMA2000 channel table

Index	Shortform	Name	Function
0-1	F-PICH	Forward Pilot Channel	The base station continuously transmits the pilot channel. This channel provides capabilities for soft **handoff** and coherent detection. Handoff is a procedure where a mobile with an on-going call changes channel and/or base station under the supervision of the network. The Walsh code is 0.
0-2	F-TDPICH	Forward Transmit Diversity Pilot Channel	The base station continuously transmits this pilot channel from the secondary antenna when transmit diversity is enabled.
0-3	F-APICH	Forward Auxiliary Pilot Channel	This pilot channel transmits the base station as an option.
0-4	F-ATDPICH	Forward Auxiliary Transmit Diversity Pilot Channel	The base station optionally transmits this pilot channel from the secondary antenna when transmit diversity is enabled.
0-5	F-SYNC	Forward Synchronisation Channel	The synchronization channel enables the mobile station to synchronize with the base station. It contains the PN offset, the system time and the long code status, information about the paging channel, together with the system ID and the network ID. The Walsh code is 32.
0-6	F-PCH	Forward Paging Channel	The paging channel carries control information specific to a mobile station when the network does not know where the mobile station is located.
0-7	F-BCCH	Forward Broadcast Channel	The broadcast channel is used to broadcast system- and cell-specific information.
0-8	F-QPCH	Forward Quick Paging Channel	The paging channel contains short form information for the mobile station, particularly if the latter is not transmitting.
0-9	F-CPCCH	Forward Common Power Control Channel	
0-10	F-CACH	Forward Common Assignment Channel	
0-11	F-CCCH	Forward Common Control Channel	General channel for transmitting control information. It also provides a mean for paging functions but it supports different data rates. It provides capability for short burst data communications.
0-12/13	F-PDCCH	Forward Packet Data Control Channel	The Forward Packet Data Control Channel carries the control information for the Forward Packet Data Channel.
0-14	F-PDCH	Forward Packet Data Channel	Packet oriented data channel, supports high data rates
1-1	F-FCH	Forward Fundamental Channel	Subchannel of a traffic channel. Contains control data and user data.
1-2	F-SCCH1	Forward Supplemental Code Channel	Subchannel of a traffic channel. Enables higher data rates for control and user data.

Index	Shortform	Name	Function
1-2	F-SCH1	Forward Supplemen-tal Channel	Subchannel of a traffic channel. Enables higher data rates for control and user data.
...			
1-4	F-DCCH	Forward Dedicated Control Channel (RC3, RC4 and RC5)	Subchannel of a traffic channel. It transports specific control information.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TYPE
on page 134

Real Time - BS1

Activates realtime generation of the channel. This option is only available for the sync channel F-SYNC and the first traffic channel.

The channel state, Real Time On or Off, is displayed in different colors. The set state for the first traffic channel is specific for the selected radio configuration.

To test the BER/BLER testers (e.g. integrated in the base station), it is possible to feed through artificial bit errors to all the data sources (and block errors to the CRC checksum).

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
REALtime:STATe on page 129

Radio Configuration (RC) - BS

Select radio configuration of the traffic channel.

The radio configuration determines the channel types, the frame lengths, the channel coding types and the data rates that can be used.

The radio configuration is the same for all sub channels of a traffic channel. If the radio configuration is modified for one of the sub channels the new value is then automatically used by all other sub-channels of this traffic channel.

The radio configuration for the packet channels F-PDCCH and F-PDCH is fixed to RC10.

The R&S Signal Generator provides a separate set of settings of all channel table parameters for each radio configuration. Changing the radio configuration causes the settings belonging to the new RC value to be activated in the channel table (the settings belonging to the old RC value are stored).

The radio configuration determines the permissible frame lengths. The frame length defines the permitted data rate and channel coding type which in turn determine the permitted Walsh codes.

This gives rise to a hierarchy within the following parameters:

Frame Length -> Data Rate + Channel Coding Type -> Walsh Code

Changing one of the parameters in this hierarchy automatically causes the lower-level settings to be changed if they are no longer permitted following the change to the higher-level parameter.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:RCONfiguration` on page 136

Frame Length- BS

Enters the frame length of the channel. The set value is specific for the selected radio configuration.

The value range depends on the channel type and radio configuration. The frame length of the F-SCH is fixed to 26.6.ms. The maximum frame length is 160 ms, the minimum frame length is 5 ms.

The frame length affects the data rates and the channel coding types that are possible within a channel. Changing the frame length may lead to a change of data rate and/or the channel coding type and this in turn may bring about a change of Walsh code.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:FLENgth` on page 128

Data Rate - BS

Enters the data rate of the channel. The set value is specific for the selected radio configuration.

The R&S Signal Generator supports all data rates between 1.2 kbps and 1,036.8 kbps defined in the standard.

The value range depends on the frame length. If the frame length is changed so that the set data rate becomes invalid, the next permissible value is automatically set.

The data rate affects the Walsh code (spreading factor) that are possible within a channel. If a data rate is changed so that the selected Walsh code becomes invalid, the next permissible value is automatically set.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:RATE` on page 125

Walsh Code - BS

Assigns the Walsh Code to the channel (see chapter 3.7, "Variable-Length Walsh Spreading - Downlink", on page 14, and see "Code Domain Graph - BS" on page 51). The set value is specific for the selected radio configuration.

The code channel is spread with the set Walsh code (spreading code).

The value range of the Walsh code depends on the frame length, the channel coding type and the data rate.

If one of these parameters is changed so that the set Walsh code gets invalid, the next permissible value is automatically set.

The standard assigns a fixed Walsh code to some channels (F-PICH, for example, always uses Walsh code 0). Generally, the Walsh code can only be varied within the range specified by the standard.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:WCODe` on page 136

Quasi Orthogonal Walsh Code State - BS

Activates/deactivates the use of the quasi orthogonal Walsh codes for the channel. The set state is specific for the selected radio configuration.

Depending on the channel type and other parameters, the standard does not allow the use of quasi-orthogonal codes. In this case the selection field is dimmed.

The quasi orthogonal Walsh Code set is selected for all channels of the base station in the upper area of the CDMA200 menu.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:QWCode:STATe` on page 129

Power - BS

Sets the channel power in dB. The set value is specific for the selected radio configuration.

The power entered is relative to the powers outputs of the other channels. If "Adjust Total Power to 0 dB" is executed (top level of the CDMA menu), all the power data is relative to 0 dB.

The set "Power" value is also the start power of the channel for "Misuse For Output Power Control".

Note: The maximum channel power of 0 dB applies to non-blanked channels (duty cycle 100%), with blanked channels, the maximum value can be increased (by Adjust Total Power) to values greater than 0 dB (to $10*\log_{10}(1/\text{duty\_cycle})$).

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:POWer` on page 128

Data - BS

Selects data source. The set value is specific for the selected radio configuration.

"All 0 All 1"	0 data or 1 data is internally generated.
"PN xx"	PRBS data in accordance with the IUT-T with period lengths between 2^9-1 and 2^{23}-1 are internally generated.
"Pattern"	A user-definable bit pattern with a maximum length of 64 bits is internally generated. The bit pattern is defined in the Pattern input box.

"Data List"   Data lists will be used. Data lists can be generated internally in the data editor or externally.

Data lists are selected in the Select Data List field.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA` on page 123

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:PATTern` on page 125

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:DSELect` on page 124

More Params - BS

Calls the menu for setting additional parameters of the selected channel (see chapter 4.8, "More Parameters - BS Channel Table", on page 61).

SCPI command:
n.a.

Channel State - BS

Activates or deactivates the channel. The set state is specific for the selected radio configuration.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:STATe` on page 130

Domain Conflict - BS

Displays whether the channel has a code domain conflict with one of the other channel. If there is a conflict, a red dot appears and the column is colored soft orange. If there is no conflict, the column is colored soft blue. The indicated value is specific for the selected radio configuration.

To call the graphical display of code domain occupancy by all the active code channels, use the "Code Domain" button (also see "Code Domain Graph - BS" on page 51).

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict[:STATe]` on page 137

`[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict:RESolve` on page 137

## 4.8   More Parameters - BS Channel Table

The "More Parameters" menu can be called in the BS channel table in column "More Params" with button "Config...". The indicated values and the settings are specific for the selected radio configuration.

The settings for the packet channel F-PDCH channel and all other channels are different (see chapter 4.9, "More Parameters for F-PDCH - BS", on page 70). The menu for the special channels and the traffic channels is described below.
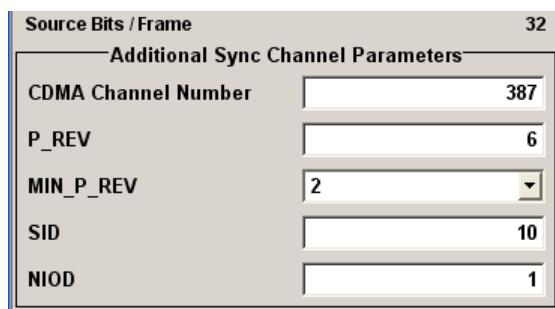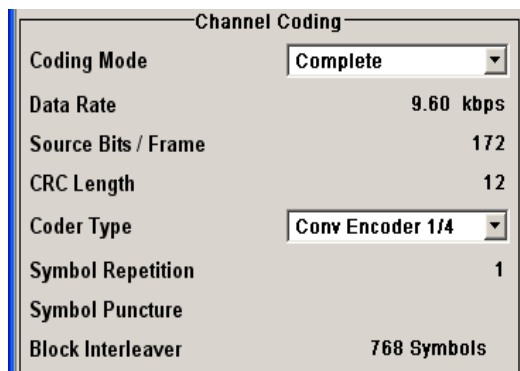
The upper section is where the channel number, channel type and Walsh length of the selected channel is displayed.
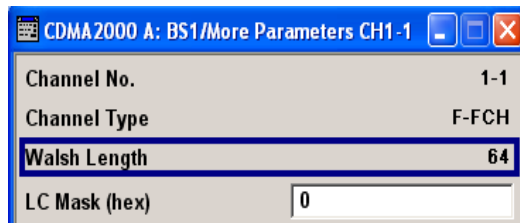
The "Power Control" section is where the settings for the power control bits are made.

This section is only available for the traffic sub channels F-FCH and F-DCCH.
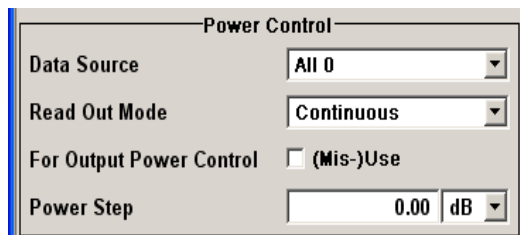
The "Channel Coding" section is where the channel coding settings are made.

The "Bit/Block Error Insertion" section is where the bit/block error simulation is configured and activated.

This section is only available for the real time channels.

4.8.1 General Settings

Channel No - More Parameters BS

Displays the channel number of the channel being configured.

SCPI command:

n.a.

Channel Type - More Parameters BS

Displays the type of the channel being configured.

SCPI command:

n.a.

Walsh Length - More Parameters BS

Displays the Walsh code of the channel being configured. The indicated value is specific for the selected radio configuration.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:WLENgth`
on page 136

LC Mask - More Parameters BS

(hex) Enters the mask of the long-code generator in hexadecimal form. The set value is specific for the selected radio configuration.

The long-code mask is a 42-bit value. The mask serves for channel-specific and user-specific scrambling of the code channel. The value range is 0 to 3FF FFFF FFFF.

The LC Mask is the same for all sub channels of a traffic channel. If the mask is modified for one of the sub channels the new value is then automatically used by all other sub-channels of this traffic channel.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:LCMask`
on page 128

4.8.2 Power Control

The "Power Control" section is where the settings for the power control bits are made. These bits are used to control the transmit power.

This section is only available for the traffic sub channels F-FCH and F-DCCH.

Data Source - Power Control - BS
Defines the data source for the power control bits of the channel. The set value is specific for the selected radio configuration.

When "Pattern" is selected, an entry field appears for the bit pattern. The maximum bit pattern length is 64 bits.

When "Data List" is selected, a button appears for calling the "File Select" window.

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA` on page 130
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:PATTern` on page 131
`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:DSELect` on page 131

Read Out Mode (Power Control) - BS
Defines power control bits usage. The set value is specific for the selected radio configuration.

With CDMA, the power control bits are used to signal the increase or reduction in transmit power to the called station.

The base station sends power control bits in the traffic channel at an 800 Hz rate instead of the scrambled data bits. The mobile station increases or decrease its output power depending on these power control bits. One to four data bits (depending on the data rate) are replaced a corresponding number of power control bits ("0...0" or "1...1").

With all read out modes, one bit is taken from the power control, multiplied and entered into the bit stream. The difference between the modes lies in the usage of the power control bits.

These different modes can be used, for example, to deliberately set a base station to a specific output power (e.g. with the pattern 11111) and then let it oscillate around this power (with Single + alt. 01 and Single + alt. 10). This then allows power measurements to be carried out at the base station (at a quasi-constant power). Together with the option (Mis-)Use for output power control (see below), Read Out Mode can also be used to generate various output power profiles.

"Continuous"　　The power control bits are used cyclically.

"Single + All 0"　The power control bits are used once, and then the power control sequence is continued with 0 bits.

"Single + All 1"　The power control bits are used once, and then the power control sequence is continued with 1 bits.

"Single + alt. 01"The power control bits are used once and then the power control
sequence is continued with 0 and 1 bits alternately (in multiples, depend-
ing on by the data rate, for example, 00001111).

"Single + alt. 10"The power control bits are used once and then the Power control bit
sequence is continued with 1 and 0 bits alternately (in multiples, depend-
ing on by the data rate, for example, 11110000).

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:
READ on page 133

Misuse for Output Power Control - BS
Activates "mis-" use of the power control data. The set value is specific for the selected
radio configuration.

With CDMA, the power control bits are used to signal the increase or reduction in transmit
power to the called station. If "(Mis-) use for output power" control is activated, the speci-
fied pattern is misused, in order to vary the intrinsic transmit power over time. Every 1.25
ms (800 Hz) a bit of this pattern is removed in order to increase (bit = "1") or reduce (bit
= "0") the channel power by the specified power step "(Power Step)". The upper limit for
this is 0 dB and the lower limit -80 dB. The following envelope is produced at a channel
power of 0 dB, power step 1.0dB and pattern "001110100000011" and Pattern ReadOut
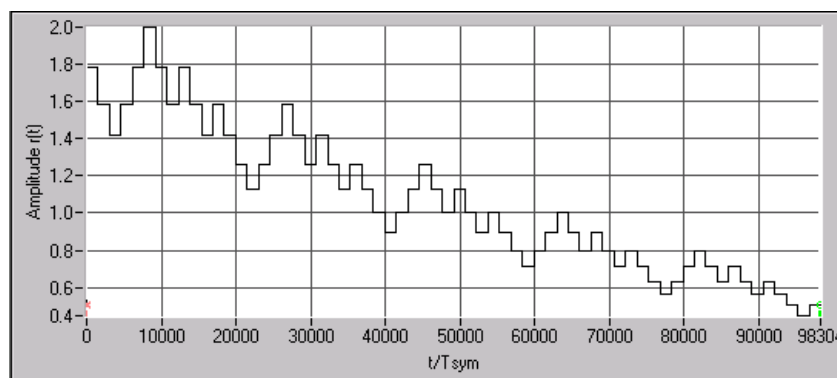Mode "Continuous":

Fig. 4-5: Dynamic change of channel power (continuous)

Note: The first bit is assigned to the first power control section. In this first section the
start power specified in the channel table is always used, i.e. only in the next power control
section (with the second power control bit) will the defined power change be effective.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:
MISuse on page 132

Power Step (DPCCH) - BS
Sets the step width of the power change in dB for (Mis-) use for output power control.
The set value is specific for the selected radio configuration.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:
PSTep on page 133

4.8.3   Channel Coding

The "Channel Coding" section or menu "More Parameters" is where the channel coding settings are made. The indicated values and the settings are specific for the selected radio configuration.

In contrast to 3GPP FDD, channel coding with CDMA2000 is part of the physical layer. The channel coding procedure may slightly vary depending on channel type, frame length and data rate.

Channel Coding Mode - More Params BS
Activates or deactivates channel coding. The set state is specific for the selected radio configuration.

"Off"   Channel coding is deactivated.
                     Channel coding is not performed. The data sources of the individual channels apply their data stream directly to the long-code scrambler. The data source supplies the traffic data with the data rate that would be available at the long-code scrambler after coding is switched on. This effective data rate, which is used for reading off from the data source, is displayed under Effective Data Rate. The Data Rate parameter displayed in the channel table continues to affect the Effective Data Rate, but no longer agrees with it.

"Complete"   The complete channel coding is performed. The channel coding procedure may slightly vary depending on channel type, frame length and data rate.

"Without Inter-   Except for the block interleaver, the whole channel coding procedure is
leaving"   carried out. In this mode the frame structure and the convolutional coder of an receiver can be tested.

"Interleaving   In this mode only block interleaver is used for coding. This allows the
Only"   deinterleaver in the receiver to be tested independently of the remaining (de-)coding process.
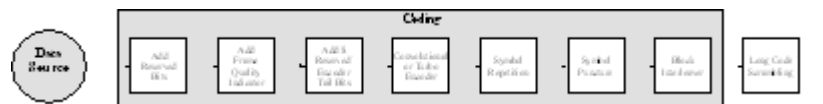
SCPI command:
[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:MODE on page 121

Effective Data Rate - More Params BS
Indication of the effective data rate. The indicated value is specific for the selected radio configuration.

For coding modes "Interleaving Only" and "Coding Off" the effective data rate differs from the set data rate, since no increase in the data rate is brought about by the convolution coder. The data rate set in the channel table is therefore not correct.

For coding modes "Without Interleaving" and "Complete" the data rate in the channel table agrees with the effective data rate, since there is an increase in the data rate due to the convolution coder.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:DATA:RATE on page 120

Source Bits / Frame - More Params BS

Indication of the number of input bits per frame for the channel coder. The indicated value is specific for the selected radio configuration.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:BITFrame on page 119

CRC Length - More Params BS

Indication of the CRC (cyclic redundancy code) type (length) for error identification. The indicated value is specific for the selected radio configuration.

SCPI command:

n.a.

Channel Coder Type - More Params BS

Selects error protection. The set value is specific for the selected radio configuration.

Which coder types are available depends on the channel type and other channel settings such as frame length, etc.

If one of these parameters is changed so that the set channel coding type gets invalid, the next permissible value is automatically set.

"Off"　　　　No error protection. This selection is available for the pilot channels only.

"Conv Encoder" Convolution Coder with generator polynomials defined by CDMA. The numeric value defines the rate of the convolution coder.

"Turbo Encoder"　Turbo Coder of rate 1/3 in accordance with the CDMA specifications. The numeric value defines the rate of the turbo coder.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:TYPE on page 122

Symbol Repetition - More Params BS

Indication of the symbol repetition rate. The indicated value is specific for the selected radio configuration.

Symbol repetition is used together with block symbol puncture for adapting the convolutional or turbo coder output data rate to the required input data rate of the interleaver.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:SREPetition on page 122

Symbol Puncture - More Params BS

Indication of the symbol puncture rate. The indicated value is specific for the selected radio configuration.

Symbol puncturing (elimination) is used together with block symbol repetition for adapting the convolutional or turbo coder output data rate to the required input data rate of the interleaver.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:SPUNcture on page 121

Block Interleaver - More Params BS

Displays the number of symbols that the interleaver processes per block. The indicated value is specific for the selected radio configuration.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:
CCODing:BINTerleaver on page 119

4.8.4 Additional Sync Channel Parameters

In the "Additional Sync Channel Parameters" sections of the "More Params" menu is available for the syncronisation channel F-SYNC and real time mode only.

CDMA Channel Number - More Params BS

Displays the CDMA Channel Number which corresponds to the RF.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:CNUMber on page 117

P_REV - More Params BS

Displays the Protocol Revision Level, i.e. specifies the CDMA2000 system release number.

The table below gives the cross-reference between the P_REV values and the CDMA2000 Releases.

P_REV	CDMA2000 Release
1	Korean PCS(Band Class4), USPCS(Band Class1)
2	IS-95

P_REV	CDMA2000 Release
3	TBS74
4	IS-95A
5	IS-95B
6	IS2000 Release 0
7	IS2000 Release A
8	IS2000 Release B

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:PREV on page 118

MIN_P_REV - More Params BS

Displays the Minimum Protocol Revision Level.

The base station sets this field to prevent mobile stations which can not be supported by the base station from accessing the CDMA system.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:MPRev on page 117

SID - More Params BS

Displays the System Identification.

The base station sets the system identification number.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:SID on page 118

NID - More Params BS

Displays the Network Identification.

The NID serves as a sub-identifier of a CDMA system as defined by the owner of the SID.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:NID on page 117

4.8.5 Error Insertion

In the "Bit Error Insertion" and "Block Error Insertion" sections of the "More Params" menu, errors can be inserted into the data source and into the CRC checksum, in order, for example, to check the bit and block error rate testers.

These functions are available for realtime channels only.

Bit Error State - More Params BS

Activates or deactivates bit error generation.

Bit errors are inserted into the data fields of the realtime channels.

When the data source is read out, individual bits are deliberately inverted at random points in the data bit stream at the specified error rate in order to simulate an invalid signal.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BIT:STATe` on page 126

Bit Error Rate - More Params BS

Sets the bit error rate.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BIT:RATE` on page 126

Block Error State - More Params BS

Activates or deactivates block error generation.

The CRC checksum is determined and then the last bit is inverted at the specified error probability in order to simulate an invalid signal.

Block error generation is only possible with channel coding enabled.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BLOCk:STATe` on page 127

Block Error Rate - More Params BS

Sets block error rate.

SCPI command:

`[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BLOCk:RATE` on page 126

4.9 More Parameters for F-PDCH - BS

The "More Parameters" menu for packet channel F-PDCH can be called in the BS channel table in column "More Params" with button "Config...".

The settings for the packet channel F-PDCH channel and all other channels are different (see chapter 4.8, "More Parameters - BS Channel Table", on page 61). The menu for the special channels and the traffic channels is described below.

The channel coding for the F-PDCHs is always carried out in full (see 3GPP2 C.S0002-C figure 3.1.3.1.1.1-19).

The parameters of both F-PDCCHs (such as Number of Slots per Subpacket, Subpacket Position, etc.) are implicitly defined by the F-PDCH settings, since both these channels are always transmitted simultaneously with the F-PDCH. The "More Parameters" menu for these F-PDCCHs is therefore mostly for display, it only enables the selection of channel coding mode.

The left part is used to enter the general settings for the packet channel.

The right, upper part contains a table for setting the parameters of the subpackets. Up to 8 subpackets can be transmitted for each regular packet.

The right, lower part displays the current configuration of the packet channel in graphical form.
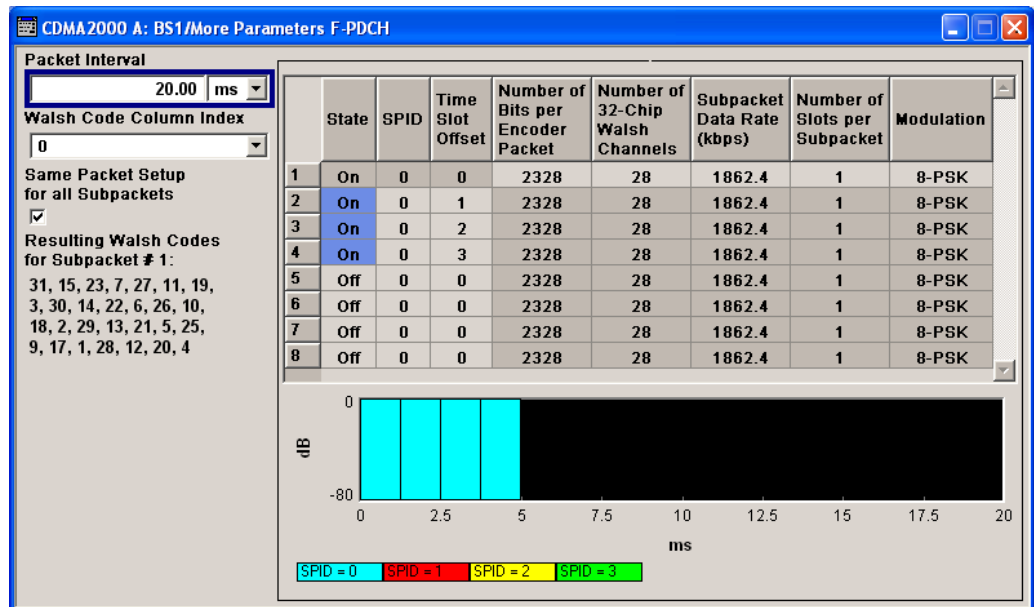
4.9.1 General Settings for Packet Channel

Packet Interval - More Params F-PDCHs BS

Select the interval at which new data packets arrive.

New F-PDCH packets are generated in this interval. Within an interval, up to 8 subpackets of a data packet can be transmitted with any required time offset.

The value range is dependent on the set sequence length (ARB settings). The values 80 ms, 40 ms, 20 ms, 10 ms and 5 ms can always be set, and the maximum value is 2000 ms. All intermediate values must satisfy the condition

Sequence Length * 80ms/2^n

where n is a whole number.

Example:

Sequence length = one 80 ms frame.

The possible values for the packet interval are 80 ms, 40 ms, 20 ms, 10 ms and 5 ms.

Sequence length = three 80 ms frames.

The possible values for the packet interval are 240 ms, 120 ms, 80 ms, 40 ms, 20 ms, 10 ms and 5 ms.

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:PINTerval` on page 138

Walsh Code Column Index - More Params F-PDCHs BS
Selects the standard-compliant set of available Walsh codes for the F_PDCH (see 3GPP2 C.S0003-C, table 2-35).

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:WINDex` on page 145

Same Packet Setup... - More Params F-PDCHs BS
Sets whether or not all subpackets are to be generated with the same settings.

In the case of the "On" setting the packet parameters (Number of Bits etc., see below) can only be changed for subpacket 1. All other subpackets receive the same parameters.

The "Off" setting allows individual settings for each subpacket.

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:PSETup` on page 138

4.9.2 Subpacket Table

The middle part contains a table for setting the parameters of the subpackets. Up to 8 subpackets can be transmitted for each regular packet (Encoder Packet).

	State	SPID	Time Slot Offset	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Subpacket	Modulation
1	On	0	0	2328	28	1862.4	1	8-PSK
2	On	0	1	2328	28	1862.4	1	8-PSK
3	On	0	2	2328	28	1862.4	1	8-PSK
4	On	0	3	2328	28	1862.4	1	8-PSK
5	Off	0	0	2328	28	1862.4	1	8-PSK
6	Off	0	0	2328	28	1862.4	1	8-PSK
7	Off	0	0	2328	28	1862.4	1	8-PSK
8	Off	0	0	2328	28	1862.4	1	8-PSK

Subpacket Number - More Params F-PDCHs BS

Index number of the subpackets in the selected channel. Each packet can include up to eight subpackets.

The subpacket is selected by the suffix to SUBPacket in remote control.

Subpacket State - More Params F-PDCHs BS

Status of the subpacket.

Subpacket 1 is always active. The rest can be turned on and off.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:STATe
on page 144

Subpacket ID - More Params F-PDCHs BS

Selects the subpacket ID.

The subpacket ID controls the subpacket symbol selection and adopts one of four possible subpackets from the encoder packet.

The ID of the first subpacket is fixed at 0. The ID can be chosen for each of the rest.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:ID
on page 138

Time Slot Offset - More Params F-PDCHs BS

Sets the starting time of the subpacket relative to the starting time of the packet interval.

The first subpacket always has an offset of 0, which cannot be changed.

The value range for the individual subpackets depends on the settings of the other subpackets:

The time slot offsets of the remaining subpackets must be entered in ascending order. Also it is not permitted to transmit two packets simultaneously.

Example:

Subpacket 2 is transmitted in time slot 5 and is 4 slots long. Subpacket 3 can only be transmitted in time slot 9 and no sooner.

In total the value range is 0 to (Packet Interval/1.25 ms -Number of Slots per Subpacket).

Example:

Packet Interval = 20 ms, Number of Slots per Subpacket = 2. The value range is 0 to 14.

The entry for "Number of Slots per Subpacket" defines the length of a packet.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:
TOFFset on page 144

PDCH Subpacket Table Parameters - More Params F-PDCHs BS

Only certain combinations of this parameter with the parameters of the last five table columns are possible. These combinations are shown in the selection list in the form of a table for all five parameters.

Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Subpacket	Modulation
2328	28	1862.4	1	8-PSK
2328	28	1862.4	1	8-PSK
3864	27	1545.6	2	QPSK
3096	26	2476.8	1	16-QAM
3864	26	3091.2	1	16-QAM
1560	25	1248.0	1	QPSK
2328	25	1862.4	1	8-PSK
3096	25	1238.4	2	QPSK
3864	25	1545.6	2	8-PSK
2328	23	931.2	2	QPSK
2328	23	1862.4	1	16-QAM

"Number of Bits per Encoder Packet"	Sets the number of bits per encoder packet. The "Number of Bits per Encoder Packet" defines the number of data bits that can be read from the data source for an encoder packet. Due to the channel coding this number is multiplied by a factor of about 5. The subsequent subpacket symbol selection then divides these bits into four different subpackets which can be selected via the SPID parameter. The "Number of Bits per Encoder Packet" can only be changed for subpacket 1. This value must be identical for the remaining subpackets, since they are all part of a single encoder packet.
"Number of 32-Chip Walsh Channels"	Selects the number of 32-chip Walsh channels.
"Subpacket Data Rate (kbps)"	Selects the data rate of the subpacket. The data rate is the result of the "Number of Bits per Encoder Packet" divided by the duration of the subpacket (= "Number of Slots per Subpacket"). Therefore only specified combinations of the "Subpacket Data Rate" with the "Number of Slots per Subpacket" at a specified "Number of Bits per Encoder Packet" are possible.
"Number of Slots per Subpacket"	Selects the number of slots per subpacket. This parameter defines the duration of the subpacket. A slot equals 1.25 ms. The "Number of Slots per Subpacket" is the result of the "Number of Bits per Encoder Packet" divided by the data rate. Therefore only specified combinations of the Subpacket Data Rate with the "Number of Slots per Subpacket" at a specified "Number of Bits per Encoder Packet" are possible.
"Modulation"	Indication of the modulation type. The modulation type is fix for each combination of the above parameters.

SCPI command:

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:
PARameters on page 139

Resulting Walsh Codes for Subpacket - More Params F-PDCHs BS
Indication of the resulting Walsh codes for the sub packet.

SCPI command:
`[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:WCODes`
on page 144

4.9.3 Subpacket Graph

The current configuration of the packet channel and its active subpackets is displayed in graphical form below the table.

The X axis is the length of the set packet interval in ms, i.e. the duration of the transmission of an encoder packet.

The relative power of the subpackets is represented on the Y axis. The subpackets are shown as bars and are 1, 2 or 4 time slots wide according to the configuration. The position on the X axis corresponds to the selected time slot offset.

The color of the bar depends on the sub packet ID (SPID). The assignment of colors to SPIDs is shown below the graph.
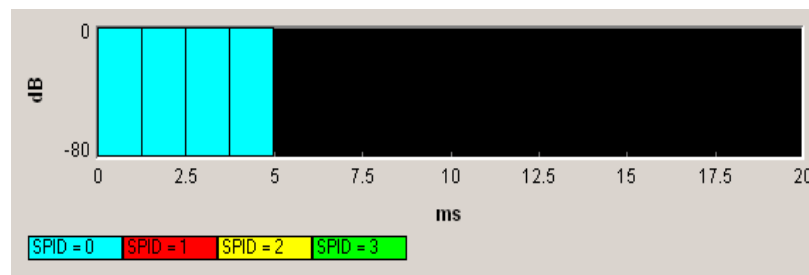

4.10 Mobile Station Configuration (MS)

The "Mobile Station Configuration" menu is called by selecting mobile station "MS1 ... MS4" in the CDMA2000 menu.

Mobile station 1 (MS1) generates all the channels in realtime, the other mobile stations generate the channels in arbitrary waveform mode.

The menu is divided into the sections "Common Settings", "Power Control" and "Channel Table".

The structure of the channel table depends on the selected operating mode and - for the traffic channel - on the selected radio configuration.
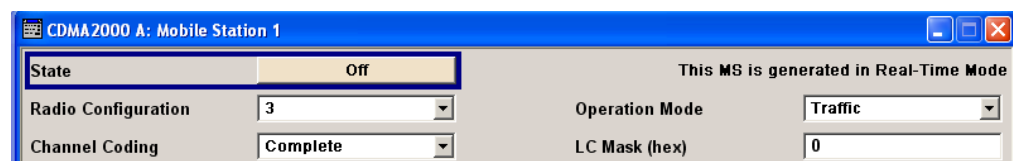
	Channel Type	Frame Length [ms]	Data Rate [kbps]	Walsh	Spread	Power [dB]	Data	Dlist Pattern	State
1	R-PICH	20.0	NotUsd	0	32	0.00	PN 9		Off
2	R-DCCH	20.0	9.6	8	16	0.00	PN 9		Off
3	R-FCH	20.0	1.5	4	16	0.00	PN 9		Off
4	R-SCH1	20.0	1.5	2	16	0.00	PN 9		Off
5	R-SCH2	20.0	1.5	6	16	0.00	PN 9		Off

4.10.1 Common Settings - MS

The "Common Settings" section is where the general settings for the selected mobile station are made.

State - MS

Activates or deactivates the selected mobile station. The number of the selected mobile station is specified in the menu header.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:STATe on page 157

Operating Mode - MS

Selects the mode in which the mobile station is to work.

The operating mode defines the generated channel types. The lower part of the menu will change in accordance with the mode. The following modes are available:

"Traffic"   In this mode the instrument generates a single traffic channel. A traffic channel consists of up to 8 sub channels depending on the selected radio configuration.
                This mode corresponds to the standard mode of a mobile station during voice and data transmission.

"Access"   In this mode, the instrument generates an access channel (R-ACH). This channel is needed to set up the connection between the mobile station and the base station.

"Enhanced   In this mode, the instrument generates an enhanced access channel (R-
Access"   ACH) and a pilot channel (R-PICH). These channels are used to set up the connection between the mobile station and the base station.

"Common Con-   In this mode, the instrument generates a common control channel (R-
trol"   ACH) and a pilot channel (R-PICH).

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:MODE on page 156

Radio Configuration - MS

Selects the radio configuration for the traffic channel.

In the reverse link, the channel scenario with the spreading codes of the individual channels is predefined by selecting the radio configuration. For this reason the channel table does not contain selection parameters for the Walsh code.

A separate set of settings of all channel table parameters is provided for each radio configuration. Changing the radio configuration causes the settings belonging to the new RC value to be activated in the channel table (the settings belonging to the old RC value are not lost).

The radio configuration determines the permissible frame lengths and the frame length defines the permitted data rate.

Changing the frame length automatically causes the data rate to be changed if it is no longer permitted.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:RCONfiguration on page 156

Channel Coding - MS
Activates or deactivates channel coding.

"Off"	Channel coding is deactivated.
"Complete"	The complete channel coding is performed. The channel coding procedure may slightly vary depending on channel type, frame length and data rate.
"Without Interleaving"	Except for the block interleaver, the whole channel coding procedure is carried out.
"Interleaving Only"	In this mode only block interleaver is used for coding.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:CCODing:MODE on page 150

LC Mask (hex) - MS
Enters the mask of the long-code generator in hexadecimal form.

The long-code mask is a 42-bit value. The mask serves for channel-specific and user-specific scrambling of the code channel. The value range is 0 to 3FF FFFF FFFF.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:LCMask on page 155

4.10.2 Power Control - MS

The "Power Control" section is where the settings for the power control bits are made. In the uplink, these bits are used exclusively for controlling the mobile station output power by activating the "Mis(use) Power Control" function. Power control puncturing of the data bits of the traffic channels for controlling the base station power is not performed.

This section is only available for the traffic channel.

Data Source (Power Control) - MS
Defines the data source for the power control bits of the channel.

When "Pattern" is selected, an entry field appears for the bit pattern. The maximum bit pattern length is 64 bits.

When "Data List" is selected, a button appears for calling the "File Select" window.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA on page 157

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:PATTern on page 158

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:DSELect on page 158

Read Out Mode (Power Control) - MS

Defines read-out mode of power control bits.

Together with the option (Mis-)Use for output power control (see below), Read Out Mode can also be used to generate various output power profiles.

"Continuous"   The power control bits are used cyclically.

"Single + All 0" The power control bits are used once, and then the power control sequence is continued with 0 bits.

"Single + All 1" The power control bits are used once, and then the power control sequence is continued with 1 bits.

"Single + alt. 01" The power control bits are used once and then the power control sequence is continued with 0 and 1 bits alternately.

"Single + alt. 10" The power control bits are used once and then the power control sequence is continued with 1 and 0 bits alternately.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:READ on page 159

Misuse for Output Power Control - MS

Activates "mis-" use of the power control data.

In the uplink, the power control bits are used exclusively for controlling the mobile station output power. Power control puncturing is not defined for controlling the base station power

If "(Mis-) use for output power control" is activated, the specified pattern is used to vary the intrinsic transmit power over time. Every 1.25 ms (800 Hz) a bit of this pattern is removed in order to increase (bit = "1") or reduce (bit = "0") the channel power by the specified power step "(Power Step)". The upper limit for this is 0 dB and the lower limit -80 dB. The following envelope is produced at a channel power of 0 dB, power step 1.0dB and pattern "001110100000011" and Pattern ReadOut Mode "Continuous":
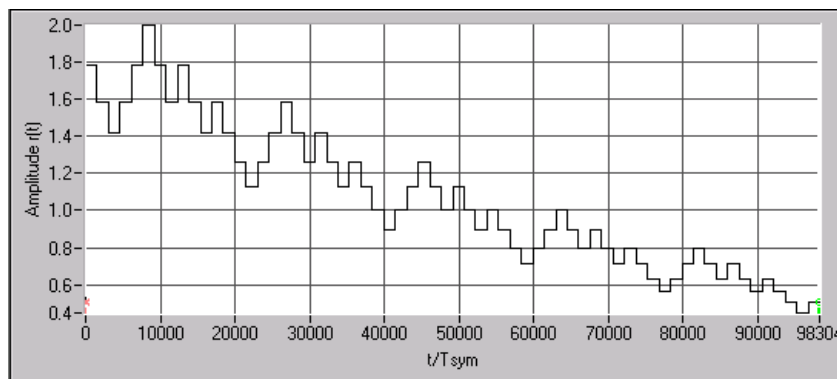
Fig. 4-6: Dynamic change of channel power (continuous)

Note: The first bit is assigned to the first power control section. In this first section the start power specified in the channel table is always used, i.e. only in the next power control section (with the second power control bit) will the defined power change be effective.

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:MISuse` on page 158

Power Step - MS
Sets the step width of the power change in dB for "(Mis-) use for output power control".

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:PSTep` on page 159

4.10.3   Channel Table - MS

The "channel table" is located in the lower part of the menu. The channel table is where the individual channel parameters are set.

The structure of the channel table depends on the selected operating mode and - for the traffic channel - on the selected radio configuration. Also, for the traffic channels, the indicated values and the settings are specific for the selected radio configuration.

In uplink, the employed Walsh code are determined by the radio configuration cannot be chosen.

The following combinations between the operating modes of the four mobile stations are allowed:

	Traffic,RC1 & RC 2	Traffic, RC3 & RC 4	Access	Enhanced Access	Common Control
Traffic, RC1 & RC 2	X		X		
Traffic, RC3 & RC 4		X		X	X
Access	X		X		

	Traffic,RC1 & RC 2	Traffic, RC3 & RC 4	Access	Enhanced Access	Common Control
Enhanced Access		X		X	X
Common Control		X		X	X

Channel Number- MS

Displays the channel number.

All channels of the selected operating mode are listed. The channels are switched on and off with the "On/Off" button in the "State" column.

SCPI command:
n.a.

Channel Type - MS

Indication of the channel type (see table 4-3). The possible channel types depend on the selected operating mode of the mobile station.

Table 4-3: List of supported channel types

Shortform	Name	Function
Traffic		
R-PICH	Reverse Pilot Channel	The Reverse Pilot Channel provides the capabilities for coherent detection.
R-DCCH	Reverse Dedicated Control Channel	The Reverse Dedicated Control Channel transports mobile-specific control information.
R-FCH	Reverse Fundamental Channel	The Reverse Fundamental Channel is similar to F-FCH; designed to transport dedicated data.
R-SCH	Reverse Supplemental Channel (RC 3...5)	The Reverse Supplemental Channels are allocated dynamically to meet a required data rate.
R-SCCH	Reverse Supplemental Code Channel (RC 1 / 2)	The Reverse Supplemental Code Channels are allocated dynamically to meet a required data rate.
Access		
R-ACH	Reverse Access Channel	The Access channel is needed to set up the connection between the mobile station and the base station.
Enhanced Access		
R-EACH	Reverse Enhanced Access Channel	The Reverse Enhanced Access Channel is needed to set up the connection between the mobile station and the base station

Shortform	Name	Function
R-PICH	Reverse Pilot Channel	The Reverse Pilot Channel provides the capabilities for coherent detection.
Common Control		
R-CCCH	Reverse Common Control Channel	The Reverse Fundamental Channel is similar to R-ACH but it is meant to transport control information.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:TYPE on page 154

Frame Length- MS

Enters the frame length of the channel. For the traffic channels, the indicated value is specific for the selected radio configuration.

The value range depends on the channel type and the selected radio configuration. The frame length of some channels is fixed. The maximum frame length is 80 ms, the minimum frame length is 5 ms.

The frame length affects the data rates that are possible within a channel. If a frame length is changed so that the set data rate becomes invalid, the next permissible value is automatically set.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:FLENgth on page 153

Data Rate - MS

Enters the data rate of the channel. For the traffic channels, the indicated value is specific for the selected radio configuration.

The R&S Signal Generator supports all data rates between 1.2 kbps and 1,036.8 kbps defined in the standard.

The value range depends on the frame length. If one of these parameters is changed so that the set data rate becomes invalid, the next permissible value is automatically set.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:RATE
on page 152

Walsh - MS

Assigns the Walsh Code to the channel (see chapter 3.9, "Spreading - Uplink",
on page 14). For the traffic channels, the indicated value is specific for the selected radio configuration.

The code channel is spread with the set Walsh code (spreading code). The Walsh codes to be used are specified by the standard and cannot be chosen.

SCPI command:

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:WCODe on page 155

Spread- MS

Indication of the spreading factor of the channel. For the traffic channels, the indicated value is specific for the selected radio configuration.

The spreading factor corresponds to the length of the employed Walsh code. The Walsh codes to be used are specified by the standard and cannot be chosen.

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:SPReading` on page 154

Power - MS

Enters the channel power in dB. For the traffic channels, the set value is specific for the selected radio configuration.

The power entered is relative to the powers outputs of the other channels. If "Adjust Total Power to 0 dB" is executed (top level of the CDMA2000 menu), all the power data is relative to 0 dB.

The set Power value is also the start power of the channel for "Misuse For Output Power Control".

Note: The maximum channel power of 0 dB applies to non-blanked channels (duty cycle 100%), with blanked channels, the maximum value can be increased (by Adjust Total Power) to values greater than 0 dB (to $1ß*\log_{10}(1/duty\_cycle)$).

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:POWer` on page 153

Data- MS

Selects data source. For the traffic channels, the set value is specific for the selected radio configuration.

"All 0 All 1"	0 data or 1 data is internally generated.
"PN xx"	PRBS data in accordance with the IUT-T with period lengths between 2^9-1 and 2^{23}-1 are internally generated.
"Pattern ... Pattern"	A user-definable bit pattern with a maximum length of 64 bits is internally generated. The bit pattern is defined in the Pattern input box.
"Data List ... Select Data List"	Data lists will be used. Data lists can be generated internally in the data editor or externally. Data lists are selected in the Select Data List field.

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA` on page 151

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:PATTern` on page 152

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:DSELect` on page 151

Channel State- MS

Activates/deactivates the channel. For the traffic channels, the indicated value is specific for the selected radio configuration.

SCPI command:

`[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:STATe` on page 154

5 Remote-Control Commands

The commands in the Source:BB:C2K subsystem are described in three sections, separated into general remote commands, commands for base station settings and commands for mobile station settings.

This subsystem contains commands for the primary and general settings of the CDMA2000 standard. These settings concern activation and deactivation of the standard, setting the transmission direction, filter, clock, trigger and clipping settings, defining the chip rate and the sequence length, as well as the preset and power adjust setting.

The commands for setting the base station and the mobile station are described in separate sections. The commands are divided up in this way to make the extremely comprehensive SOURce:BB:C2K subsystem clearer.

SOURce\<hw\>

For one-path instruments, the keyword SOURce is optional and can be omitted.

The numeric suffix to SOURce distinguishes between signal generation for path A and path B in the case of two-path instruments:

- SOURce[1] = path A
  The keyword SOURce is optional and can be omitted

- SOURce2 = path B
  The keyword SOURce is mandatory, i.e. the command must contain the keyword with suffix 2.

OUTput\<ch\>

The numeric suffix to OUTPut distinguishes between the available markers.

Only two markers are available for the R&S SMBV, i.e. the allowed values for the suffix are 1 or 2.

Placeholder \<root\>

For commands that read out or save files in the default directory, the default directory is set using command MMEM:CDIRectory. The examples in this description use the place holder \<root\> in the syntax of the command.

- D:\ - for selecting the internal hard disk of Windows instruments

- E:\ - for selecting the memory stick which is inserted at the USB interface of Windows instruments

- /var/\<instrument\> - for selecting the internal flash card of Linux instrument, where \<instrument\> is the instument name, e.g. smbv.

- /usb - for selecting the memory stick which is inserted at the USB interface of Linux instrument.

5.1 Primary Commands

[:SOURce<hw>]:BB:C2K:COPY:COFFset <COffset>

The command sets the offset for the Walsh code in the destination base station. The minimum value is 0 (Walsh codes are identical), the maximum value is 255.

This command is only available in the downlink (`SOUR:BB:C2K:LINK FORW/DOWN`).

Parameters:

<COffset>   integer

                        Range: 0 to 255
                        Increment: 1
                        *RST: 0

Example: `BB:C2K:COPY:COFF 10`
                    the Walsh code is shifted by 10 when the source base station is
                    copied to the destination base station.

[:SOURce<hw>]:BB:C2K:COPY:DESTination <Destination>

The command selects the station to which data is to be copied. Whether the data is copied to a base station or a mobile station depends on which transmission direction is selected (command `C2K:LINK UP | DOWN`).

Parameters:

<Destination>   1|2|3|4

                        Range: 1 to 4
                        *RST: 2

Example: BB:C2K:LINK DOWN

selects the downlink transmit direction (base station to mobile station).

BB:C2K:COPY:SOUR 1

selects base station 1 as the source.

BB:C2K:COPY:DEST 4

selects base station 4 as the destination.

BB:C2K:COPY:EXEC

starts copying the parameter set of base station 1 to base station 4.

[:SOURce<hw>]:BB:C2K:COPY:EXECute

The command starts the copy process. The dataset of the source station is copied to the destination station. Whether the data is copied to a base station or a mobile station depends on which transmission direction is selected (command :BB:C2K:LINK UP | DOWN).

Example: BB:C2K:COPY:EXEC

starts copying the parameter set of the selected source station to the selected destination station.

Usage: Event

[:SOURce<hw>]:BB:C2K:COPY:SOURce <Source>

The command selects the station that has data to be copied. Whether the station copied is a base or mobile station depends on which transmission direction is selected (command C2K:LINK UP | DOWN).

Parameters:

<Source>   1|2|3|4

Range: 1 to 4
*RST: 1

Example: BB:C2K:LINK UP

selects the uplink transmit direction (mobile station to base station).

BB:C2K:COPY:SOUR 1

selects mobile station 1 as the source.

BB:C2K:COPY:DEST 4

selects mobile station 4 as the destination.

BB:C2K:COPY:EXEC

starts copying the parameter set of mobile station 1 to mobile station 4.

[:SOURce\<hw>]:BB:C2K:CRATe?

The command queries the spreading rate. The output chip rate which determines the rate of the spread symbols as is used for signal output can be set with the command `SOUR:BB:C2K:CRAT:VAR`.

Return values:

\<CRate>   R1M2

Example: `BB:C2K:CRAT?`
queries the system chip rate.
`Response:R1M2`
the system chip rate is 1.2288 Mcps.

Usage: Query only

[:SOURce\<hw>]:BB:C2K:CRATe:VARiation \<Variation>

The command enters the output chip rate.

The output chip rate changes the output clock and the modulation bandwidth, as well as the synchronization signals that are output. It does not affect the calculated chip sequence.

Parameters:

\<Variation>   float

Range: 1 Mcps to 5 Mcps
Increment: 1 Hz
*RST: 1.2288 Mcps

Example: `BB:C2K:CRAT:VAR 4086001`
sets the chip rate to 4.08 Mcps.

[:SOURce\<hw>]:BB:C2K:IQSWap[:STATe] \<State>

This command inverts the Q-part of the baseband signal if set to ON. The signal on the baseband outputs meets the cdma2000 standard. In order to generate an RF signal that conforms to the standard, the "I/Q Swap" function in the "I/Q Modulator" menu must be enabled ("On") (`SOURce:IQ:SWAP ON`).

Parameters:

\<State>   0|1|OFF|ON

*RST: OFF

Example: `BB:C2K:IQSW:STAT ON`
inverts the Q-part of the baseband signal.

[:SOURce<hw>]:BB:C2K:LINK <Link>

The command defines the transmission direction. The signal either corresponds to that of a base station (FORWard | DOWN) or that of a mobile station (REVerse | UP).

Parameters:

<Link>   DOWN|UP

                              *RST: FORWard|DOWN

Example: BB:C2K:LINK DOWN
                              the transmission direction selected is base station to mobile station. The signal corresponds to that of a base station.

[:SOURce<hw>]:BB:C2K:POWer:ADJust

The command sets the power of the active channels in such a way that the total power of the active channels is 0 dB. This will not change the power ratio among the individual channels.

Example: BB:C2K:POW:ADJ
                              the total power of the active channels is set to 0 dB, the power ratio among the individual channels is unchanged.

Usage: Event

[:SOURce<hw>]:BB:C2K:POWer[:TOTal]?

The command queries the total power of the active channels. After "Power Adjust", this power corresponds to 0 dB.

Return values:

<Total>   float

Example: BB:C2K:POW?
                              queries the total power of the active channels.
                              Response: -22.5
                              the total power is -25 dB.

Usage: Query only

[:SOURce<hw>]:BB:C2K:PRESet

The command produces a standardized default for the CDMA2000 standard. The settings correspond to the *RST values specified for the commands.

All CDMA2000 settings are preset.

Example:	BB:C2K:PRES
	resets all the CDMA2000 settings to default values.

| **Usage:** | Event |

[:SOURce<hw>]:BB:C2K:SETTing:CATalog?

This command reads out the files with CDMA2000 settings in the default directory. The default directory is set using command MMEM:CDIRectory. Only files with the file extension *.cdma2k will be listed.

Return values:
<Catalog>	string

Example:	MMEM:CDIR '<root>\user\cdma
	sets the default directory to <root>\user\cdma.
	BB:C2K:SETT:CAT?
	reads out all the files with CDMA2000 settings in the default directory.
	Response: 'CDMA_UP','CDMA_DN'
	the files CDMA_UP and CDMA_DN are available.

| **Usage:** | Query only |

[:SOURce<hw>]:BB:C2K:SETTing:DELete <Filename>

This command deletes the selected file with CDMA2000 settings. The directory is set using command MMEM:CDIRectory. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension *.cdma2k will be deleted.

Setting parameters:
<Filename>	string

Example:	BB:C2K:SETT:DEL 'CDMA_UP
	deletes file CDMA_UP.

| **Usage:** | Setting only |

[:SOURce<hw>]:BB:C2K:SETTing:LOAD <Filename>

This command loads the selected file with CDMA2000 settings. The directory is set using command MMEM:CDIRectory. A path can also be specified, in which case the files in the specified directory are read. The file extension may be omitted. Only files with the file extension *.cdma2k will be loaded.

Setting parameters:
<Filename>	string

Example: BB:C2K:SETT:LOAD 'CDMA_UP'
                     loads file CDMA_UP.

Usage: Setting only

[:SOURce<hw>]:BB:C2K:SETTing:STORe <Filename>

This command stores the current CDMA2000 settings into the selected file. The directory is set using command MMEM:CDIRectory. A path can also be specified, in which case the files in the specified directory are read. Only the file name has to be entered. CDMA2000 settings are stored as files with the specific file extensions *.cdma2k.

Setting parameters:
<Filename>   string

Example: BB:C2K:SETT:STOR 'CDMA_UP'
                     stores the current CDMA2000 settings into file CDMA_UP.

Usage: Setting only

[:SOURce<hw>]:BB:C2K:SLENgth <SLength>

The command sets the sequence length of the arbitrary waveform component of the CDMA2000 signal in the number of frames. This component is calculated in advance and output in the arbitrary waveform generator. It is added to the realtime signal components.

Parameters:
<SLength>   float

                     Range: 1 frame to 511 frames
                     *RST: 1

Example: BB:C2K:SLEN 10
                     sets the sequence length to 10 frames.

[:SOURce<hw>]:BB:C2K:STATe <State>

The command activates modulation in accordance with the CDMA2000 standard. Activating this standard deactivates all the other digital standards and digital modulation modes (in case of two-path instruments, this affects the same path).

BB:C2K:STAT ON deactivates the other standards and digital modulation.

Parameters:
<State>   0|1|OFF|ON

                     *RST: OFF

Example: BB:C2K:STAT ON
                     activates modulation in accordance with the CDMA2000 standard.

[:SOURce<hw>]:BB:C2K:WAVeform:CREate <Filename>

This command creates a waveform using the current settings of the "CDMA2000" menu. The file name is entered with the command. The file is stored with the predefined file extension `*.wv`. The file name and the directory it is stored in are user-definable.

Setting parameters:

<Filename>　　　　　　　　string

Example:　　　　　　　`MMEM:CDIR '<root>\user\waveform`
　　　　　　　　　　　　sets the default directory to <root>\user\waveform.
　　　　　　　　　　　　`BB:C2K:WAV:CRE 'cdma_bs'`
　　　　　　　　　　　　creates the waveform file `cdma_bs.wv` in the default directory.

Usage:　　　　　　　　Setting only

[:SOURce]:BB:C2K:VERSion?

The command queries the version of the CDMA standard underlying the definitions.

Return values:

<Version>　　　　　　　string

Example:　　　　　　　`BB:C2K:VERS?`
　　　　　　　　　　　　queries the CDMA version.
　　　　　　　　　　　　`Response:　　Release C`
　　　　　　　　　　　　CDMA Release 5

Usage:　　　　　　　　Query only

5.2　Filter/Clipping/Power Settings

5.2.1　Filter Settings

[:SOURce<hw>]:BB:C2K:FILTer:TYPe <Type>

The command selects the filter type.

Parameters:

<Type>   RCOSine|COSine|GAUSs|LGAuss|CONE|COF705|
                   COEQualizer|COFequalizer|C2K3x|APCO25|SPHase|
                   RECTangle|PGAuss|LPASs|DIRac|ENPShape|EWPShape|
                   LPASSEVM

                   *RST: Downlink:COEF; Uplink: CONE

Example: BB:C2K:FILT:TYPE CONE
                   sets the filter type CdmaOne. This filter type is defined by the
                   standard for the uplink.

[:SOURce<hw>]:BB:C2K:FILTer:ILENgth <ILength>

(available for R&S WinIQSIM2 only)

The command sets the impulse length (number of filter tabs).

Parameters:

<ILength>   integer

                   Range: 1 to 128
                   Increment: 1
                   *RST: 10

Example: BB:C2K:FILT:ILEN 10
                   sets the number of filter tabs to 10.

[:SOURce<hw>]:BB:C2K:FILTer:ILENgth:AUTO <Auto>

(available for R&S WinIQSIM2 only)

The command acivates/deactivates the impulse length state. If activated, the most sen-
sible parameter values are selected. The value depends on the coherence check.

Parameters:

<Auto>   0|1|OFF|ON

                   *RST: ON

Example: BB:C2K:FILT:ILEN:AUTO ON
                   the most sensible parameters are selected automatically.

[:SOURce<hw>]:BB:C2K:FILTer:OSAMpling <OSampling>

(available for R&S WinIQSIM2 only)

The command sets the upsampling factor.

Parameters:

<OSampling>   integer

                     Range: 1 to 32
                     *RST: 32

Example: BB:C2K:FILT:OSAM 32
                     sets the upsampling factor to 32.

[:SOURce<hw>]:BB:C2K:FILTer:OSAMpling:AUTO <Auto>

(available for R&S WinIQSIM2 only)

The command acivates/deactivates the upsampling factor state. If activated, the most sensible parameter values are selected. The value depends on the coherence check. If deactivated, the values can be changed manually.

Parameters:

<Auto>   0|1|OFF|ON

                     *RST: ON

Example: BB:C2K:FILT:OSAM:AUTO ON
                     the most sensible parameters are selected automatically.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:APCO25 <Apco25>

The command sets the roll-off factor for filter type APCO25.

Parameters:

<Apco25>   float

                     Range: 0.05 to 0.99
                     Increment: 0.01
                     *RST: 0.20

Example: BB:C2K:FILT:PAR:APCO25 0.2
                     sets the roll-off factor to 0.2 for filter type APCO25.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:COSine <Cosine>

The command sets the roll-off factor for the Cosine filter type.

Parameters:

<Cosine>   float

                     Range: 0.00 to 0.99
                     Increment: 0.01
                     *RST: 0.35

Example: `BB:C2K:FILT:PAR:COS 0.35`
                     sets the roll-off factor to 0.35 for filter type Cosine.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:GAUSs <Gauss>

The command sets the roll-off factor for the Gauss filter type.

Parameters:

<Gauss>   float

                     Range: 0.15 to 2.5
                     Increment: 0.01
                     *RST: 0.5

Example: `BB:C2K:FILT:PAR:GAUS 0.5`
                     sets B x T to 0.5 for the Gauss filter type.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:LPASs <LPass>

The command sets the cut off frequency factor for the Lowpass (ACP Opt.) filter type.

Parameters:

<LPass>   float

                     Range: 0.05 to 2.0
                     *RST: 0.5

Example: `BB:C2K:FILT:PAR:LPAS 0.5`
                     the cut of frequency factor is set to 0.5.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:LPASSEVM <LPassEvm>

The command sets the cut off frequency factor for the Lowpass (EVM Opt.) filter type.

Parameters:

<LPassEvm>   float

                     Range: 0.05 to 2.0
                     *RST: 0.5

Example: `BB:C2K:FILT:PAR:LPASSEVM 0.5`
                     the cut of frequency factor is set to 0.5.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:PGAuss <PGauss>

The command sets the roll-off factor for the Pure Gauss filter type.

Parameters:

<PGauss>   float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 0.5

Example: `BB:C2K:FILT:PAR:GAUS 0.5`
sets B x T to 0.5 for the Pure Gauss filter type.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:RCOSine <RCosine>

The command sets the roll-off factor for the Root Cosine filter type.

Parameters:

<RCosine>   float

Range: 0.00 to 0.99
Increment: 0.01
*RST: 0.22

Example: `BB:C2K:FILT:PAR:RCOS 0.22`
sets the roll-off factor to 0. 22 for filter type Root Cosine.

[:SOURce<hw>]:BB:C2K:FILTer:PARameter:SPHase <SPhase>

The command sets B x T for the Split Phase filter type.

Parameters:

<SPhase>   float

Range: 0.15 to 2.5
Increment: 0.01
*RST: 2.00

Example: `BB:C2K:FILT:PAR:SPH 0.5`
sets B x T to 0.5 for the Split Phase filter type.

5.2.2 Clipping Settings

[:SOURce<hw>]:BB:C2K:CLIPping:LEVel <Level>

The command sets the limit for level clipping (Clipping). This value indicates at what point the signal is clipped. It is specified as a percentage, relative to the highest level. 100% indicates that clipping does not take place.

Level clipping is activated with the command `[:SOURce<hw>]:BB:C2K:CLIPping:STATe`

Parameters:

<Level>   integer

Range: 0 PCT to 100 PCT
Increment: 1
*RST: 100 PCT

Example: `BB:C2K:CLIP:LEV 80PCT`
sets the limit for level clipping to 80% of the maximum level.
`BB:C2K:CLIP:STAT ON`
activates level clipping.

[:SOURce<hw>]:BB:C2K:CLIPping:MODE <Mode>

The command sets the method for level clipping (Clipping).

Parameters:

<Mode>   VECTor|SCALar

VECTor
The reference level is the amplitude | i+jq |

SCALar
The reference level is the absolute maximum of the I and Q values.

*RST: VECTor

Example: `BB:C2K:CLIP:MODE SCAL`
selects the absolute maximum of all the I and Q values as the
reference level.
`BB:C2K:CLIP:LEV 80PCT`
sets the limit for level clipping to 80% of this maximum level.
`BB:C2K:CLIP:STAT ON`
activates level clipping.

[:SOURce<hw>]:BB:C2K:CLIPping:STATe <State>

The command activates level clipping (Clipping). The value is defined with the command
`[:SOURce<hw>]:BB:C2K:CLIPping:LEVel`, the mode of calculation with the com-
mand `[:SOURce<hw>]:BB:C2K:CLIPping:MODE`.

Parameters:

<State>   0|1|OFF|ON

*RST: OFF

Example: `BB:C2K:CLIP:STAT ON`
activates level clipping.

5.3 Clock Settings

This section lists the remote control commands, necessary to configure the clock.

The clock settings are available for R&S SMx and R&S AMU instruments only.

[:SOURce<hw>]:BB:C2K:CLOCk:MODE <Mode>

The command enters the type of externally supplied clock (:C2K:CLOCk:SOURce EXTernal). When MCHip is used, a multiple of the chip clock is supplied via the CLOCK connector and the chip clock is derived internally from this. The multiplier is entered with the command [:SOURce<hw>]:BB:C2K:CLOCk:MULTiplier.

For two-path instruments, the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Parameters:

<Mode>   CHIP|MCHip

                   *RST: CHIP

Example: BB:C2K:CLOC:MODE CHIP
                   selects clock type "Chip", i.e. the supplied clock is a chip clock.

[:SOURce<hw>]:BB:C2K:CLOCk:MULTiplier <Multiplier>

The command specifies the multiplier for clock type "Multiplied" (:BB:C2K:CLOCk:MODE MCHip) in the case of an external clock source.

For two-path instruments, the only numerical suffix allowed for SOURce is 1, since the external clock source is permanently allocated to path A.

Parameters:

<Multiplier>   integer

                   Range: 1 to 64
                   Increment: 1
                   *RST: 4

Example: `BB:C2K:CLOC:SOUR EXT`
                        selects the external clock source. The clock is supplied via the
                        CLOCK connector.
                        `BB:C2K:CLOC:MODE MCH`
                        selects clock type "Multiplied", i.e. the supplied clock has a rate
                        which is a multiple of the chip rate.
                        `BB:C2K:CLOC:MULT 12`
                        the multiplier for the external clock rate is 12.

[:SOURce<hw>]:BB:C2K:CLOCk:SOURce <Source>

The command selects the clock source.

For two-path instruments, selecting EXTernal is only possible for path A, since the exter-
nal clock source is permanently allocated to path A; selecting AINTernal is only possible
for path B.

Parameters:

<Source>   INTernal|EXTernal|AINTernal

                        INTernal
                        The internal clock reference is used.

                        EXTernal
                        The external clock reference is supplied to the CLOCK connector.
                        Commands `[:SOURce<hw>]:BB:C2K:CLOCk:MODE` and `[:`
                        `SOURce<hw>]:BB:C2K:CLOCk:MULTiplier` are used to enter
                        the type of the external clock.

                        *RST: INTernal

Example: `:BB:C2K:CLOC:SOUR EXT`
                        selects the external clock source. The clock is supplied via the
                        CLOCK connector.
                        `BB:C2K:CLOC:MODE MCH`
                        selects clock type "Multiplied", i.e. the supplied clock has a rate
                        which is a multiple of the chip rate.
                        `BB:C2K:CLOC:MULT 12`
                        the multiplier for the external clock rate is 12.

[:SOURce<hw>]:BB:C2K:CLOCk:SYNChronization:EXECute

(for R&S SMBV only)

Performs automatically adjustment of the instrument's settings required for the synchro-
nization mode, set with the command `[:SOURce<hw>]:BB:C2K:CLOCk:`
`SYNChronization:MODE`.

Example:	BB:C2K:CLOC:SYNC:MODE MAST
	the instrument is configured to work as a master one.
	BB:C2K:CLOC:SYNC:EXEC
	all synchronization's settings are adjusted accordingly.
Usage:	Event

[:SOURce<hw>]:BB:C2K:CLOCk:SYNChronization:MODE <Mode>

(for R&S SMBV only)

Selects the synchronization mode.

This parameter is used to enable generation of very precise synchronous signal of several connected R&S SMBVs.

Note: If several instruments are connected, the connecting cables from the master instrument to the slave one and between each two consecutive slave instruments must have the same length and type.Avoid unnecessary cable length and branching points.

Parameters:

<Mode>	NONE|MASTer|SLAVe
	NONE
	The instrument is working in stand-alone mode.
	MASTer
	The instrument provides all connected instrument with its synchronisation (including the trigger signal) and reference clock signal.
	SLAVe
	The instrument receives the synchronisation and reference clock signal from another instrument working in a master mode.
	*RST: NONE

Example:	BB:C2K:CLOC:SYNC:MODE MAST
	the instrument is configured to work as a master one.

5.4 Trigger Settings

The trigger settings are available for R&S SMx and R&S AMU instruments only.

EXTernal<ch>

The numeric suffix to EXTernal<ch> distinguishes between the external trigger via the TRIGGER 1 (suffix 1) and TRIGGER 2 (suffix 2) connector.

[:SOURce<hw>]:BB:C2K[:TRIGger]:SEQuence <Sequence>

The command selects the trigger mode.

Parameters:

<Sequence>   AUTO|RETRigger|AAUTo|ARETrigger|SINGle

AUTO
The modulation signal is generated continuously.

RETRigger
The modulation signal is generated continuously. A trigger event (internal or external) causes a restart.

AAUTo
The modulation signal is generated only when a trigger event occurs. After the trigger event the signal is generated continuously. Signal generation is stopped with command `SOUR:BB:C2K:TRIG:ARM:EXEC` and started again when a trigger event occurs.

ARETrigger
The modulation signal is generated only when a trigger event occurs. The device automatically toggles to RETRIG mode. Every subsequent trigger event causes a restart.
Signal generation is stopped with command `SOUR:BB:C2K:TRIG:ARM:EXEC` and started again when a trigger event occurs.

SINGle
The modulation signal is generated only when a trigger) event occurs. After the trigger event the signal is generated once to the set sequence length (`SOUR:BB:C2K:TRIG:SLEN`). Every subsequent trigger event causes a restart.

*RST: AUTO

Example: `BB:C2K:SEQ AAUT`
sets the "Armed_auto" trigger mode; the device waits for the first trigger (e.g. with `*TRG`) and then generates the signal continuously.

[:SOURce<hw>]:BB:C2K:TRIGger:ARM:EXECute

The command stops signal generation for trigger modes Armed_Auto and Armed_Retrigger. A subsequent internal or external trigger event restart signal generation.

Example: `BB:C2K:TRIG:SOUR INT`
sets internal triggering.
`BB:C2K:TRIG:SEQ ARET`
sets Armed_Retrigger mode, i.e. every trigger event causes signal generation to restart.
`BB:C2K:TRIG:EXEC`
executes a trigger, signal generation is started.
`BB:C2K:TRIG:ARM:EXEC`
signal generation is stopped.
`BB:C2K:TRIG:EXEC`
executes a trigger, signal generation is started again.

Usage: Event

[:SOURce<hw>]:BB:C2K:TRIGger:EXECute

The command executes a trigger. The internal trigger source must be selected using the command `:BB:C2K:TRIG:SOUR INT` and a trigger mode other than AUTO must be selected using the command `:BB:C2K:TRIG:SEQ`.

Example: `BB:C2K:TRIG:SOUR INT`
sets internal triggering.
`BB:C2K:TRIG:SEQ RETR`
sets Retrigger mode, i.e. every trigger event causes signal generation to restart.
`BB:C2K:TRIG:EXEC`
executes a trigger.

Usage: Event

[:SOURce<hw>]:BB:C2K:TRIGger:EXTernal:SYNChronize:OUTPut <Output>

(enabled for "Trigger Source" External)

Enables/disables output of the signal synchronous to the external trigger event.

For R&S SMBV instruments:

See also "Sync. Output to External Trigger" on page 38 for a detailed description of the applications of this setting.

Parameters:

<Output>   0|1|OFF|ON

ON
The signal calculation starts simultaneously with the external trigger event but because of the instrument's processing time the first samples are cut off and no signal is outputted. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.

OFF
The signal output begins after elapsing of the processing time and starts with sample 0, i.e. the complete signal is outputted.
This mode is recommended for triggering of short signal sequences with signal duration comparable with the processing time of the instrument.

*RST: ON

Example: BB:C2K:TRIG:SOUR EXT
sets external triggering.
BB:C2K:TRIG:EXT:SYNC:OUTP ON
enables synchrounous output to external trigger

[:SOURce<hw>]:BB:C2K:TRIGger:OBASeband:DELay <Delay>

The command specifies the trigger delay (expressed as a number of chips) for triggering by the trigger signal from the second path (two-path instruments only).

Parameters:

<Delay>   float

Range: 0 chips to 65535 chips
Increment: 1 chip
*RST: 0 chips

Example: BB:C2K:TRIG:SOUR OBAS
sets for path A the internal trigger executed by the trigger signal from the second path (path B).
BB:C2K:TRIG:OBAS:DEL 50
sets a delay of 50 symbols for the trigger.

[:SOURce<hw>]:BB:C2K:TRIGger:OBASeband:INHibit <Inhibit>

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only for triggering by the second path.

Parameters:

<Inhibit>   integer

Range: 0 chips to 67108863 chips
Increment: 1 chip
*RST: 0 chips

Example: BB:C2K:TRIG:SOUR OBAS
sets for path A the internal trigger executed by the trigger signal
from the second path (path B).
BB:C2K:TRIG:INH 200
sets a restart inhibit for 200 chips following a trigger event.

[:SOURce<hw>]:BB:C2K:TRIGger:RMODe?

The command queries the current status of signal generation for all trigger modes with
CDMA2000 modulation on.

Return values:

<RMode>   STOP|RUN

RUN
the signal is generated. A trigger event occurred in the triggered
mode.

STOP
the signal is not generated. A trigger event did not occur in the
triggered modes, or signal generation was stopped by the
command :BB:C2K:TRIG:ARM:EXECute (armed trigger modes
only).

Example: SOUR2:BB:C2K:TRIG:SOUR EXT
sets external triggering via the TRIGGER 1 connector for path B
of a two-path instrument.
BB:C2K:TRIG:MODE ARET
selects the Armed_Retrigger mode.
BB:C2K:TRIG:RMOD?
queries the current status of signal generation.
Response: RUN
the signal is generated, an external trigger was executed.

Usage: Query only

[:SOURce<hw>]:BB:C2K:TRIGger:SLENgth <SLength>

The command defines the length of the signal sequence to be output in the "Single" trigger
mode (SOUR:BB:C2K:SEQ SING). The unit is defined with command [:
SOURce<hw>]:BB:C2K:TRIGger:SLUNit. It is then possible to output deliberately
just part of the frame, an exact sequence of the frame, or a defined number of repetitions
of the frame.

Parameters:

<SLength>   float

                    Range: 1 chip to 2^32-1 (4 294 967 295) chips
                    *RST: 1 frame length

Example: BB:C2K:SEQ SING
                    sets trigger mode Single.
                    BB:C2K:TRIG:SLUN CHIP
                    sets unit chips for the entry of sequence length.
                    BB:C2K:TRIG:SLEN 200
                    sets a sequence length of 200 chips. The first 200 chips of the
                    current frame will be output after the next trigger event.

[:SOURce<hw>]:BB:C2K:TRIGger:SLUNit <SlUnit>

The command defines the unit for the entry of the length of the signal sequence ([:
SOURce<hw>]:BB:C2K:TRIGger:SLENgth) to be output in the Single trigger mode
(SOUR:BB:C2K:SEQ SING).

Parameters:

<SlUnit>   FRAMe|CHIP|SEQuence

                    *RST: SEQuence

Example: BB:C2K:SEQ SING
                    sets trigger mode Single.
                    BB:C2K:TRIG:SLUN FRAM
                    sets unit frames for the entry of sequence length.
                    BB:C2K:TRIG:SLEN 2
                    sets a sequence length of 2 frames. The current frame will be out-
                    put twice after the next trigger event.

[:SOURce<hw>]:BB:C2K:TRIGger:SOURce <Source>

The command selects the trigger source.

Parameters:

<Source>   INTernal|EXTernal|BEXTernal|OBASeband

INTernal
Triggering is executed by means of the Trigger command `[: SOURce<hw>]:BB:C2K:TRIGger:EXECute` on page 101 or `*TRG` in the case of remote control and by means of "Execute Trigger" in the case of manual operation.

EXTernal
Triggering is executed by means of the signal on the TRIGGER 1 connector.

BEXTernal
Triggering is executed by means of the signal on the TRIGGER 2 connector.

OBASeband
Triggering is executed by means of the trigger signal from the second path (two-path instruments only).

*RST: INTernal

Example: `BB:C2K:TRIG:SOUR EXT`
sets external triggering via the TRIGGER 1 connector.

[:SOURce<hw>]:BB:C2K:TRIGger[:EXTernal<ch>]:DELay <Delay>

The command specifies the trigger delay (expressed as a number of chips)for external triggering.

Parameters:

<Delay>   float

                     Range: 0 chips to 65535 chips
                     Increment: 1 chip
                     *RST: 0 chips

Example: `BB:C2K:TRIG:SOUR EXT`
sets an external trigger via the TRIGGER 1 connector.
`BB:C2K:TRIG:DEL 50`
sets a delay of 50 symbols for the trigger.

[:SOURce<hw>]:BB:C2K:TRIGger[:EXTernal<ch>]:INHibit <Inhibit>

The command specifies the number of chips by which a restart is to be inhibited following a trigger event. This command applies only in the case of external triggering.

Parameters:

<Inhibit>　　　　　　　integer

　　　　　　　　　　　　Range:　　　　0 chips to 67108863 chips
　　　　　　　　　　　　Increment:　 1 chip
　　　　　　　　　　　　*RST:　　　　　0 chips

Example:　　　　　`BB:C2K:TRIG:SOUR EXT`
　　　　　　　　　　　　selects an external trigger via the TRIGGER 1 connector.
　　　　　　　　　　　　`BB:C2K:TRIG:INH 200`
　　　　　　　　　　　　sets a restart inhibit for 200 chips following a trigger event.

5.5 Marker Settings

This section lists the remote control commands, necessary to configure the markers.

ⓘ The marker delay settings are available for R&S SMx and R&S AMU instruments only.

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut:DELay:FIXed <Fixed>

(for R&S SMx and R&S AMU instruments only)

The command restricts the marker delay setting range to the dynamic range. In this range the delay can be set without restarting the marker and signal. If a delay is entered in setting ON but is outside this range, the maximum possible delay is set and an error message is generated.

Parameters:

<Fixed>　　　　　　　0|1|OFF|ON

　　　　　　　　　　　　*RST:　　　　　OFF

Example:　　　　　`BB:C2K:TRIG:OUTP:DEL:FIX ON`
　　　　　　　　　　　　restricts the marker signal delay setting range to the dynamic range.

[:SOURce\<hw\>]:BB:C2K:TRIGger:OUTPut\<ch\>:DELay \<Delay\>

(for R&S SMx and R&S AMU instruments only)

The command defines the delay between the signal on the marker outputs and the start of the signal, expressed in terms of chips. Command `[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut:DELay:FIXed` can be used to restrict the range of values to the dynamic range, i.e. the range within which a delay of the marker signals can be set without restarting the marker and signal.

Parameters:

\<Delay\>	float

	Range:	0 chips to (2^24 - 1) chips
	Increment:	1 chip
	*RST:	0

Example:	`BB:C2K:TRIG:OUTP2:DEL 16000`
	sets a delay of 16000 chips for the signal on connector MARKER 2.

[:SOURce\<hw\>]:BB:C2K:TRIGger:OUTPut\<ch\>:DELay:MAXimum?

(for R&S SMx and R&S AMU instruments only)

The command queries the maximum marker delay for setting `:BB:C2K:TRIG:OUTP:DEL:FIX ON`.

Return values:

\<Maximum\>	float

Example:	`BB:C2K:TRIG:OUTP:DEL:FIX ON`
	restricts the marker signal delay setting range to the dynamic range.
	`BB:C2K:TRIG:OUTP:DEL:MAX`
	queries the maximum of the dynamic range.
	`Response: 20000`
	the maximum for the marker delay setting is 20000 chips.
Usage:	Query only

[:SOURce\<hw\>]:BB:C2K:TRIGger:OUTPut\<ch\>:DELay:MINimum?

(for R&S SMx and R&S AMU instruments only)

The command queries the minimum marker delay for setting `:BB:C2K:TRIGger:OUTPut:DELay:FIXed ON`.

Return values:

\<Minimum\>	float

Example: BB:C2K:TRIG:OUTP:DEL:FIX ON

restricts the marker signal delay setting range to the dynamic
range.

BB:C2K:TRIG:OUTP:DEL:MIN

queries the minimum of the dynamic range.

Response: 0

the minimum for the marker delay setting is 0 symbols.

Usage: Query only

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:MODE <Mode>

The command defines the signal for the selected marker output.

Parameters:

<Mode>   PCGRoup|RFRame|SCFRame|SFRame|ESECond|CSPeriod|
                       RATio|USER|TRIGger

PCGRoup
A marker signal is generated at the start of each power control
group (every 1.25 ms).

RFRame
A marker signal is generated every 20 ms (traffic channel clock).

SCFRame
A marker signal is generated at the start of each sync channel
frame (every 26,6 ms).

SFRame
A marker signal is generated every 80 ms (super frame clock).

ESECond
A marker signal is generated every 2 s (even second mark).

CSPeriod
A marker signal is generated at the start of each arbitrary
waveform sequence (depending on the set sequence length). The
marker signal is also generated if the signal contains no ARB.

RATio
A regular marker signal corresponding to the Time Off / Time On
specifications in the commands [:SOURce<hw>]:BB:C2K:
TRIGger:OUTPut<ch>:OFFTime and [:SOURce<hw>]:BB:
C2K:TRIGger:OUTPut<ch>:ONTime is generated.

USER
A marker signal is generated at the beginning of every user-
defined period. The period is defined with command [:
SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:PERiod.

*RST: RFRame

Example: BB:C2K:TRIG:OUTP2:MODE RFR

selects the traffic channel clock on output MARKER 2.

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:ONTime <OnTime>
[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:OFFTime <OffTime>

The command sets the number of chips in a period (ON time + OFF time) during which the marker signal in setting `SOURce:BB:C2K:TRIGger:OUTPut:MODE RATio` on the marker outputs is OFF.

Parameters:

<OffTime>   integer

                      Range: 1 chip to 16777215 chips
                      Increment: 1
                      *RST: 1 chip

Example: `BB:C2K:TRIG:OUTP2:OFFT 2000`
                      sets an OFF time of 2000 chips for marker signal 2 on path A.
                      `BB:C2K:TRIG:OUTP2:OFFT 2000`
                      sets an OFF time of 2000 chips for marker signal 2.
                      `BB:C2K:TRIG:OUTP2:OFFT 2000`
                      sets an OFF time of 2000 chips for marker signal 2.

[:SOURce<hw>]:BB:C2K:TRIGger:OUTPut<ch>:PERiod <Period>

The command sets the repetition rate for the signal at the marker outputs, expressed in terms of chips. The setting is only valid for selection `USER` in `:BB:C2K:TRIG:OUTP:MODE`.

Parameters:

<Period>   integer

                      Range: 2 to (2^32-1) chips
                      Increment: 1 chip
                      *RST: 1 Frame (38400 chips)

Example: `BB:C2K:TRIG:OUTP2:MODE USER`
                      selects the user marker for the signal on connector MARKER 2.
                      `BB:C2K:TRIG:OUTP2:PER 1600`
                      sets a period of 1600 chips, i.e. the marker signal is repeated every 1600th chip.

5.6 Predefined Settings

The R&S Signal Generator gives you the opportunity to generate predefined test settings for base station 1. These predefined settings enable the creation of highly complex scenarios for the downlink by presetting the channel table of base station 1. The settings take effect only after execution of command [:SOURce<hw>]:BB:C2K: PPARameter:EXECute.

[:SOURce<hw>]:BB:C2K:PPARameter:CRESt <Crest>

This commands selects the desired range for the crest factor of the test scenario. The crest factor of the signal is kept in the desired range by automatically setting appropriate Walsh codes and timing offsets.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`.

The setting of command `[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:WCODe` is adjusted according to the selection.

Parameters:

<Crest>   MINimum|AVERage|WORSt

MINimum
The crest factor is minimized. The Walsh codes are spaced as closely as possible.

AVERage
An average crest factor is set. The Walsh codes are distributed uniformly over the code domain.

WORSt
The crest factor is set to an unfavorable value (i.e. maximum). The Walsh codes are as wildly spaced as possible.

*RST: MINimum

Example: BB:C2K:PPAR:CRES WORS
sets the crest factor to an unfavorable value.

[:SOURce<hw>]:BB:C2K:PPARameter:EXECute

This command presets the channel table of base station 1 with the parameters defined by the PPARameter commands.

Example: BB:C2K:PPAR:EXEC
configures the signal sequence as defined by
the :BB:C2K:PPARameter commands.

Usage: Event

[:SOURce<hw>]:BB:C2K:PPARameter:PCHannel[:STATe] <State>

The command activates/deactivates the paging channel.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`.

Parameters:

<State>   0|1|OFF|ON

                     *RST: ON

Example: `BB:C2K:PPAR:PCH ON`
                     activates F-PCH.

[:SOURce<hw>]:BB:C2K:PPARameter:PICHannel[:STATe] <State>

The command activates/deactivates the pilot channel.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`.

Parameters:

<State>   0|1|OFF|ON

                     *RST: ON

Example: `BB:C2K:PPAR:PICH ON`
                     activates F-PICH.

[:SOURce<hw>]:BB:C2K:PPARameter:RCONfiguration <RConfiguration>

The command selects the radio configuration for the traffic channel.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`.

The R&S Signal Generator provides a separate set of settings of all channel table parameters for each radio configuration. If the radio configuration is changed, the set of channel table values belonging to this RC is automatically activated.

Parameters:

<RConfiguration>   1|2|3|4|5

                     *RST: 1

Example: `BB:C2K:PPAR:RCON 1`
                     selects radio configuration 1.

[:SOURce<hw>]:BB:C2K:PPARameter:SCHannel[:STATe] <State>

The command activates/deactivates the F-SYNC

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:` `PPARameter:EXECute`.

Parameters:

<State>   0|1|OFF|ON

                           *RST: ON

Example: `BB:C2K:PPAR:SCH ON`
                           activates the F-SYNC.

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:COUNt <Count>

This command sets the number of activated traffic channels.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:` `PPARameter:EXECute`.

Parameters:

<Count>   integer

                           Range: 0 to 8
                           *RST: 1

Example: `BB:C2K:PPAR:TCH:COUN 2`
                           the predefined signal contains 2 traffic channels.

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:DATA:RATE <Rate>

This command sets the data rate of F-FCH and F-SCH. The set value is specific for the selected radio configuration.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:` `PPARameter:EXECute`. It is specific for the selected radio configuration.

The value range depends on the frame length. If the frame length is changed so that the set data rate becomes invalid, the next permissible value is automatically set.

The data rate affects the Walsh code (spreading factor) that are possible within a channel. If a data rate is changed so that the selected Walsh code becomes invalid, the next permissible value is automatically set.

Parameters:

<Rate>   DR1K2|DR1K3|DR1K5|DR1K8|DR2K4|DR2K7|DR3K6|DR4K8|
                           DR7K2|DR9K6|DR14K4|DR19K2|DR28K8|DR38K4|DR57K6|
                           DR76K8|DR115K2|DR153K6|DR230K4|DR259K2|DR307K2|
                           DR460K8|DR518K4|DR614K4|DR1036K8|NUSed

                           *RST: DR1K2

Example: `BB:C2K:PPAR:TCH:DATA:RATE D240K`

sets the data rate of F-FCH and F-SCH to 240 ksps.

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:DCCHannel[:STATe] <State>

The command activates/deactivates the dedicated control channel. F-DCCH can not be selected for RC1 and RC2.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`. It is specific for the selected radio configuration.

Parameters:

<State>   0|1|OFF|ON

*RST: ON

Example: `BB:C2K:PPAR:TCH:DCCH ON`
activates F-DCCH.

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:FCHannel[:STATe] <State>

The command activates/deactivates the fundamental channel.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`. It is specific for the selected radio configuration.

Parameters:

<State>   0|1|OFF|ON

*RST: ON

Example: `BB:C2K:PPAR:TCH:FCH ON`
activates F-FCH.

[:SOURce<hw>]:BB:C2K:PPARameter:TCHannel:FLENgth <FLength>

The command activates/deactivates the fundamental channel. The set value is specific for the selected radio configuration.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:PPARameter:EXECute`. It is specific for the selected radio configuration.

The frame length affects the data rates that are possible within a channel. Changing the frame length may lead to a change of data rate and this in turn may bring about a change of Walsh code.

Parameters:

<FLength>   20|40|80

*RST: 20 ms

Example: `BB:C2K:PPAR:TCH:FLEN 20 ms`

sets the frame length of the code channels to 20 ms.

[:SOURce\<hw\>]:BB:C2K:PPARameter:TCHannel:SCHannel:COUNt \<Count\>

The command defines the number of supplemental channels. The maximum number of supplemental channels depends on the selected radio configuration.

The setting takes effect only after execution of command `[:SOURce<hw>]:BB:C2K:`
`PPARameter:EXECute`. It is specific for the selected radio configuration.

Parameters:

\<Count\>   integer

Range: 1 to 7
*RST: 1

Example: `BB:C2K:PPAR:TCH:SCH:COUN 2`
selects two F-SCHs.

5.7 Setting Base Stations

The `SOURce:BB:C2K:BSTation` system contains commands for setting base stations.

The commands of this system only take effect if the CDMA2000 standard is activated, the DOWN transmission direction is selected and the particular base station is enabled:

- `SOURce:BB:C2K:STATe ON`

- `SOURce:BB:C2K:LINK DOWN`

- `SOURce:BB:C2K:BSTation2:STATe ON`

Suffixes

The channel table for the base station is configured from fourteen special channels and up to eight traffic channels. Each traffic channel consists of four to eight code channels. The type and number of code channels depends on the radio configuration chosen for the traffic channel.

The individual channels are selected in SCPI via the suffixes to keywords `CGRoup` and `COFFset`.

The special channel have the suffix 0 to `CGRoup` and 1 to 14 to `COFFset` corresponding to the channel index 0-1 to 0-14 in the channel table.

The code channels of a traffic channel are addressed by means of suffixes 1 to 8 for the traffic channel and 1 to 8 to `COFFset` for the sub channels of the selected traffic channel. Thus `CGRoup2:COFFset1` is the code channel F-FCH of the traffic channel 2 and equates to the channel index 2-1 in the channel table.

Table 5-1: Structure of the traffic channel for different radio configurations.

	Radio Configuration 1, 2	Radio Configuration 3,4,5
1-1 (CGRoup1:COFFset1)	F-FCH	F-FCH
1-2 (CGRoup1:COFFset2)	F-SCH1	F-SCH1
1-3 (CGRoup1:COFFset3)	F-SCH2	F-SCH2
1-4 (CGRoup1:COFFset4)	F-SCH3	F-DCCH
1-5 (CGRoup1:COFFset5)	F-SCH4	-
1-6 (CGRoup1:COFFset6)	F-SCH5	-
1-7 (CGRoup1:COFFset7)	F-SCH6	-
1-8 (CGRoup1:COFFset8)	F-SCH7	-

Regardless of the radio configuration, in all traffic channels the COFFset1 corresponds to the F-FCH, and the COFFset2 and COFFset3 correspond to the F-SCH1 and F-SCH2, respectively. In radio configurations 1 and 2 the COFFset4 corresponds to the F-SCH3, and in radio configurations 3, 4, 5 to the F-DCCH. COFFset5, COFFset6,COFFset7 and COFFset8 exist only in radio configurations 1 and 2, where they correspond to the F-SCH4 to F-SCH7.

For the code channels of a traffic channels, the settings of the channel table parameters are specific for the selected radio configuration. I.e. a complete set of settings exists for each of the five possible radio configurations.

BSTation<st>

Determines the base station. Value range <st> = [1]|2|3|4

CGRoup<di>

Value range <di>= 0|[1]|..8

COFFset<ch>

Value range <ch>= [1]..13

[:SOURce<hw>]:BB:C2K:BSTation:PRESet

a standardized default for all the base stations. The settings correspond to the *RST values specified for the commands.

All base station settings are preset. An overview is provided in "Reset All Base Stations" on page 27.

| **Example:** | BB:C2K:BST:PRES |
| | resets all the base station settings to default values. |

| **Usage:** | Event |

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:CNUMber <CNumber>

Sets the CDMA Channel Number which corresponds to the RF.

Parameters:

<CNumber>	integer
	Range: 1 to 1000
	*RST: 387

| **Example:** | BB:C2K:BST:SYNC:CNUM 400 |
| | sets the channel number |

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:MPRev <MPrev>

Sets the Minimum Protocol Revision Level.

The base station sets this field to prevent mobile stations which can not be supported by the base station from accessing the CDMA system.

Parameters:

<MPrev>	2	8
	Range: 2 to 8
	*RST: 2

| **Example:** | BB:C2K:BST:SYNC:MPR 3 |
| | sets the MIN_P_REV parameter |

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:NID <Nid>

Sets the Network Identification.

The NID serves as a sub-identifier of a CDMA system as defined by the owner of the SID.

Parameters:

<Nid>	integer

Range: 1 to 65535
*RST: 1

Example: `BB:C2K:BST:SYNC:NID 5`

sets the network identification parameter

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:PREV <Prev>

Sets the Protocol Revision Level, i.e. specifies the CDMA2000 system release number.

The table below gives the cross-reference between the P_REV values and the CDMA2000 Releases.

P_REV	CDMA2000 Release
1	Korean PCS(Band Class4), USPCS(Band Class1)
2	IS-95
3	TBS74
4	IS-95A
5	IS-95B
6	IS2000 Release 0
7	IS2000 Release A
8	IS2000 Release B

Parameters:

<Prev>	integer

Range: 1 to 8
*RST: 6

Example: `BB:C2K:BST:SYNC:PREV 4`

sets the P_REV parameter

[:SOURce<hw>]:BB:C2K:BSTation:SYNC:SID <Sid>

Displays the System Identification.

The base station sets the system identification number.

Parameters:

<Sid>	integer

Range: 0 to 32767
*RST: 10

Example: `BB:C2K:BST:SYNC:SID 10`
sets the system identification parameter

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: BINTerleaver?

The command queries the number of symbols per block which are processed by the interleaver. This value is only available for channel coding modes "Complete" and "Without Interleaving"
(`SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP | NOIN`).

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<BInterleaver>   48|96|128|144|192|288|384|576|768|1152|1536|2304|3072|
                         4608|6144|9216|12288|18432|36864|NONE

Example: `BB:C2K:BST:CGR3:COFF1:CCOD:MODE COMP`
selects channel coding mode "Complete" for F-FCH of the third traffic channel.
`BB:C2K:BST:CGR3:COFF1:CCOD:BINT?`
queries the number of symbols per block which are processed by the interleaver.
`Response:`   `384`
384 symbols per block are processed.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: BITFrame?

The command queries the number of input bits per frame for the channel coder. This value is only available for channel coding modes "Complete" and "Without Interleaving"
(`SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP | NOIN`).

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<BitFrame>   float

Example: BB:C2K:BST:CGR3:COFF1:CCOD:MODE COMP
selects channel coding mode "Complete" for F-FCH of the third
traffic channel.
BB:C2K:BST:CGR3:COFF1:CCOD:BITF?
queries the number of input bits per frame.
Response: 16
16 bits per frame.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: CRC?

The command queries the CRC (cyclic redundancy code) type (length). This value is only
available for channel coding modes "Complete" and "Without Interleaving"
(SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP |
NOIN).

For the traffic channels, this value is specific for the selected radio configuration.

Return values:
<Crc>   float

Example: BB:C2K:BST:CGR1:COFF1:CCOD:MODE COMP
selects channel coding mode "Complete" for F-FCH of the first
traffic channel.
BB:C2K:BST:CGR1:COFF1:CCOD:CRC?
queries the CRC type.
Response: 6
CRC type 6 is used.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: DATA:RATE?

The command queries the effective data rate in Hz. This value is only available for chan-
nel coding modes "Off" and "Interleaving Only"
(SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE OFF |
OINT).

When channel coding is switched off, the effective data rate differs from the data rate set
in the channel table. The data are read out with the effective rate.

For the traffic channels, this value is specific for the selected radio configuration.

Return values:
<Rate>   float

Example: `BB:C2K:BST:CGR3:COFF1:CCOD:MODE OINT`
selects channel coding mode "Interleaving Only" for F-FCH of the third traffic channel.
`BB:C2K:BST:CGR3:COFF1:CCOD:DATA:RATE?`
queries the effective data rate.
`Response:  19200`
the effective data is 19.2 kbps.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: MODE <Mode>

The command selects channel coding mode. For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Mode>   OFF|COMPlete|NOINterleaving|OINTerleaving

OFF
Channel coding is deactivated.

COMPlete
The complete channel coding is performed. The channel coding procedure may slightly vary depending on channel type, frame length and data rate.

OINTerleaving
Except for the block interleaver, the whole channel coding procedure is carried out. In this mode the frame structure and the convolutional coder of an receiver can be tested.

NOINterleaving
In this mode only block interleaver is used for coding. This allows the deinterleaver in the receiver to be tested independently of the remaining (de-)coding process.

*RST: COMPlete

Example: `BB:C2K:BST:CGR3:COFF1:CCOD:MODE OFF`
deactivates channel coding for F-FCH of the third traffic channel.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing: SPUNcture?

The command queries the symbol puncture rate. This value is only available for channel coding modes "Complete" and "Without Interleaving"
(`SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP | NOIN`).

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<SPuncture>   8OF24|1OF5|1OF9|4OF12|2OF18|2OF6|T2OF18|T4OF12|
                     NONE

                     xOFy
                     a symbol puncture rate of x out of y is used

                     TxOFy
                     a symbol puncture rate of x out of y Turbo is used

Example: `BB:C2K:BST:CGR3:COFF1:CCOD:MODE COMP`
                     selects channel coding mode "Complete" for F-FCH of the third
                     traffic channel.
                     `BB:C2K:BST:CGR3:COFF1:CCOD:SPUN?`
                     queries the symbol puncture rate.
                     `Response:  8OF24`
                     a symbol puncture rate of 8 out of 24 is used.

Usage: Query only

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing:
    SREPetition?**

The command queries symbol repetition rate. This value is only available for channel
coding modes "Complete" and "Without Interleaving"
(`SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP |
NOIN`).

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<SRepetition>   float

Example: `BB:C2K:BST:CGR3:COFF1:CCOD:MODE COMP`
                    selects channel coding mode "Complete" for F-FCH of the third
                    traffic channel.
                    `BB:C2K:BST:CGR3:COFF1:CCOD:SREP?`
                    queries symbol repetition rate.
                    `Response:  8`
                    a symbol repetition rate of 8 is used.

Usage: Query only

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:CCODing:
    TYPE** <Type>

The command sets the channel coding type.

This value is only available for channel coding modes "Complete" and "Without Interleaving" (`SOURce:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:CCODing:MODE COMP | NOIN`). For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Type>   CON2|CON3|CON4|CON6|TUR2|TUR3|TUR4|TUR5|OFF| DEFault

                           NONE
No error protection

                           TURx
Turbo Coder of rate 1/x in accordance with the CDMA specifications.

                           CONx
Convolution Coder of rate 1/x with generator polynomials defined by CDMA.

                           *RST: Channel-specific

Example: `BB:C2K:BST:CGR3:COFF2:CCOD:MODE COMP`
selects channel coding mode "Complete" for F-SCH1 of the third traffic channel.
`BB:C2K:BST:CGR3:COFF2:CCOD:TYPE TURB4`
selects turbo coder with a rate of 1/4 for F-SCH1 of the third traffic channel.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA <Data>

The command selects the data source for the specified channel.

For the traffic channels, this value is specific for the selected radio configuration.

The data source for the power control bits is selected with the command `:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:TPC:DATA`.

Parameters:

<Data>   ZERO|ONE|PATTern|PN9|PN11|PN15|PN16|PN20|PN21|PN23|
                         DLISt

PNxx
The pseudo-random sequence generator is used as the data
source. Different random sequence lengths can be selected.

DLISt
A data list is used. The data list is selected with the
command `:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:
DATA:DSEL`.

ZERO | ONE
Internal 0 and 1 data is used.

PATTern
Internal data is used The bit pattern for the data is defined by the
command `:BB:C2K:BST:CGRoup:COFFset:DATA:PATT`.

*RST: F-PICH; F-TDPICH; F-APICH; F-ATDPICH: ALL0; all
              other channels: PN9

Example: `BB:C2K:BST2:CGR3:COFF1:DATA PATT`
                        selects as the data source for the F-FCH of the third traffic channel
                        of base station 2, the bit pattern defined with the following com-
                        mand:
                        `BB:C2K:BST2:CGR3:COFF1:DATA:PATT  #H3F,8`
                        defines the bit pattern.

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:
    DSELect** <DSelect>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the
user's choice. The directory applicable to the following commands is defined with the
command `MMEMory:CDIR`. To access the files in this directory, you only have to give the
file name, without the path and the file extension.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:
<DSelect>   string

Example: BB:C2K:BST2:CGR3:COFF1:DATA DLIS
                      selects the Data Lists data source for the F-FCH of the third traffic
                      channel of basestation2.
                      MMEM:CDIR '<root>\Lists\DM\IqData'
                      selects the directory for the data lists.
                      BB:C2K:BST2:CGR3:COFF1:DATA:DLIS 'cdma_list1'
                      selects file "cdma_list1" as the data source. This file must be in
                      the directory <root>\Lists\DM\IqData and have the file
                      extension *.dm_iqd.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA: PATTern <Pattern>

The command sets the bit pattern for the PATTern selection. The first parameter determines the bit pattern (choice of hexadecimal, octal or binary notation), the second specifies the number of bits to use. The maximum length is 64 bits.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:
<Pattern>   64bit pattern

                      *RST: 0

Example: BB:C2K:BST2:CGR3:COFF1:DATA:PATT #H800FE038,30
                      defines the bit pattern.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DATA:RATE <Rate>

The command sets the data rate for the specified channel. The value range depends on the channel type, the selected radio configuration and the frame length. Parameter NUSed is returned for channel 0-1 to 0-4.

For the traffic channels, this value is specific for the selected radio configuration.

The value range depends on the frame length. If the frame length is changed so that the set data rate becomes invalid, the next permissible value is automatically set.

The data rate affects the Walsh code (spreading factor) that are possible within a channel. If a data rate is changed so that the selected Walsh code becomes invalid, the next permissible value is automatically set.

Parameters:
<Rate>   DR1K2|DR1K3|DR1K5|DR1K8|DR2K4|DR2K7|DR3K6|DR4K8|
                      DR7K2|DR9K6|DR14K4|DR19K2|DR28K8|DR38K4|DR57K6|
                      DR76K8|DR115K2|DR153K6|DR230K4|DR307K2|NUSed

                      *RST: Channel-specific

Example: `BB:C2K:BST2:CGR3:COFF1:DATA:RATE DR4K8`
sets a data rate of 4.8 kbps for F-FCH of the third traffic channel of base station 2.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BIT: RATE <Rate>

The command sets the bit error rate.

Suffix:

<st>   1
        This command is available only for the realtime channels of base station 1.

Parameters:

<Rate>   float

          Range: 1E-7 (0.0000001) to 1E-1 (0.1)
          *RST: 1E-3

Example: `BB:C2K:BST:CGR1:COFF3:REAL:STAT ON`
activates the real time generation of F-SCH2 of the first traffic channel of base station1.
`BB:C2K:BST:CGR1:COFF3:DERR:BIT:RATE 1E-4`
sets a bit error rate of 0.0001.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:BIT: STATe <State>

The command activates bit error generation.

Suffix:

<st>   1
        This command is available only for the realtime channels of base station 1.

Parameters:

<State>   0|1|OFF|ON

           *RST: OFF

Example: `BB:C2K:BST:CGR1:COFF3:REAL:STAT ON`
activates the real time generation of F-SCH2 of the first traffic channel of base station 1.
`BB:C2K:BST:CGR1:COFF3:DERR:BIT:STAT ON`
activates bit error generation.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor: BLOCk:RATE <Rate>

The command sets the block error rate.

Block error generation is only possible when channel coding is activated. For the traffic channels, this value is specific for the selected radio configuration.

Suffix:

<st>	1
	This command is available only for the realtime channels of base station 1.

Parameters:

<Rate>	float
	Range: 1E-4 (0.0001) to 1E-1 (0.1)
	*RST: 1E-1

Example: `BB:C2K:BST:CGR1:COFF3:REAL:STAT ON`
activates the real time generation of F-SCH2 of the first traffic channel of base station 1.
`BB:C2K:BST:CGR1:COFF3:CCOD:MODE COMP`
activates complete channel coding.
`BB:C2K:BST:CGR1:COFF3:DERR:BLOC:RATE 1E-2`
sets the block error rate to 0.01.
`BB:C2K:BST:CGR1:COFF3:DERR:BLOC:STAT ON`
activates block error generation.

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:DERRor:
    BLOCk:STATe** <State>

The command activates or deactivates block error generation.

Suffix:

<st>	1
	This command is available only for the realtime channels of base station 1.

Parameters:

<State>	0|1|OFF|ON
	*RST: OFF

Example: `BB:C2K:BST:CGR1:COFF3:REAL:STAT ON`
activates the real time generation of F-SCH2 of the first traffic channel of base station 1.
`BB:C2K:BST:CGR1:COFF3:CCOD:MODE COMP`
activates complete channel coding.
`BB:C2K:BST:CGR1:COFF3:DERR:BLOC:RATE 1E-2`
sets the block error rate to 0.01.
`BB:C2K:BST:CGR1:COFF3:DERR:BLOC:STAT ON`
activates block error generation.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:FLENgth
<FLength>

The command sets the frame length of the selected channel. The value range is channel specific.

For the traffic channels, this value is specific for the selected radio configuration.

The value range of the frame length depends on the channel type and the selected radio configuration.

The frame length affects the data rates that are possible within a channel. Changing the frame length may lead to a change of data rate and this in turn may bring about a change of Walsh code.

Parameters:

<FLength>   5|10|20|26.6|40|80|160|NUSed

                   26 ms
                   Frame length of 26,6. Also all inputs between 26.6 and 26.7 ms
                   are allowed.

                   *RST: F-SYNC: 26.6; F_BCH: 40 ms; F_CACH: 5 ms; all
                              other channels: 20 ms

Example: BB:C2K:BST:CGR3:COFF4:FLEN 5 ms
                   sets the frame length of sub channel 3-4 to 5 ms.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:LCMask
<LcMask>

The command sets the mask of the Long Code Generator of the base station.

For the traffic channels, this value is specific for the selected radio configuration.

The LC Mask is the same for all sub channels of a traffic channel. If the mask is modified for one of the sub channels the new value is then automatically used by all other sub-channels of this traffic channel.

Parameters:

<LcMask>   integer

                   Range: #H0 to #H3FF FFFF FFFF
                   *RST: #H0

Example: BB:C2K:BST1:CGR2:COFF1:LCM #H55
                   sets the Long Code Mask to #H55.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:POWer
<Power>

The command sets the channel power relative to the powers of the other channels. This setting also determines the starting power of the channel for Misuse Output Power Control.

With the command `[:SOURce<hw>]:BB:C2K:POWer:ADJust`, the power of all the activated channels is adapted so that the total power corresponds to 0 dB. This will not change the power ratio among the individual channels.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Power>   float

                                Range: -80 dB to 0 dB
                                Increment: 0.01 dB
                                *RST: Channel-specific

Example: `BB:C2K:BST2:CGR3:COFF4:POW -10dB`

                                sets the channel power of sub channel 3-4 of base station 2 to -10 dB relative to the power of the other channels.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:QWCode: STATe <State>

This command activates/deactivates the use of the quasi orthogonal Walsh codes for the channel.

The quasi orthogonal Walsh Code set is selected for all channels of the base station with command `[:SOURce<hw>]:BB:C2K:BSTation<st>:QWSet`.

For the traffic channels, this value is specific for the selected radio configuration. It is only available for radio configuration 3 and higher.

Parameters:

<State>   0|1|OFF|ON

                                *RST: OFF

Example: `BB:C2K:BST1:QWS 3`
                                selects quasi orthogonal Walsh code set 3 for base station 1.
                                `BB:C2K:BST1:CGR3:COFF4:QWC:STAT ON`
                                activates the use of the quasi orthogonal Walsh code for sub channel 3-4.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:REALtime: STATe <State>

This command activates/deactivates realtime generation of the selected channel. Realtime generation is possible for F-SYNC and the first traffic channel of base station 1.

For the traffic channel, this value is specific for the selected radio configuration.

Parameters:

<State>   0|1|OFF|ON

                                *RST: OFF

Example: BB:C2K:BST:CGR0:COFF5:REAL:STAT ON

activates realtime generation of F-SYNC of base station 1.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:STATe <State>

This command activates/deactivates the selected channel.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<State>   0|1|OFF|ON

                *RST: OFF

Example: BB:C2K:BST2:CGR1:COFF2:STAT OFF

deactivates sub channel 1-2 of base station 1.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA <Data>

The command determines the data source for the power control bits of the selected F-FCH or F-DCCH.

Power control is available for sub channel types F-FCH and F-DCCH. F-DCCH is only generated for radio configurations 3, 4 and 5.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Data>   ZERO|ONE|PATTern|DLISt

                DLISt
A data list is used. The data list is selected with the command [:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:DSELect.

                ZERO | ONE
Internal 0 and 1 data is used.

                PATTern
Internal data is used The bit pattern for the data is defined by the command [:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:PATTern. The maximum length is 64 bits.

                *RST: ZERO

Example: `BB:C2K:BST2:CGR1:RCON 4`
selects radio configuration4 for the first traffic channel of base sta-
tion 2. This setting is valid for all sub channels of this traffic chan-
nel. With RC4, the traffic channel includes a F-DCCH.
`BB:C2K:BST2:CGR1:COFF4:TPC:DATA PATT`
selects as the data source for the power control bits of F-DCCH
the bit pattern defined with the following command.
`BB:C2K:BST2:CGR1:COFF4:TPC:DATA:PATT`
`#HF0C20,19`
defines the bit pattern.

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:
DSELect** <DSelect>

The command selects the data list for the DLISt data source selection.

Power control is available for sub channel types F-DCCH and F-FCH. F-DCCH is only
generated for radio configurations 3, 4 and 5.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the
user's choice. The directory applicable to the following commands is defined with the
command `MMEMory:CDIR`. To access the files in this directory, you only have to give the
file name, without the path and the file extension.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:
<DSelect>   string

Example: `BB:C2K:BST2:CGR1:RCON 4`
selects radio configuration RC4 for the first traffic channel of base
station 2. This setting is valid for all sub channels of the traffic
channel. With RC4, the traffic channel includes a F-DCCH.
`:BB:C2K:BST2:CGR1:COFF4:TPC:DATA DLIS`
selects the DLISt data source.
`MMEM:CDIR '<root>\Lists\DM\IqData'`
selects the directory for the data lists.
`BB:C2K:BST2:CGR1:COFF4:TPC:DATA:DSEL 'cdma_ch4'`
selects the file `cdma_ch4` as the data source. This file must bei in
the directory `<root>\List\DM\IqData` and have the file exten-
sion `*.dm_iqd`.

**[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:DATA:
PATTern** <Pattern>

The command determines the bit pattern for the `PATTern` selection. The maximum bit
pattern length is 64 bits.

Power control is available for sub channel types F-DCCH and F-FCH. F-DCCH is only generated for radio configurations 3, 4 and 5.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Pattern>   64 bit pattern

                             *RST: #H0,1

Example: `BB:C2K:BST2:CGR1:RCON 4`
                             selects radio configuration RC4 for the first traffic channel of base station 2. This setting is valid for all sub channels of the traffic channel. With RC4, the traffic channel includes a F-DCCH.
                             `BB:C2K:BST2:CGR1:COFF4:TPC:DATA:PATT  #H3F,8`
                             defines the bit pattern for the power control-bits.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:MISuse
      <MisUse>

The command activates "mis-" use of the power control bits of the selected F-DCCH or F- FCH for controlling the channel powers of these channels.

Power control is available for sub channel types F-DCCH and F-FCH. F-DCCH is only generated for radio configurations 3, 4 and 5.

The bit pattern (see com-
mands `:BB:C2K:BSTation<n>:CGRoup<n>:COFFset<n>:TPC...`) of the power control bits of each channel is used to control the channel power. A "1" leads to an increase of channel powers, a "0" to a reduction of channel powers. Channel power is limited to the range 0 dB to -80 dB. The step width of the change is defined with the command `[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:PSTep`.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<MisUse>   0|1|OFF|ON

                             *RST: OFF

Example: `BB:C2K:BST2:CGR1:RCON 4`
                             selects radio configuration RC4 for the first traffic channel of base station 2. This setting is valid for all sub channels of the traffic channel. With RC4, the traffic channel includes a F-DCCH.
                             `BB:C2K:BST2:CGR1:COFF4:TPC:MIS ON`
                             activates regulation of channel power for DCCH of the first traffic channel of base station 2 via the power control bit pattern.
                             `BB:C2K:BST2:CGR1:COFF4:TPC:PST 1 dB`
                             sets the step width for the change of channel powers to 1 dB.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:PSTep
    <PStep>

The command defines the step width for the change of channel powers in the case of
"mis-" use of the power control bits.

Power control is available for sub channel types F-DCCH and F-FCH. F-DCCH is only
generated for radio configurations 3, 4 and 5.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<PStep>   float

                        Range: -10 dB to 10 dB
                        Increment: 0.01 dB
                        *RST: 0

Example: `BB:C2K:BST2:CGR1:RCON 4`
                        selects radio configuration RC4 for the first traffic channel of base
                        station 2. This setting is valid for all sub channels of the traffic
                        channel. With RC4, the traffic channel includes a F-DCCH.
                        `BB:C2K:BST2:CGR1:COFF4:TPC:PST 1 dB`
                        sets the step width for the change of channel powers to 1 dB.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TPC:READ
    <Read>

The command sets the read out mode for the bit pattern of the power control bits.

The bit pattern is defined with the com-
mands `:BB:C2K:BST<n>:CGRoup<n>:COFFset<n>:TPC....`

Power control is available for sub channel types F-DCCH and F-FCH. F-DCCH is only
generated for radio configurations 3, 4 and 5.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Read>   CONTinuous|S0A|S1A|S01A|S10A

CONTinuous
The bit pattern is used cyclically.

S0A
The bit pattern is used once, then the power control bit sequence continues with 0 bits.

S1A
The bit pattern is used once, then the power control bit sequence continues with 1 bits.

S01A
The bit pattern is used once and then the power control bit sequence is continued with 0 and 1 bits alternately.

S10A
The bit pattern is used once and then the power control bit sequence is continued with 1 and 0 bits alternately.

*RST: CONTinuous

Example: BB:C2K:BST2:CGR1:RCON 4
selects radio configuration RC4 for the first traffic channel of base station 2. This setting is valid for all sub channels of the traffic channel. With RC4, the traffic channel includes a F-DCCH.
BB:C2K:BST2:CGR1:COFF4:TPC:READ S0A
'the bit pattern is used once, after which a 0 sequence is generated (applies to F-DCCH of the first traffic channel of base station 2).

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:TYPE?

The command queries the channel type.

The channel type is firmly fixed for channel numbers 0-1 to 0-14 (CGR0:COFF1 to CGR0:COFF14), i.e. for the special channels (control and packet channels). The remaining channel numbers are assigned to the individual code channels of the eight possible traffic channels. In this case the first traffic channel occupies the range 1-1 to 1-8 (CGR1:COFF1 to CGR1:COFF8), the second occupies the range 2-1 to 2-8 (CGR2:COFF1 to CGR2:COFF8), etc. Since the type and number of code channels depends on the radio configuration of the channel, the channels x-2 to x-8 are variously occupied. X-1 is always the fundamental channel (F-FCH) of the traffic channel.

Return values:

<Type>   F-PICH|F-SYNC|F-PCH|F-TDPICH|F-APICH|F-ATDPICH|F-
                          BCH|F-QPCH|F-CPCCH|F-CACH|F-CCCH|F-DCCH|F-FCH|F-
                          SCH|F-PDCCH|F-PDCH

F-PICH
Pilot Channel

F-SYNC
Sync Channel

F-PCH
Paging Channel

F-TDPICH
Transmit Diversity Pilot Channel.

F-APICH
Auxiliary Pilot Channel

F-ATDPICH
Auxiliary Transmit Diversity Pilot Channel

F-BCH
Broadcast Channel

F-CPCCH
Common Power Control Channel

F-QPCH
Quick Paging Channel

F-CACH
Common Assignment Channel

F-CCCH
Common Control Channel

F-DCCH
Dedicated Control Channel

F-FCH
Fundamental Channel

F-SCH
Supplemental Channel

F-PDCCH
Packet Data Control Channel

F-PDCH
Forward Packet Data Channel

Example: BB:C2K:BST2:CGR0:COFF12:TYPE?
                      queries type of channel 0-12 of base station 2.
                      Response: F-PDCCH
                      channel 0-12 is a Packet Dedicated Control Channel.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:WCODe
     <WCode>

The command assigns the Walsh Code to the channel. The standard assigns a fixed walsh code to some channels (F-PICH, for example, always uses Walsh code 0). Generally, the Walsh code can only be varied within the range specified by the standard.

For the traffic channels, this value is specific for the selected radio configuration.

The value range of the Walsh code depends on the frame length, the channel coding type and the data rate.

If one of these parameters is changed so that the set Walsh code gets invalid, the next permissible value is automatically set.

Parameters:

<WCode>	float
	*RST: Channel-specific

Example: BB:C2K:BST1:CGR3:COFF5:WCOD 23
                assigns Walsh code 23 to sub channel 3-5 of base station 1.

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:WLENgth?

The command queries the Walsh Code length of the channel. For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<WLength>	float

Example: BB:C2K:BST1:CGR3:COFF5:WLEN?
                queries Walsh code length of sub channel 3-5 of base station 1.
                Response: 64
                the Walsh code length is 64.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:RCONfiguration
     <RConfiguration>

The command selects the radio configuration for the traffic channel. The settings of the channel table parameters are specific for the selected radio configuration.

The R&S Signal Generator provides a separate set of settings of all channel table parameters for each radio configuration. If the radio configuration is changed, the set of channel table values belonging to this RC is automatically activated.

Parameters:

<RConfiguration>	1|2|3|4|5
	*RST: Traffic channel 1/2: 3; all other traffic channels: 1

Example:　　　　　　`BB:C2K:BST2:CGR1:RCON 4`

selects radio configuration RC4 for the first traffic channel of base station 2. This setting is valid for all sub channels of the traffic channel. With RC4, the traffic channel includes a F-DCCH.

[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict:MODE <Mode>

The command switches the order of the spreading codes.

Parameters:

<Mode>　　　　　　　HAD|BREV

HAD
the code channels are displayed in the order determined by the Hadamard matrix. The codes are numbered as Walsh codes according to the standard.

BREV
the code channels are displayed in the order defined by the Orthogonal Variable Spreading Factor (OVSF) code tree (3GPP code).

*RST:　　　　HAD

Example:　　　　　　`BB:C2K:BST2:DCON:MODE HAD`

selects that the codes are numbered as Walsh codes according to the standard.

[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict:RESolve

The command resolves existing domain conflicts by modifying the Walsh codes of the affected channels.

Example:　　　　　　`BB:C2K:BST2:DCON:STAT?`

queries whether a code domain conflict exists for base station 2.
`Response: 1`
there is a conflict.
`BB:C2K:BST2:DCON:RES`
resolves the code domain error by modifying the Walsh codes of the affected channels.

Usage:　　　　　　　Event

[:SOURce<hw>]:BB:C2K:BSTation<st>:DCONflict[:STATe]?

The command queries whether there is (response 1) or is not (response 0) a conflict (overlap) in the hierarchically-structured Walsh codes.

Return values:

<State>　　　　　　　0|1|OFF|ON

Example: BB:C2K:BST2:DCON:STAT?
                     queries whether a code domain conflict exists for base station 2.
                     Response: 0
                     there is no conflict.

Usage: Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:PINTerval <PInterval>

The command sets the interval between two data packets for F-PDCH. The range depends on the ARB settings sequence length (:BB:C2K:SLENgth). The values 80 ms, 40 ms, 20 ms, 10 ms and 5 ms can always be set, and the maximum value is 2000 ms. All intermediate values must satisfy the condition:

Sequence Length * 80ms/2^n, where n is a whole number.

Parameters:
<PInterval>   float

                     Range: 5 ms to 2000 ms
                     *RST: 20 ms

Example: BB:C2K:BST2:PDCH:PINT 10 ms
                     sets an interval of 10 ms between two data packets.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:PSETup <PSetup>

The command selects for F-PDCH if all subpackets are generated using the same settings or if the settings of subchannel 1 are valid for all sub channels. However, the value of "Number of Bits per Encoder Packet" is a quality of the complete encoder packet, therefore it is always set for all sub packet channels via the entry for sub channel 1.

Parameters:
<PSetup>   0|1|OFF|ON

                     ON
                     Packet parameters can be changed only for sub packet 1, all sub packets are generated with these settings.

                     OFF
                     Packet parameters can be set individually for each sub packet.

                     *RST: ON

Example: BB:C2K:BST2:PDCH:PSET OFF
                     selects that all sub packets can be configured separately.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:ID <Id>

The command selects the sub packet ID for F_PDCH. The sub packet ID determines the sub packet symbol selection and selects one of four available subpackets of the encoder packets. The SPID of sub packet 1 is always 1.

Parameters:

<Id>   0|1|2|3

                            Range: 0 to 3
                            *RST: 0

Example: `BB:C2K:BST2:PDCH:SUBP3:ID 3`
                            selects SPID 3 for sub packet 3.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:PARameters
    <Parameters>

The command selects a fixed combination of parameters "Bits per Encoder Packet", "Number of 32-Chip Walsh Channels", "Subpacket Data Rate", "Number of Slots per Subpackets" and "Modulation Order". These combinations are shown in the following list in the form of a table for all five parameters.

The complete range of 127 possible combinations is only available for subpacket 1. If "Same Packet Setup for all Subpackets" is enabled (`SOUR:BB:C2K:BST2:PDCH:PSET ON`), this command is only valid for subpacket 1.

Parameter of command `SOUR:BB: C2K:BST: PDCH:PAR`	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Sub-packet	Modulation Order
1	2328	28	1862.4	1	8-PSK
2	3864	27	1545.6	2	QPSK
3	3096	26	2476.8	1	16-QAM
4	3864	26	3091.2	1	16-QAM
5	1560	25	1248.0	1	QPSK
6	2328	25	1862.4	1	8-PSK
7	3096	25	1238.4	2	QPSK
8	3864	25	1545.6	2	8-PSK
9	2328	23	931.2	2	QPSK
10	2328	23	1862.4	1	16-QAM
11	3096	23	2476.8	1	16-QAM
12	3864	23	1545.6	2	8-PSK
13	1560	22	1248.0	1	QPSK
14	3096	22	1238.4	2	QPSK
15	1560	21	1248.0	1	8-PSK
16	3096	21	1238.4	2	8-PSK
17	3096	21	2476.8	1	16-QAM

Parameter of command SOUR:BB: C2K:BST: PDCH:PAR	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Sub-packet	Modulation Order
18	3864	21	1545.6	2	8-PSK
19	1560	20	624.0	2	QPSK
20	2328	20	465.6	4	QPSK
21	2328	20	931.2	2	QPSK
22	2328	20	1862.4	1	16-QAM
23	3096	20	619.2	4	QPSK
24	408	19	326.4	1	QPSK
25	792	19	316.8	2	QPSK
26	792	19	633.6	1	QPSK
27	1560	19	1248.0	1	8-PSK
28	3096	19	1238.4	2	8-PSK
29	3864	19	772.8	4	QPSK
30	3864	19	1545.6	2	16-QAM
31	2328	18	1862.4	1	16-QAM
32	1560	17	1248.0	1	8-PSK
33	2328	17	931.2	2	QPSK
34	3096	17	1238.4	2	8-PSK
35	3864	17	1545.6	2	16-QAM
36	2328	16	1862.4	1	16-QAM
37	3096	16	619.2	4	QPSK
38	3864	16	772.8	4	QPSK
39	792	15	633.6	1	QPSK
40	1560	15	624.0	2	QPSK
41	1560	15	1248.0	1	16-QAM
42	2328	15	931.2	2	8-PSK
43	3096	15	1238.4	2	16-QAM
44	3864	15	1545.6	2	16-QAM
45	1560	14	312.0	4	QPSK
46	2328	14	465.6	4	QPSK
47	3864	14	772.8	4	QPSK
48	3864	14	1545.6	2	16-QAM

Parameter of command SOUR:BB: C2K:BST: PDCH:PAR	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Sub-packet	Modulation Order
49	792	13	633.6	1	QPSK
50	1560	13	624.0	2	QPSK
51	1560	13	1248.0	1	16-QAM
52	2328	13	931.2	2	8-PSK
53	3096	13	619.2	4	QPSK
54	3096	13	1238.4	2	16-QAM
55	3864	13	1545.6	2	16-QAM
56	1560	12	1248.0	1	16-QAM
57	3096	12	1238.4	2	16-QAM
58	3864	12	772.8	4	8-PSK
59	408	11	326.4	1	QPSK
60	792	11	158.4	4	QPSK
61	792	11	316.8	2	QPSK
62	792	11	633.6	1	QPSK
63	1560	11	624.0	2	QPSK
64	1560	11	1248.0	1	16-QAM
65	2328	11	465.6	4	QPSK
66	2328	11	931.2	2	16-QAM
67	3096	11	619.2	4	QPSK
68	3096	11	1238.4	2	16-QAM
69	3864	11	772.8	4	8-PSK
70	792	10	633.6	1	8-PSK
71	1560	10	624.0	2	8-PSK
72	2328	10	931.2	2	16-QAM
73	3096	10	619.2	4	8-PSK
74	792	9	633.6	1	8-PSK
75	1560	9	312.0	4	QPSK
76	1560	9	624.0	2	8-PSK
77	2328	9	465.6	4	QPSK
78	2328	9	931.2	2	16-QAM
79	3096	9	619.2	4	8-PSK

Parameter of command SOUR:BB: C2K:BST: PDCH:PAR	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Sub-packet	Modulation Order
80	3864	9	772.8	4	16-QAM
81	408	8	163.2	2	QPSK
82	408	8	326.4	1	QPSK
83	792	8	316.8	2	QPSK
84	792	8	633.6	1	16-QAM
85	1560	8	624.0	2	16-QAM
86	2328	8	465.6	4	8-PSK
87	2328	8	931.2	2	16-QAM
88	3096	8	619.2	4	16-QAM
89	3864	8	772.8	4	16-QAM
90	408	7	326.4	1	QPSK
91	792	7	316.8	2	QPSK
92	792	7	633.6	1	16-QAM
93	1560	7	312.0	4	QPSK
94	1560	7	624.0	2	16-QAM
95	2328	7	465.6	4	8-PSK
96	3096	7	619.2	4	16-QAM
97	3864	7	772.8	4	16-QAM
98	408	6	326.4	1	QPSK
99	792	6	158.4	4	QPSK
100	792	6	316.8	2	QPSK
101	792	6	633.6	1	16-QAM
102	1560	6	312.0	4	QPSK
103	1560	6	624.0	2	16-QAM
104	2328	6	465.6	4	16-QAM
105	3096	6	619.2	4	16-QAM
106	408	5	163.2	2	QPSK
107	408	5	326.4	1	8-PSK
108	792	5	316.8	2	8-PSK
109	1560	5	312.0	4	8-PSK
110	2328	5	465.6	4	16-QAM

Parameter of command
`SOUR:BB:`
`C2K:BST:`
`PDCH:PAR`
	Number of Bits per Encoder Packet	Number of 32-Chip Walsh Channels	Subpacket Data Rate (kbps)	Number of Slots per Sub-packet	Modulation Order

111	408	4	81.6	4	QPSK
112	408	4	163.2	2	QPSK
113	408	4	326.4	1	16-QAM
114	792	4	158.4	4	QPSK
115	792	4	316.8	2	16-QAM
116	1560	4	312.0	4	16-QAM
117	2328	4	465.6	4	16-QAM
118	408	3	81.6	4	QPSK
119	408	3	163.2	2	QPSK
120	408	3	326.4	1	16-QAM
121	792	3	158.4	4	QPSK
122	792	3	316.8	2	16-QAM
123	1560	3	312.0	4	16-QAM
124	408	2	81.6	4	QPSK
125	408	2	163.2	2	16-QAM
126	792	2	158.4	4	16-QAM
127	408	1	81.6	4	16-QAM

Parameters:

<Parameters>   1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19|20|21|22|23|24|
25|26|27|28|29|30|31|32|33|34|35|36|37|38|39|40|41|42|43|44|
45|46|47|48|49|50|51|52|53|54|55|56|57|58|59|60|61|62|63|64|
65|66|67|68|69|70|71|72|73|74|75|76|77|78|79|80|81|82|83|84|
85|86|87|88|89|90|91|92|93|94|95|96|97|98|99|100|101|102|103|
104|105|106|107|108|109|110|111|112|113|114|115|116|117|
118|119|120|121|122|123|124|125|126|127

Range: 1 to 127
*RST: 1

Example: `BB:C2K:BST2:PDCH:SUBP1:PAR 48`

selects combination of parameters with index 48 (see following table).

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:STATe
     <State>

This command activates/deactivates the selected sub packet for F_PDCH. Sub packet
1 is always active.

Parameters:

<State>   0|1|OFF|ON

                           *RST: OFF

Example: BB:C2K:BST2:PDCH:SUBP3:STAT ON
                          activates sub packet 3.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:TOFFset
     <TOffset>

The command sets start of the sub packet relative to the start of the packet interval. The
offset is entered in slots. Sub packet 1 has offset 0. The value range for the individual
subpackets depends on the settings of the other subpackets. The time slot offsets of the
other sub packet have to be entered in ascending order. Also, two packets cannot be
sent at the same time.

In total the maximum value depends on the selected packet interval and the number of
slots per sub packet as follows:

Packet Interval/1.25 ms - Number of Slots per Subpacket.

Parameters:

<TOffset>   float

                           Range: 0 Slots to 1000 Slots
                           *RST: 0

Example: BB:C2K:BST2:PDCH:SUBP3:TOFF 4
                          enters at time slot offset of 4 slots. Sub packet 3 is sent 4 slots
                          after the begin of the packet interval.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:SUBPacket<di>:WCODes?

The command queries the resulting Walsh codes for the selected sub packet of F-PDCH.
Packet channels may be assigned to more than one code channel.

Return values:

<WCodes>   string

Example: BB:C2K:BST2:PDCH:SUBP3:RES:WCOD?
                          queries the resulting Walsh codes for sub packet 3 of F-PDCH of
                          base station 2.
                          Response: "31, 15, 23"
                          the resulting walsh codes are 31,15,23.

Usage:　　　　　　　Query only

[:SOURce<hw>]:BB:C2K:BSTation<st>:PDCHannel:WINDex <WIndex>

The command selects a standard Walsh set for F-PDCH. Four different sets are defined in the standard.

Parameters:

<WIndex>　　　　　　0|1|2|3

　　　　　　　　　　*RST:　　　　0

Example:　　　　　BB:C2K:BST2:PDCH:WIND 2

selects set 2 for PDCH of base station 2.

[:SOURce<hw>]:BB:C2K:BSTation<st>:PNOFfset <PnOffset>

The command sets the PN offset (short code) of the base station. The PN offset permits signals of different base stations to be distinguished.

Parameters:

<PnOffset>　　　　　integer

　　　　　　　　　　Range:　　　0 to 511
　　　　　　　　　　*RST:　　　　0

Example:　　　　　BB:C2K:BST3:PNOF 123

sets a PN offset of 123 for base station 3.

[:SOURce<hw>]:BB:C2K:BSTation<st>:QWSet <QwSet>

The command selects the quasi orthogonal Walsh code set. The standard defines three different sets.

The quasi-orthogonal Walsh codes are used for a given channel if `[:SOURce<hw>]:BB:C2K:BSTation<st>:CGRoup<di>:COFFset<ch>:QWCode:STATe` is ON.

Parameters:

<QwSet>　　　　　　integer

　　　　　　　　　　Range:　　　1 to 3
　　　　　　　　　　*RST:　　　　1

Example:　　　　　BB:C2K:BST2:QWS 2

selects set 2 for base station 2.

[:SOURce<hw>]:BB:C2K:BSTation<st>:STATe <State>

The command activates and deactivates the specified base station.

Parameters:

\<State>	0|1|OFF|ON
	*RST: OFF

Example: BB:C2K:BST2:STAT OFF

deactivates base station 2.

[:SOURce\<hw>]:BB:C2K:BSTation\<st>:TDELay \<TDelay>

The command sets the time shift of the selected base station compared to base station 1 in chips.

Suffix:

\<st>	2|3|4
	The command is only valid for base stations 2, 3 and 4. So a suffix must be specified at BSTation (2, 3, or 4).

Parameters:

\<TDelay>	float
	Range: 0 chips to 98304 chips
	*RST: 0

Example: BB:C2K:BST2:TDEL 256

shifts base station 2 by 256 chips compared to base station 1.

[:SOURce\<hw>]:BB:C2K:BSTation\<st>:TDIVersity \<TDiversity>

The command activates and deactivates signal calculation with transmit diversity (OFF). To activate transmit diversity, the antenna must be specify whose signals are to be simulated (ANT1 or ANT2).

The diversity scheme is selected using command [:SOURce\<hw>]:BB:C2K: BSTation\<st>:TDIVersity:MODE.

Parameters:

\<TDiversity>	OFF|ANT1|ANT2
	OFF
	No transmit diversity.
	ANT1
	Calculate and apply the output signal for antenna 1.
	ANT2
	Calculate and apply the output signal for antenna 2.
	*RST: OFF

Example: BB:C2K:BST2:TDIV ANT2

activates transmit diversity, the signal of antenna 2 is simulated.

[:SOURce<hw>]:BB:C2K:BSTation<st>:TDIVersity:MODE <Mode>

The command selects the diversity scheme.

Command `[:SOURce<hw>]:BB:C2K:BSTation<st>:TDIVersity` activates transmit diversity and selects the antenna.

Parameters:

<Mode>   OTD|STS

OTD
Orthogonal Transmit Diversity Mode.

STS
Space Time Spreading Mode.

*RST: OTD

Example: `BB:C2K:BST2:TDIV:MODE OTD`
selects scheme OTD for Transmit Diversity.
`BB:C2K:BST2:TDIV ANT2`
activates transmit diversity, the signal of antenna 2 is simulated.

5.8 Mobile Station Settings

The `SOURce:BB:C2K:MSTation` system contains commands for setting mobile stations.

The commands of this system only take effect when the CDMA2000 standard is activated, the `UP` transmission direction is selected and the particular mobile station is enabled:

● `SOURce:BB:C2K:STATe ON`

● `SOURce:BB:C2K:LINK UP`

● `SOURce:BB:C2K:MSTation2:STATe ON`

The channels of mobile station 1 are always generated in real time.

For the code channels of a traffic channels, the settings of the channel table parameters are specific for the selected radio configuration. I.e. a complete set of settings exists for each of the four possible radio configurations.

Suffixes

MSTation<st>

Determines the mobile station. Value range <st> = [1]|2|3|4

CHANnel<ch>

Value range <ch>= 0|[1]|..8

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:COUNt <Count>

The command sets the number of additional mobile stations.

The R&S Signal Generator provides the opportunity to simulate up to 64 additional mobile stations - corresponding to a receive signal for a base station with high capacity utilization. The fourth mobile station (MS4) serves as a template for all other stations. The only parameters of the additional mobile stations to be modified are the LC mask and the power. A time delay of the additional mobile stations to one another can be defined.

Parameters:

<Count>   integer

                             Range: 1 to 64
                             *RST: 4

Example: BB:C2K:MST:ADD:COUN 20
                             sets 20 additional mobile stations.
                             BB:C2K:MST:ADD:POW:OFFS -3.0
                             sets the power offset to -3 dB.
                             BB:C2K:MST:ADD:LCM:STEP #H1
                             sets the step width for increasing the LC mask to 1.
                             BB:C2K:MST:ADD:STAT ON
                             connects the 20 mobile stations to the CDMA signal.

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:LCMask:STEP <Step>

The command sets the step width for increasing the LC mask of the additional mobile stations. The start value is the LC mask of MS4.

Parameters:

<Step>   integer

                          Range: #H1 to #HFFFFFF
                          Increment: #H1

Example: BB:C2K:MST:ADD:LCM:STEP #H55
                          sets the step width for increasing the long code mask to #H55.

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:POWer:OFFSet <Offset>

The command sets the power offset of the active channels of the additional mobile stations relative to the power of the active channels of the reference station MS4.

The offset applies to all the additional mobile stations. The resultant overall power must fall within the range 0 ... - 80 dB. If the value is above or below this range, it is limited automatically.

Parameters:

<Offset>   float

                          Range: -80 dB to 0 dB
                          Increment: 0.01 dB
                          *RST: 0 dB

Example: BB:C2K:MST:ADD:POW:OFFS -3.0
                          sets the offset to -3 dB.

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:STATe <State>

The command activates additional mobile stations.

Parameters:

<State>   0|1|OFF|ON

                          *RST: OFF

Example: BB:C2K:MST:ADD:STAT ON
                          connects the additional mobile stations to the CDMA2000 signal.

[:SOURce<hw>]:BB:C2K:MSTation:ADDitional:TDELay:STEP <Step>

The command sets the step width for the time delay of the additional mobile stations to one another. The start value returns the time delay of MS4. Entry is made in chips and can be a maximum of 1 frame.

Parameters:

<Step>   integer

Range: 0 chips to 1535 chips
Increment: 1 chip
*RST: 0 chips

Example: `BB:C2K:MST:ADD:TDEL:STEP 256`
shifts each of the mobile stations 256 chips apart, starting from the
time delay of MS4.

[:SOURce<hw>]:BB:C2K:MSTation:PRESet

The command produces a standardized default for all the mobile stations. The settings
correspond to the ***RST** values specified for the commands. An overview is provided in
"Reset All Mobile Stations" on page 27.

All mobile station settings are preset.

Example: `BB:C2K:MST:PRES`
resets all the mobile station settings to default values.

Usage: Event

[:SOURce<hw>]:BB:C2K:MSTation<st>:CCODing:MODE <Mode>

The command selects the channel coding mode.

Parameters:

<Mode>   OFF|COMPlete|NOINterleaving|OINTerleaving

OFF
Channel coding is deactivated.

COMPlete
The complete channel coding is performed. The channel coding
procedure may slightly vary depending on channel type, frame
length and data rate.

OINTerleaving
Except for the block interleaver, the whole channel coding
procedure is carried out.

NOINterleaving
In this mode only block interleaver is used for coding.

*RST: OFF

Example: `BB:C2K:MST:CCOD:MODE OFF`
deactivates channel coding for mobile station 1.

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA <Data>

The command sets the data source for the specified channel.

The data source for the power control bits is selected with the command `[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA`. For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Data>   ZERO|ONE|PATTern|PN9|PN11|PN15|PN16|PN20|PN21|PN23|DLISt

PNxx
The pseudo-random sequence generator is used as the data source. Different random sequence lengths can be selected.

DLISt
A data list is used. The data list is selected with the command `[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:DSELect`.

ZERO | ONE
Internal 0 and 1 data is used.

PATTern
Internal data is used The bit pattern for the data is defined by the command `[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:PATTern`.

*RST: PN9

Example: BB:C2K:MST1:CHAN2:DATA PN16
selects as the data source for channel 2 of mobile station 1, internal PRBS data with a sequence length of 2^{16}-1.

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:DATA:DSELect <DSelect>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:
<DSelect>   string

Example: `BB:C2K:MST1:CHAN1:DATA DLIS`
selects the Data Lists data source.
`MMEM:CDIR '<root>\Lists\Dm\IQData'`
selects the directory for the data lists.
`BB:C2K:MST1:CHAN1:DATA:DSEL 'dpdch_13'`
selects file `'cdma_13'` as the data source. This file must be in the
directory `<root>\Lists\DM\IqData` and have the file exten-
sion `*.dm_iqd`.

[:SOURce\<hw>]:BB:C2K:MSTation\<st>:CHANnel\<ch>:DATA:PATTern \<Pattern>

The command determines the bit pattern for the data component when the PATTern data
source is selected. The first parameter determines the bit pattern (choice of hexadecimal,
octal or binary notation), the second specifies the number of bits to use. The maximum
length is 64 bits.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:
\<Pattern>   64-bit pattern

                   *RST: 0

Example: `BB:C2K:MST1:CHAN1:DATA PATT`
selects Pattern data source.
`BB:C2K:MST1:CHAN1:DATA:PATT  #H800FFFF80003FFE,`
`60`
defines the bit pattern.

[:SOURce\<hw>]:BB:C2K:MSTation\<st>:CHANnel\<ch>:DATA:RATE \<Rate>

The command sets the data rate for the specified channel. The value range depends on
the channel type, the selected radio configuration and the frame length.

For the traffic channels, this value is specific for the selected radio configuration.

The value range of the data rate depends on the channel type and the frame length. If
the frame length is changed so that the set data rate becomes invalid, the next permissible
value is automatically set.

Parameters:
\<Rate>   DR1K2|DR1K3|DR1K5|DR1K8|DR2K4|DR2K7|DR3K6|DR4K8|
                   DR7K2|DR9K6|DR14K4|DR19K2|DR28K8|DR38K4|DR57K6|
                   DR76K8|DR115K2|DR153K6|DR230K4|DR259K2|DR307K2|
                   DR460K8|DR518K4|DR614K4|DR1036K8|NUSed

                   *RST: R-DCCH: DR9K6; R-FCH: DR1K5; R-SCH: DR1K5;
                               R-ACC: DR4K8

Example: BB:C2K:MST2:MODE TRAF

selects operating mode traffic.

BB:C2K:MST2:RCON 3

selects radio configuration 3 for the traffic channel.

BB:C2K:MST2:CHAN3:DATA:RATE DR4K8

sets a data rate of 4.8 kbps for channel 3 f mobile station 2 (R-FCH in this configuration).

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:FLENgth <FLength>

The command sets the frame length of the selected channel. The value range depends on the channel type and the selected radio configuration

For the traffic channels, this value is specific for the selected radio configuration.

The frame length affects the data rates that are possible within a channel. Changing the frame length may lead to a change of data rate.

Parameters:

<FLength>   5|10|20|26.6|40|80

*RST: 20 ms

Example: BB:C2K:MST:CHAN3:FLEN 5 ms

sets the frame length of sub channel 3 to 5 ms.

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:POWer <Power>

The command sets the channel power relative to the powers of the other channels. This setting also determines the starting power of the channel for Misuse Output Power Control.

With the command [:SOURce<hw>]:BB:C2K:POWer:ADJust, the power of all the activated channels is adapted so that the total power corresponds to 0 dB. This will not change the power ratio among the individual channels.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<Power>   float

Range: -80 dB to 0 dB
Increment: 0.01 dB
*RST: 0 dB

Example: BB:C2K:MST2:CHAN3:POW -10dB

sets the channel power of sub channel 3 of mobile station 2 to -10 dB relative to the power of the other channels.

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:SPReading?

The command queries he spreading factor of the channel. The spreading factor corresponds to the length of the employed Walsh code. The Walsh codes to be used are specified by the standard and cannot be chosen.

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<Spreading>   float

Example: BB:C2K:MST2:CHAN1:SPR?

queries he spreading factor of channel 1 of mobile station 2.

Response: 32

Usage: Query only

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:STATe <State>

This command activates/deactivates the selected channel.

For the traffic channels, this value is specific for the selected radio configuration.

Parameters:

<State>   0|1|OFF|ON

*RST: OFF

Example: BB:C2K:MST2:CHAN2:STAT OFF

deactivates sub channel 2 of mobile station 2.

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:TYPE?

The command queries the channel type. The channel type depends on the selected operating mode and, for the sub channels of the traffic channel, from the selected radio configuration.

Return values:

<Type>   R-PICH|R-ACH|R-EACH|R-CCCH|R-DCCH|R-FCH|R-SCCH|R-
                   SCH2|R-SCH1

                   R-ACH
                   Access Channel.

                   R-EACH
                   Enhanced Access Channel

                   R-CCCH
                   Common Control Channel

                   R-PICH
                   Pilot Channel.

                   R-DCCH
                   Dedicated Control Channel

                   R-FCH
                   Fundamental Channel

                   R-SCHx
                   Supplemental Channel 1 | 2

                   R-SCCH
                   Supplemental Control Channel

Example: BB:C2K:MST2:CHAN2:TYPE?
                    queries type of channel 2.
                    Response: R-SCCH
                    channel 2 is a Supplemental Control Channel.

Usage: Query only

[:SOURce<hw>]:BB:C2K:MSTation<st>:CHANnel<ch>:WCODe?

The command queries the Walsh code. The standard assigns a fixed walsh code to some channels.

For the traffic channels, this value is specific for the selected radio configuration.

Return values:

<WCode>   float

Example: BB:C2K:MST1:CHAN3:WCOD?
                    queries the Walsh code of channel 3 of mobile station 1.
                    Response: 3
                    the Walsh code is 3.

Usage: Query only

[:SOURce<hw>]:BB:C2K:MSTation<st>:LCMask <LcMask>

The command sets the mask of the Long Code Generator of the mobile station.

Parameters:

<LcMask>　　　　　　　　integer

　　　　　　　　　　　　　Range:　　　#H0　to　#H3FF FFFF FFFF
　　　　　　　　　　　　　*RST:　　　　#H0

Example:　　　　　　　`BB:C2K:MST1:LCM #H55`
　　　　　　　　　　　　　sets the Long Codes to #H55.

[:SOURce<hw>]:BB:C2K:MSTation<st>:MODE <Mode>

The command selects operating mode for the mobile station. The channel specific
parameters are set with commands `SOUR:BB:C2K:MST<n>:CHANnel<n>:...n.`

Parameters:

<Mode>　　　　　　　　TRAFfic|ACCess|EACCess|CCONtrol

　　　　　　　　　　　　　TRAFfic
　　　　　　　　　　　　　The mobile station generates a single traffic channel A traffic
　　　　　　　　　　　　　channel consists of up to 8 sub channels depending on the
　　　　　　　　　　　　　selected radio configuration (R-FCH, R-SCCH, R-SCH, R-DCCH).
　　　　　　　　　　　　　This mode corresponds to the standard mode of a mobile station
　　　　　　　　　　　　　during voice and data transmission.

　　　　　　　　　　　　　ACCess
　　　　　　　　　　　　　The mobile station generate an access channel (R-ACH). This
　　　　　　　　　　　　　channel is needed to set up the connection between the mobile
　　　　　　　　　　　　　station and the base station.

　　　　　　　　　　　　　EACCess
　　　　　　　　　　　　　The mobile station generates an enhanced access channel (R-
　　　　　　　　　　　　　ACH) and a pilot channel (R-PICH).

　　　　　　　　　　　　　CCONtrol
　　　　　　　　　　　　　The mobile station generates a common control channel (R-ACH)
　　　　　　　　　　　　　and a pilot channel (R-PICH).

　　　　　　　　　　　　　*RST:　　　TRAFfic

Example:　　　　　　　`BB:C2K:MST1:MODE TRAF`
　　　　　　　　　　　　　switches the mobile station into standard mode - voice and data
　　　　　　　　　　　　　transmission.

[:SOURce<hw>]:BB:C2K:MSTation<st>:RCONfiguration <RConfiguration>

The command selects the radio configuration for the traffic channel.

The settings of the channel table parameters are specific for the selected radio configu-
ration.

A separate set of settings of all channel table parameters for each radio configuration is
provided. If the radio configuration is changed, the set of channel table values belonging
to this RC is automatically activated.

Parameters:

<RConfiguration>   1|2|3|4

                              *RST: 1

Example: `BB:C2K:MST2:MODE TRAF`
                              switches mobile station 2 into standard mode - voice and data
                              transmission.
                              `BB:C2K:MST2:RCON 3`
                              selects radio configuration 3. With RC3, the traffic channel
                              includes five sub channels.

[:SOURce<hw>]:BB:C2K:MSTation<st>:STATe <State>

The command activates and deactivates the specified mobile station.

Parameters:

<State>   0|1|OFF|ON

                              *RST: 0

Example: `BB:C2K:MST2:STAT OFF`
                              deactivates mobile station 2.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA <Data>

The command sets the data source for the power control bits of the traffic channels.

Parameters:

<Data>   ZERO|ONE|PATTern|DLISt

                              DLISt
                              A data list is used. The data list is selected with the command
                              `[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:`
                              `DSELect`.

                              ZERO | ONE
                              Internal 0 and 1 data is used.

                              PATTern
                              Internal data is used The bit pattern for the data is defined by the
                              command `[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:`
                              `DATA:PATTern`. The maximum length is 64 bits.

                              *RST: ZERO

Example: `BB:C2K:MST2:TPC:DATA PATT`
                              selects Pattern data source for the power control bits. The bit pat-
                              tern is defined with the following command.
                              `BB:C2K:MST2:TPC:DATA:PATT  #H3F,8`
                              defines the bit pattern.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:DSELect <DSelect>

The command selects the data list for the DLISt data source selection.

The lists are stored as files with the fixed file extensions `*.dm_iqd` in a directory of the user's choice. The directory applicable to the following commands is defined with the command `MMEMory:CDIR`. To access the files in this directory, you only have to give the file name, without the path and the file extension.

Parameters:

<DSelect>   <data list name>

Example: `BB:C2K:MST2:TPC:DATA DLIS`
                          selects the DLISt data source.
                          `MMEM:CDIR '<root>\Lists\DM\IqData'`
                          selects the directory for the data lists.
                          `BB:C2K:MST2:TPC:DATA:DSEL 'cdma_ch4'`
                          'selects the file `cdma_ch4` as the data source. This file must be in
                          the directory `<root>\Lists\DM\IqData` and have the file
                          extension `*.dm_iqd`.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:DATA:PATTern <Pattern>

The command determines the bit pattern for the `PATTern` selection. The maximum bit pattern length is 64 bits.

Parameters:

<Pattern>   64 bit pattern

                          *RST: #H0,1

Example: `BB:C2K:MST2:TPC:DATA:PATT  #H3F, 8`
                          defines the bit pattern for the power control-bits.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:MISuse <MisUse>

The command activates/deactives the use of the power control data for controlling the mobile station output power. On the uplink, the power control bits are used exclusively for controlling the mobile station output power. Power control puncturing is not defined for controlling the base station power.

The bit pattern (see commands `:BB:C2K:MSTation<n>:TPC...`) of the power control bits w is used to control the channel power. A "1" leads to an increase of channel powers, a "0" to a reduction of channel powers. Channel power is limited to the range 0 dB to -80 dB. The step width of the change is defined with the command `[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:PSTep`.

Parameters:

<MisUse>   0|1|OFF|ON

                          *RST: OFF

Example: `BB:C2K:MST2:TPC:MIS ON`
activates regulation of channel power for mobile station 2 via the
power control bit pattern.
`BB:C2K:MST2:TPC:PST 1 dB`
sets the step width for the change of channel powers to 1 dB.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:PSTep <PStep>

The command defines the step width for the change of channel powers in the case of
"mis-" use of the power control bits.

Parameters:

<PStep>   float

Range:	-10 dB to 10 dB
Increment:	0.01 dB
*RST:	0 dB

Example: `BB:C2K:MST2:TPC:PST 0.1 dB`
sets the step width for the change of channel powers to 1 dB.

[:SOURce<hw>]:BB:C2K:MSTation<st>:TPC:READ <Read>

The command sets the read out mode for the bit pattern of the power control bits.

The bit pattern is defined with the commands `:BB:C2K:MST<n>:TPC....`

Parameters:

<Read>   CONTinuous|S0A|S1A|S01A|S10A

CONTinuous
The bit pattern is used cyclically.

S0A
The bit pattern is used once, then the power control bit sequence
continues with 0 bits.

S1A
The bit pattern is used once, then the power control bit sequence
continues with 1 bits.

S01A
The bit pattern is used once and then the power control bit
sequence is continued with 0 and 1 bits alternately.

S10A
The bit pattern is used once and then the power control bit
sequence is continued with 1 and 0 bits alternately.

*RST: CONTinuous

Example: `BB:C2K:MST2:TPC:READ S0A`

the bit pattern is used once, after which a 0 sequence is generated (applies to R-DCCH of mobile station 2).

List of Commands

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